Personality Psychology

Which Measures of Beliefs About Others' Prosociality Predict Prosocial Behavior in Economic Games?

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Keywords: person perception, perceiver effects, prosocial behavior, interdependence, generalized trust

https://doi.org/10.1525/collabra.121385

Collabra: Psychology

Vol. 10, Issue 1, 2024

Prosocial behavior often entails the possibility to be exploited by other people. Correspondingly, situations affording prosocial behavior are often characterized by one's dependence on others' unknown behavior. In such situations, actors will arguably assess the risk of being taken advantage of by others before making a decision. Thus, prosocial behavior might be shaped by how prosocial actors generally believe others to be (e.g., trustworthy vs. exploitative). However, a recent investigation found no consistent evidence that perceiver effects, which describe interindividual differences in judging others' personality in first impressions and thus capture beliefs about others' prosociality, predict prosocial behavior (Rau et al., 2020). We replicate and extend these findings by pursuing two approaches to examine the influence of beliefs about others' prosociality on behavior in four behavioral games (public goods game, trust game as trustor and trustee, mind game), two of which involve dependence on others under uncertainty. In our main study (N = 962), perceiver effects failed to predict prosocial behavior. This was confirmed by a meta-analysis of all studies that investigated this relation, providing strong evidence against the predictive validity of perceiver effects for behavior in economic games. In a follow-up analysis, generalized expectations (as measured by generalized trust) predicted prosocial behavior in one of the two relevant games while controlling for honesty-humility, which we interpret as tentative evidence for the role of generalized expectations in prosocial behavior in economic games. We contemplate that the discrepancy between perceiver effects and generalized expectations as measures of beliefs about others' prosociality might be attributable to their implicit vs. explicit nature and suggest future research to explore whether perceiver effects predict more implicit measures of prosocial behavior.

A key feature of many interdependent situations in everyday life is that prosocial behavior comes with the risk of others exploiting one's good will. For example, when loaning money to someone, one faces the risk of the money not being returned. Likewise, contributing to a group project at work increases the chance of a successful group result which every group member benefits from, but at the same time it comes with the risk that others lean back and take advantage of the effort one puts into the project without contributing much themselves. Thus, while prosocial behavior may increase social welfare, it often involves the risk that others exploit one's own benevolence.

Situations like these in which an individual's prosocial behavior can be exploited by others involve *dependence under uncertainty*, meaning that the actor's ultimate outcome depends on others' behavior, and this behavior is unknown to the actor at the time of decision making (Thielmann, Spadaro, et al., 2020). Such interdependent situations have commonly been studied using economic games (Thielmann et al., 2021). In these games, two or more individuals (*players*) interact with each other by making decisions that affect their own and the others' (usually monetary) outcomes. A key advantage of economic games is that they allow measuring consequential behavior in controlled experimental settings.

Whenever economic games involve dependence under uncertainty, players' behaviors should be driven by their beliefs about others' prosociality. In the absence of concrete information about the intentions of interaction partners, individuals should rely on their beliefs about others' prosociality to guide their own behavior. For example, when others are believed to be selfish and untrustworthy,

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players should be reluctant to cooperate because they will arguably want to avoid being exploited. In line with this reasoning, meta-analytic evidence shows that in social dilemma games that are usually characterized by dependence under uncertainty, players' own prosocial behavior is strongly related to their expectation about their co-players' prosocial behavior, e.g., how much money they expect their co-players to contribute to the group in the respective economic game ($r = .58$; Balliet & Van Lange, 2013). Besides such state-like, contextual expectations, research has also investigated whether trait-like, *generalized* expectations about others influence prosocial behavior in situations involving dependence under uncertainty. Such generalized expectations have traditionally been assessed using self-report measures of how individuals tend to view others' trustworthiness and prosociality. If one generally expects others to be trustworthy and cooperative, one should also be more willing to make oneself dependent on their actions when dependence under uncertainty is afforded, and this should manifest, on average, in more prosocial behavior (although some people might still defect to exploit others even if they expect others to cooperate, as illustrated below). Indeed, there are significant, small-to-medium-sized meta-analytic relations between generalized expectations and prosocial behavior in economic games affording dependence under uncertainty, although correlations are descriptively smaller than correlations for context-specific expectations (e.g., $r = .15$ for trust propensity; Thielmann, Spadaro, et al., 2020).

As Rau et al. (2020) pointed out, however, these findings are limited in several ways. First, generalized expectations might overlap with prosocial personality traits, such as honesty-humility, that is, "the tendency to be fair and genuine in dealing with others, in the sense of cooperating with others even when one might exploit them without suffering retaliation" (Ashton & Lee, 2007, p. 156). This is because more prosocial individuals tend to have more positive expectations about others' prosociality (Falk et al., 2018; Pletzer et al., 2018) through the process of assumed similarity or social projection, respectively (Thielmann, Hilbig, et al., 2020; Thielmann & Hilbig, 2022). Importantly, many situations (and economic games) that afford dependence under uncertainty also involve other affordances related to these broader prosocial personality traits, e.g., the possibility to exploit others. To return to the example above, coworkers might not only hesitate to contribute to a group project because they do not want to be exploited themselves (dependence under uncertainty), but also because they themselves want to lean back and exploit others' work (possibility for exploitation). In economic games that afford a possibility for exploitation, prosocial personality traits like honesty-humility are theoretically and empirically linked to prosocial behavior (Thielmann, Spadaro, et al., 2020). Thus, generalized expectations might relate to prosocial behavior partly because of their overlap with trait prosociality. While there are studies that do indicate that generalized expectations have a unique effect on prosocial behavior (e.g., Boone et al., 2010), this effect is likely overestimated when trait prosociality is not controlled for. The meta-analytic finding that the effects of generalized expec-

tations are somewhat unspecific across different economic games casts further doubt on the assumption of substantive predictive validity above trait prosociality. Specifically, generalized expectations tend to correlate as strongly with prosocial behavior in situations that do vs. do not afford dependence under uncertainty (Thielmann, Spadaro, et al., 2020), which is difficult to explain if generalized expectations carry substantial incremental validity for the prediction of prosocial behavior above and beyond trait prosociality in situations that afford dependence under uncertainty.

Second, the measurement and validity of generalized expectations themselves have been subject to criticism. In most prior studies, generalized expectations have been collected immediately before or after participants completed the economic game. It is possible, however, that generalized expectations measured in this way are confounded by rationalizations of one's behavior in the economic game, i.e. that participants rationalize their own degree of cooperation by embracing self-serving narratives about others' trustworthiness. For example, it is possible that participants justify their own uncooperative behavior in an economic game by convincing themselves afterwards that others are not trustworthy to not feel selfish or exploitative (Balliet & Van Lange, 2013). Possibly, the observed relation between generalized expectations and prosocial behavior can at least in part be traced back to this confounding effect.

Even more in general, it has been challenged how validly self-report measures can capture beliefs about others' prosociality. Established measures like the General Trust Scale (Yamagishi & Yamagishi, 1994) ask respondents how they tend to view "most people". However, there seem to be quite large differences in how broad this term is interpreted, i.e. who exactly respondents think of when asked about "most people". Cross-cultural research and think-aloud techniques reveal that at least some respondents interpret these items rather narrowly in relation to other people in their local communities like family members or neighbors, rather than other people in general like strangers or new acquaintances (Delhey et al., 2011; Sturgis & Smith, 2010). This indicates that one's own generalized expectations can be quite difficult to introspectively assess, which opens the door for other, more indirect ways of assessing beliefs about others' prosociality.

Previous Work Linking Perceiver Effects to Prosocial Behavior in Economic Games

To overcome the limitations associated with generalized expectations and introduce an alternative way to operationalize individuals' beliefs about others' prosociality, Rau et al. (2020) investigated the relation between *perceiver effects* and prosocial behavior. Perceiver effects describe individuals' general tendencies in judging others' personalities in first impressions (Kenny, 1994, 2020; Srivastava et al., 2010). For instance, if Paula rates a set of strangers (i.e., targets) concerning how fair-minded they seem and provides a higher mean-rating than most perceivers (who are judging the same targets), she would be said to have a positive perceiver effect for fairness. In the context of

prosocial behavior in situations that afford dependence under uncertainty, theoretically, the most relevant perceiver effect should concern prosocial personality traits, i.e. how positively individuals judge others in prosocial personality traits. For example, due to her positive perceiver effect for fairness, Paula should be more willing to cooperate with others in these situations than the average perceiver because she should consider the risk of being exploited by them lower. However, research has shown that when someone has a positive perceiver effect for one trait, that perceiver also tends to have a positive perceiver effect for other traits with the same evaluative polarity (e.g., Paula would also rate targets as more open and assertive than the average perceiver), which points towards individual differences in the global positivity of impressions (Heynicke et al., 2022; Rau, Carlson, et al., 2021). This tendency towards forming globally positive vs. negative impressions of others is stable over time and across situations (Heynicke et al., 2022; Rau, Carlson, et al., 2021; Srivastava et al., 2010), is related to other personality traits (Rau, Nestler, et al., 2021; Wood et al., 2010) and predicts social outcomes such as popularity among peers (Rau, Carlson, et al., 2022). Importantly, perceiver effects in highly evaluative traits – like prosocial personality traits (e.g., honesty-humility) – load particularly strongly on the global positivity of perceiver effects (Rau, Carlson, et al., 2021; Thielmann & Hilbig, 2022); in other words, how prosocially others are seen is strongly related to how positively others are seen in general. Given the evidence on the reliability and validity of the positivity of perceiver effects and the high congruence of the positivity of perceiver effects and perceiver effects in prosocial personality traits, the positivity of perceiver effects should predict prosocial behavior in situations that involve dependence under uncertainty.

Of note, perceiver effects should not be affected by the validity problems of generalized expectations. First, since perceiver effects are retrieved from actual personality ratings about others, they measure genuine idiosyncrasies in perceiving others and are, thus, arguably not distorted by individuals' lack of self-knowledge about their own generalized expectations (Rau et al., 2020). Second, given that participants might not be aware that their own beliefs are obtained from ratings they provide about others, perceiver effects should not capture rationalizations of economic gaming behavior and thus might reflect beliefs about others' prosociality more purely than generalized expectations in the context of economic games. Taken together, perceiver effects are a reliable and valid operationalization of beliefs about others' prosociality and might possess some advantages above generalized expectations in terms of validity, especially in the context of economic games. Therefore, they should relate to prosocial behavior in economic games that involve dependence under uncertainty.

However, this reasoning was not fully supported in two studies on the association between perceiver effects and prosocial behavior in a social dilemma game (i.e., the public goods game) conducted by Rau et al. (2020). Whereas perceiver effects predicted prosocial behavior in and of themselves as well as above and beyond honesty-humility in Study 1 ($N = 83$), Study 2 ($N = 413$) failed to replicate these findings. Further, in an unpublished analysis based on data from Rau, Nestler et al. (2021[1]; $N = 200$), the relation between perceiver effects and prosocial behavior in the public goods game only just reached statistical significance ($p = .040$). Overall, evidence on the link between perceiver effects and prosocial behavior has remained inconclusive.

The Present Research

To reach a robust conclusion on this issue, we aimed for a large-scale replication of Rau et al. (2020). Besides aiming for a larger sample, we tackled key limitations of this earlier research. As mentioned by Rau et al. (2020), one important weakness of their studies was that perceiver effects were measured in face-to-face group interactions. Therefore, participants had the chance to get to know each other before judging each other's personality. It is conceivable that perceiver effects measured this way capture the social reality of the specific group situation instead of generalized perceptual tendencies in first impressions. For example, when Alex was joking around a lot, he might have made the other group members laugh repeatedly, in turn evoking a more positive perception of the others by Alex. This positive perceiver effect would not have been caused by Alex's general perceptual tendencies towards others, but by the specific social consequences of his own behavior. As such, it is possible that the significant relation between perceiver effects and prosocial behavior observed in Study 1 by Rau et al. (2020) is an artifact caused by the social dynamics of the group situation. Thus, to conclude that beliefs about others' prosociality drive the link between perceiver effects and prosocial behavior, perceiver effects have to be measured in a way that rules out any social interactions between perceivers and targets. To that end, we administered the Online-Tool for Assessing Perceiver Effects (O-TAPE; Rau, Nestler, et al., 2021) in the present study, in which participants rate the personality of standardized social media profiles, to ensure that perceiver effects are not distorted by the social dynamics of face-to-face interactions. Importantly, the O-TAPE has been shown to predict perceiver effects obtained in real-life settings above and beyond other personality traits and demonstrates a similar nomological network as real-life perceiver effects (Rau, Nestler, et al., 2021), rendering it a valid operationalization of perceiver effects which is not susceptible to confounding effects of group dynamics.

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1 The article mentioned that a public goods game was included at the end of the study without reporting corresponding results. The study used a dichotomous public goods game where participants could choose to voluntarily waive 0.50€ of their compensation to increase the compensation of everyone in the study by 1 cent.

Furthermore, we extended earlier studies by also investigating the discriminant validity of perceiver effects in predicting prosocial behavior. Specifically, to attribute the potential relation between perceiver effects and prosocial behavior to beliefs about others' prosociality, perceiver effects should only relate to prosocial behavior in situations characterized by dependence under uncertainty, but not to prosocial or ethical behavior more generally. For example, when Anna considers whether to lend her mobile phone to a stranger who claims to need it for an urgent call, Anna's beliefs about others' prosociality should be triggered given that there is a risk of being exploited (i.e., the stranger stealing her mobile phone); her outcome eventually depends on the stranger, whose behavior is unknown at the time of Anna deciding whether to help them out. In contrast, the stranger's decision on whether or not to return the mobile phone should not be influenced by their belief about Anna, since Anna has no control over the stranger keeping her mobile phone; thus, the stranger does not depend on Anna's behavior and takes no risk of being exploited by her. Therefore, in this scenario, perceiver effects should explain Anna's, but not the stranger's behavior. To investigate whether perceiver effects indeed predict behavior only in situations that afford dependence under uncertainty, we measured behavior in four situations, only two of which involved dependence under uncertainty. We hypothesized perceiver effects to predict behavior only in these two situations. This effect should appear above and beyond the (to-be-expected) influence of honesty-humility, which is theoretically and empirically linked to prosocial behavior in all four situations (Heck et al., 2018; Thielmann, Spadaro, et al., 2020; Zettler et al., 2020). By including two games that involve dependence under uncertainty instead of only one, we went even further beyond prior research to provide more conclusive evidence that any relation between perceiver effects and prosocial behavior can be traced back to dependence under uncertainty instead of any other specific configuration of one single economic game.

Our main hypotheses concerned the global positivity of perceiver effects across various traits rather than trait-specific perceiver effects, which are less stable across situations (Rau, Lawless DesJardins, et al., 2022). However, it is conceivable that specifically viewing others as fair-minded and sympathetic (independently of how globally positive or negative others are viewed) might affect prosocial behavior when one depends on others' prosociality. Thus, we also explored whether trait-specific perceiver effects for honesty-humility and agreeableness – two traits relevant for prosocial behavior (Thielmann, Spadaro, et al., 2020) – are uniquely linked to prosocial behavior. Finally, in a follow-up analysis, we also considered an established measure of generalized expectations (i.e., generalized trust) as predictor of prosocial behavior in the same games as perceiver effects. Addressing important weaknesses of prior studies, we measured generalized expectations outside of the economic gaming context to rule out possible confounding effects and controlled for honesty-humility to analyze the incremental validity of generalized expectations. This al-

lowed us to compare the validity of both operationalizations of beliefs about others' prosociality, perceiver effects and generalized expectations, vis-à-vis for the prediction of prosocial behavior. We preregistered our main study prior to collecting the economic games data and, in a separate registration, our follow-up analysis prior to conducting it. The preregistrations can be obtained from https://aspredicted.org/tf5v7.pdf and https://aspredicted.org/hp85e.pdf, respectively.

Overall, we hypothesized that:

- Beliefs about others' prosociality – measured in terms of perceiver effects as well as generalized trust – will predict prosocial behavior in economic games that afford dependence under uncertainty.
- Honesty-humility will predict prosocial behavior across all economic games applied.
- The relation between beliefs about others' prosociality and prosocial behavior (see above) will hold once controlling for honesty-humility.

Main Study

Methods

Participants and Procedure

The present investigation was part of the Prosocial Personality Project (PPP), a large-scale, multi-wave study measuring various aspects of personality and prosocial behavior. In the main study, we consider a sample of $N = 962$ participants (436 female, 524 male, 2 diverse; $M[SD]_{age} = 43.67[12.25]$ years, with diverse educational backgrounds) who provided usable data regarding self-reported personality and demographics (assessed at wave 1 of the PPP base study), behavioral games (assessed at wave 6 of the PPP base study, 19 weeks after wave 1 on average), and perceiver effects (assessed at PPP follow-up wave 2020-05c, 24 weeks after wave 1 on average). A full description of all measures included in the PPP, detailed information on the pre-specified exclusion criteria for each wave, and prior publications using data from the PPP can be found online (https://osf.io/m2abp/). The data we used in this study were not analyzed together in any prior investigation.

Participants were recruited through a professional panel provider in Germany. They received monetary compensation for their participation (in line with the panel provider's regulation), plus bonus payments contingent on their (and, if applicable, the matched interaction partners') behavior in the games. Participants were matched with their interaction partners and paid by the panel provider after completing data collection. As described in detail below, the sample was split into three approximately equally large subsamples for the collection of three of the behavioral games. In the analysis involving the least observations ($n = 316$, see below), the obtained sample sizes offer satisfactory statistical power (1-β = .85) to detect relatively small correlations of $r = .15$, with a one-tailed α of .05 (given the directionality of our hypotheses). This effect size corresponds to the meta-analytical relation between generalized expectations (as measured by trust propensity) and prosocial behavior in

Table 1. Descriptive Statistics of the Positivity of Perceiver Effects in the O-TAPE

Dimension	M	SD	α
Honesty-humility (*greedy, dishonest* vs. *modest, sincere*)	5.43	0.78	.75
Emotional stability (*anxious, sensitive* vs. *relaxed, emotionally stable*)	5.35	0.77	.65
Extraversion (*reserved, quiet* vs. *sociable, lively*)	4.70	0.78	.60
Agreeableness (*critical, quick-tempered* vs. *sympathetic, gentle*)	5.37	0.72	.68
Conscientiousness (*disorganized, careless* vs. *reliable, self-disciplined*)	5.38	0.75	.70
Openness to experience (*conventional, uncreative* vs. *open to new experiences, artistic*)	5.56	0.72	.61
Positivity of perceiver effects (across dimensions)	5.30	0.57	.90

Note. Perceiver effects made up between 10% and 20% of the variance in the raw (dyadic) ratings, thus exceeding the threshold of 10% which has been proposed as a prerequisite for investigating correlates of perceiver effects (Kenny, 1994, 2020). Variance proportions for each dimension can be found on the OSF.

social dilemmas as mentioned above (Thielmann, Spadaro, et al., 2020).

Measures

Perceiver effects. To measure perceiver effects, we used the Online-Tool for Assessing Perceiver Effects (O-TAPE; Rau, Nestler, et al., 2021). Participants judged the personality of 10 standardized targets based on screenshots of fictional Facebook profiles. Judgments were provided on six bipolar adjective scales (see Table 1), each of which sought to represent one of the six HEXACO personality dimensions (Ashton & Lee, 2007). To align the social desirability of the dimensions, emotionality was reverse-keyed such that higher values reflected greater emotional stability. Perceiver effect scores for each dimension were computed by averaging participants' ratings across targets. Since our main hypotheses concerned the global positivity of perceiver effects, we averaged the six perceiver effect scores across HEXACO dimensions (see Rau, Nestler, et al., 2021) and labelled the resulting variable *positivity of perceiver effects*. Descriptive statistics of the O-TAPE ratings are shown in Table 1.

Behavioral games. Participants were randomly assigned to complete one of three economic games measuring prosocial behavior: a *public goods game* (PGG), a *trust game as trustor* (TG-Trustor), or a *trust game as trustee* (TG-Trustee). Additionally, all participants played the *mind game* (MG), which is a measure of (dis)honest behavior. Crucially, these four behavioral games differ regarding their situational affordances: the PGG and the TG-Trustor involve dependence under uncertainty, whereas the TG-Trustee and the MG do not.

In the PGG (Samuelson, 1954), participants ($n = 316$) were assigned to groups of four and endowed with 4.00€ each. They were asked how much, if any, of their endowment they wanted to contribute to a group account, in 0.50€ increments. The money contributed to the group account was doubled and equally divided among all group members. Given this setup, contributing money maximizes the group's outcome (i.e., indicates prosociality) but reduces one's individual outcome. The PGG affords dependence under uncertainty because players do not know how much their co-players will contribute, but their own outcome depends on it. Thus, the PGG simulates situations in which

prosocial behavior increases social welfare but decreases one's individual outcome. A potential real-life example of this is cleaning one's shared flat, which benefits all roommates but comes with individual costs in terms of time and effort, entailing the risk of others leaning back and exploiting one's prosocial behavior.

In the TG (Berg et al., 1995), dyad members received an initial endowment of 3.00€ each. As trustor ($n = 321$), participants chose how much of their endowment (in 0.50€ increments) to transfer to the trustee, who received three times the transferred amount. As trustee ($n = 325$), participants chose how much of the received (tripled) amount to return to the trustor. Thus, the trustor's outcome depends on the amount the trustee returns, which is unknown to the trustor when making a choice. Therefore, as a trustor, the TG involves dependence under uncertainty. For the trustee, by contrast, dependence under uncertainty is not involved because the trustee has the final say. Consequently, the TG mimics real-life trust situations, like deciding whether to tell someone a personal secret and thus trusting them to not share it with other people for personal benefits. For others not to find out about the secret, the trustor depends on the trustee to keep it for themselves, which the trustor does not know at the time of telling the secret. Therefore, they depend on the trustee's uncertain behavior, who in turn is not affected by the trustor's behavior after being told the secret. Since trustor and trustee were matched after completing data collection, the trustee made their choices for every potential transfer by the trustor (strategy method; Selten, 1967). In general, the amount transferred by trustors and the average proportion of money returned by trustees can be considered indicators of prosocial behavior (Berg et al., 1995; Thielmann et al., 2021).

In the MG (Jiang, 2013; $n = 962$), participants were asked to choose a number between 1 and 8 (in integers), to note it down on a piece of paper, and to then report whether this number matched a randomly selected number (again an integer between 1 and 8) shown on the next survey screen. If participants responded "yes", they received a bonus payment of 2€; if they responded "no", they received no such bonus. Participants were aware that nobody could know whether the two numbers actually matched. Therefore, they could simply lie to obtain the bonus without having to fear being caught cheating. As a result, the MG simulates

Table 2. Descriptive Statistics of the Behavioral Games

Game	Measure	M	SD
Public goods game (n = 333)	Contributed money (0-4€)	2.01	1.01
Trust game as trustor (n = 334)	Transferred money (0-3€)	1.59	0.76
Trust game as trustee (n = 337)	Average proportion of returned money (0-1)	0.47	0.18
Mind game (n = 1,029)	"No" (0) vs. "Yes" (1) response	0.32[a]	-

[a] This corresponds to an estimated prevalence of dishonesty of 23%. For all correlations and regression analyses involving the mind game, we reverse-keyed the responses such that positive values reflect honest behavior, thus being keyed in the same (socially desirable) direction as behavior the other games.

real-life situations in which one can cheat without the possibility of being caught, like employees being responsible for tracking their working hours without being controlled by their superiors. However, "yes"-responses in the MG do not necessarily indicate dishonest behavior given that participants can actually win with a probability of 12.5% (i.e., 1/8). Crucially, it is possible to account for this noise in the "yes"-responses (Moshagen & Hilbig, 2017), which we did in all correlations and logistic regressions using the RRreg package (Heck & Moshagen, 2018) in R. Since the MG is a single-player game, it does not afford dependence under uncertainty. Descriptive statistics of all games are summarized in Table 2.

Honesty-humility. Participants completed the German version of the HEXACO-60 (Ashton & Lee, 2009), a self-report measure of the HEXACO personality dimensions. Each dimension is measured using 10 items and a 5-point Likert-type scale. For this study, only honesty-humility (M = 3.62, SD = 0.63, α = 0.76) with its facets modesty, sincerity, greed-avoidance, and fairness is relevant.[2]

Analyses

We strictly adhered to the pre-registered data-analytic strategy. Data and analysis scripts are available on the OSF as are zero-order relations between all variables. We estimated four regression models for each of the four dependent variables. Model 1 included the positivity of perceiver effects as the only predictor. Given that both perceiver effects and honesty-humility have been shown to covary with sociodemographic variables (Lee & Ashton, 2020; Rau, Nestler, et al., 2021), Model 2 controlled for age and gender to rule out potential confounding influences. For this model, we hypothesized a positive regression weight of perceiver effects in the PGG and in the TG-Trustor, both of which involve dependence under uncertainty. For the TG-Trustee and the MG, we assumed the regression weight to be substantially smaller since behavior in these games should not depend on expectations about others. However,

since perceiver effects are positively associated with honesty-humility (Rau, Nestler, et al., 2021), and honesty-humility should be related to behavior in all four games, we conceived that even in these games there might be a small positive effect that is attributable to unspecific variation in honesty-humility. Therefore, we did not formulate a specific hypothesis concerning these regression weights. In the third model, honesty-humility served as the only predictor, which we expected to positively relate to behavior in all games. Finally, Model 4 included honesty-humility and perceiver effects as predictors, in addition to age and gender. We hypothesized a positive regression weight of honesty-humility in all games, whereas the regression weight of perceiver effects should only provide incremental predictive validity beyond honesty-humility in the PGG and the TG-Trustor.

Results and Discussion

Table 3 provides a summary of results from the regression analyses. As is apparent, in Model 1, the positivity of perceiver effects only predicted behavior in the MG but not in any other game. This remained true when controlling for demographic variation (Model 2). Once honesty-humility was additionally controlled for (Model 4), perceiver effects failed to predict behavior in any game. Thus, unlike hypothesized, perceiver effects were not uniquely predictive of behavior in any of the games, irrespective of whether or not they afforded dependence under uncertainty. By contrast, honesty-humility significantly predicted behavior in all games except the PGG in and of itself (Model 3) as well as above and beyond demographic variation and perceiver effects (Model 4). With zero-order correlations ranging between r = .07 (PGG) and r = .22 (TG-Trustee), the effect sizes of honesty-humility were in the ballpark of meta-analytic findings (Heck et al., 2018; Thielmann, Spadaro, et al., 2020), thus replicating the consistently found association between honesty-humility and prosocial/honest behavior.

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[2] The HEXACO personality model distinguishes between active cooperativeness, i.e., honesty-humility, and reactive cooperativeness, i.e., agreeableness (Hilbig et al., 2013). As all economic games included in our study afford active cooperation to be expressed, honesty-humility is the more relevant personality factor, which is supported by its consistent predictive power for behavior in all games we consider (Heck et al., 2018; Thielmann, Spadaro, et al., 2020). In contrast, reactive cooperation is not or only marginally afforded in the games we use, as suggested by meta-analytic findings showing that HEXACO agreeableness is only weakly related to the games in question (Thielmann, Spadaro, et al., 2020). Therefore, we did not include it is a covariate in our study.

Table 3. **The Positivity of Perceiver Effects as Predictor of Game Behavior in the Main Study**

Predictor	Model 1		Model 2		Model 3		Model 4	
	b [95%-CI]	p	b [95%-CI]	p	b [95%-CI]	p	b [95%-CI]	p
Public Goods Game (n = 316; 0–4€)								
Perceiver effects (z-scores)	-0.06 [-0.18, 0.06]	.827	-0.06 [-0.18, 0.06]	.837			-0.07 [-0.19, 0.05]	.883
Gender [a] (0 = female, 1 = male)			0.25 [0.02, 0.47]	.035			0.27 [0.04, 0.50]	.023
Age (z-scores)			0.11 [-0.01, 0.22]	.063			0.09 [-0.02, 0.21]	.116
Honesty-humility (z-scores)					0.07 [-0.05; 0.18]	.133	0.08 [-0.04, 0.20]	.100
Trust Game as Trustor (n = 321; 0–3€)								
Perceiver effects (z-scores)	0.04 [-0.04, 0.12]	.149	0.04 [-0.04, 0.12]	.138			0.02 [-0.06, 0.10]	.348
Gender [a] (0 = female, 1 = male)			0.03 [-0.15, 0.21]	.741			0.03 [-0.14, 0.21]	.732
Age (z-scores)			0.07 [-0.02, 0.15]	.133			0.05 [-0.04, 0.14]	.260
Honesty-humility (z-scores)					.14 [0.06; 0.22]	<.001	0.13 [0.04, 0.21]	.002
Trust Game as Trustee (n = 325; 0–1)								
Perceiver effects (z-scores)	0.01 [-0.01, 0.03]	.181	0.01 [-0.01, 0.03]	.174			0.01 [-0.01, 0.02]	.283
Gender [a] (0 = female, 1 = male)			0.02 [-0.02, 0.06]	.382			0.03 [-0.01, 0.07]	.139
Age (z-scores)			0.00 [-0.02, 0.02]	.854			-0.01 [-0.03, 0.01]	.558
Honesty-humility (z-scores)					0.04 [0.02; 0.06]	<.001	0.04 [0.02, 0.06]	<.001
Mind Game [b] (n = 962)								
Perceiver effects (z-scores)	0.18 [-0.02, 0.39]	.034	0.17 [-0.04, 0.38]	.050			0.12 [-0.10, 0.33]	.141
Gender [a] (0 = female, 1 = male)			-0.37 [-0.80, 0.04]	.072			-0.37 [-0.80, 0.06]	.088
Age (z-scores)			0.28 [0.07, 0.49]	.007			0.24 [0.02, 0.45]	.029
Honesty-humility (z-scores)					0.44 [0.24, 0.65]	<.001	0.42 [0.21, 0.62]	<.001

Note. For perceiver effects and honesty-humility, one-sided p-values are reported.

[a] We excluded the two participants identifying as diverse in Models 2 and 4, which resulted in sample sizes of n = 316 for the public goods game, n = 320 for the trust game as trustor, n = 324 for the trust game as trustee and n = 960 for the mind game.

[b] We reverse-keyed regression weights for the mind game such that positive values reflect honest behavior, thus being keyed in the same (socially desirable) direction as behavior the other games.

Moreover, we examined whether trait-specific perceiver effects for honesty-humility and agreeableness that go beyond individuals' general positivity of perceiver effects account for variation in prosocial behavior. To this end, we set up a structural equation model in which the trait-specific residuals of honesty-humility and agreeableness (after accounting for the positivity of perceiver effects) predicted behavior in the games. Overall, we found no significant associations for trait-specific perceiver effects in any game.[3] A detailed summary of these results is provided on the OSF.

Synthesis of Available Evidence

Given the mixed findings on the predictive utility of perceiver effects across previous studies and the present one, we aimed to provide a more systematic overview of the available evidence. As illustrated in Figure 1, a (non-preregistered) meta-analytic summary of all relevant studies we are aware of reveals that the overall association between perceiver effects and prosocial behavior is close to zero. Notably, the methodological setup varied in several regards between studies: Games were implemented in face-to-face vs. online settings, they involved different group sizes, and perceiver effects were assessed in traditional round-robin setups vs. using standardized materials (O-TAPE). However, none of these methodological variations seem to explain the differences in observed effect sizes. Taken together, the available evidence suggests that perceiver effects do not predict prosocial behavior in economic games that afford dependence under uncertainty.

Follow-up Analysis

The above findings conflict with evidence linking generalized expectations with prosocial behavior in situations involving dependence under uncertainty (Balliet & Van Lange, 2013; Thielmann, Spadaro, et al., 2020). Two explanations for this seem plausible: First, there might not be an association between beliefs about others' prosociality – no matter whether operationalized as generalized expectations or perceiver effects – and prosocial behavior in the population, and previous reports of such associations with generalized expectations resulted from the methodological limitations described above. Second, generalized expectations capture something unique about beliefs about others'

prosociality that is not captured by perceiver effects and, therefore, relate to prosocial behavior. Fortunately, the PPP allowed us to test these competing interpretations given that wave 5 of the base study also included a measure of generalized trust, one of the most commonly used indicators of generalized expectations. Indeed, supporting that perceiver effects and generalized trust are largely distinct, albeit related, they only showed a modest correlation of $r = .19$ ($p < .001$) in the PPP. It is thus conceivable that generalized trust may have a different relation to prosocial behavior than do perceiver effects. Thus, we conducted a follow-up analysis using generalized trust as a measure of generalized expectations[4] instead of perceiver effects to predict behavior in the games under scrutiny. Notably, since participants completed the generalized trust scale in another wave than the behavioral games and we were able to control for honesty-humility as a covariate, our analysis forestalls common limitations of earlier studies on this issue.

Methods

For the follow-up analysis, we included all participants of the PPP who provided usable data on generalized trust that were collected in wave 5 of the PPP base study (16 weeks after wave 1 on average) alongside the same self-reported personality scales, behavioral games, and demographic information as in the main study. This resulted in a sample of $N = 1,020$[5] participants (466 female, 552 male, 2 diverse; $M[SD]_{age} = 43.35[12.35]$). Most participants of this sample (78%) overlap with the main study sample such that no systematic differences between these samples should be expected whatsoever. As in the main study, the sample size provides satisfactory statistical power ($1-\beta = .86$) to detect correlations of $r = .15$ with a one-tailed α of .05 in the analysis with the fewest participants ($n = 329$; see below). The generalized trust measure we used was the German version of the General Trust Scale (Yamagishi & Yamagishi, 1994), which contains five items about how trustworthy one expects others to be and reached a mean score of $M = 3.48$ ($SD = 0.66$, $\alpha = .90$) in our sample on a scale from 1 to 5.
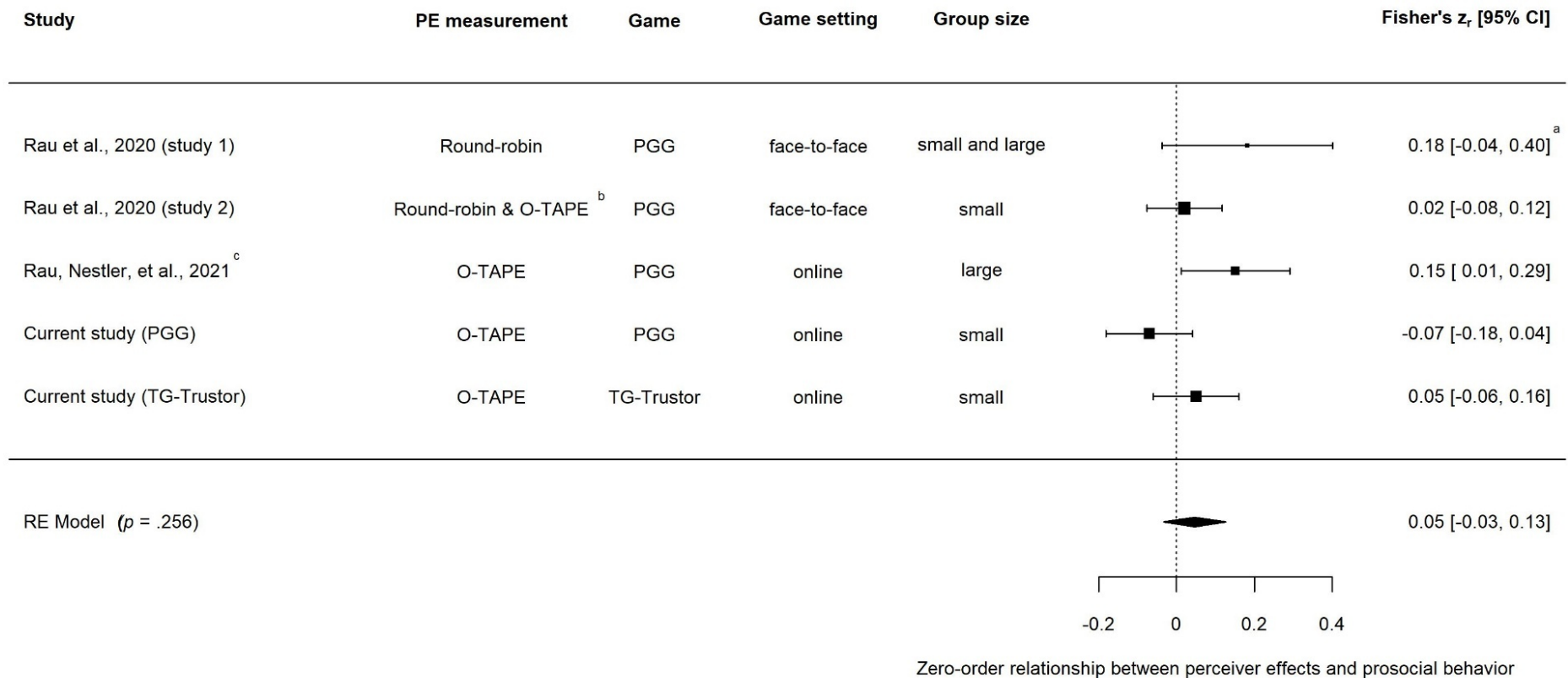
We estimated the same regression models as in our main study but with the aggregated score of the General Trust Scale instead of perceiver effects as predictor. These models

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3 In addition to the positivity of perceiver effects and trait-specific perceiver effects, we also analyzed whether the perceiver effect for honesty-humility (i.e., the aggregated score of the honesty-humility perceiver effect instead of the trait-specific perceiver effect from the SEM), which is intuitively the most relevant perceiver effect in the context of our study, relates to prosocial behavior. These analyses produced virtually identical results to the positivity of perceiver effects. They can be obtained from the OSF (https://osf.io/qhu9r/).

4 Note that we had preregistered to consider the Trait Cynicism Scale (Chowdhury & Fernando, 2014) as another measure of generalized expectations and to utilize the common factor of both scales to predict prosocial behavior. We did find that a bifactor model (i.e., all items load on one general factor and one scale-specific factor) provided the best fit and utilized the general factor as a measure of generalized expectations to predict prosocial behavior. However, it turned out that this effect was entirely driven by the General Trust Scale as the aggregated score of this scale yielded almost equivalent results as the general factor of the bifactor model. To keep our main text as concise as possible, we decided to report only the results of the General Trust Scale in our paper, but we provide detailed information on the CFAs of both scales and their results regarding the prediction of prosocial behavior on the OSF (https://osf.io/qhu9r/).

5 This sample is slightly smaller than the preregistered sample since we had to exclude 60 participants who provided data in only one of the two self-report measures of generalized expectations, and 52 participants who did not provide data in any economic game.

Study	PE measurement	Game	Game setting	Group size		Fisher's z_r [95% CI]
Rau et al., 2020 (study 1)	Round-robin	PGG	face-to-face	small and large		0.18 [-0.04, 0.40][a]
Rau et al., 2020 (study 2)	Round-robin & O-TAPE[b]	PGG	face-to-face	small		0.02 [-0.08, 0.12]
Rau, Nestler, et al., 2021[c]	O-TAPE	PGG	online	large		0.15 [0.01, 0.29]
Current study (PGG)	O-TAPE	PGG	online	small		-0.07 [-0.18, 0.04]
Current study (TG-Trustor)	O-TAPE	TG-Trustor	online	small		0.05 [-0.06, 0.16]
RE Model (*p* = .256)						0.05 [-0.03, 0.13]

Zero-order relationship between perceiver effects and prosocial behavior

Figure 1. Evidence on the Relation Between Perceiver Effects and Prosocial Behavior in Economic Games Involving Dependence Under Uncertainty

Note. Effect sizes were aggregated with a random-effects meta-analysis. O-TAPE = Online Tool for Assessing Perceiver Effects; PGG = public goods game; TG-Trustor = Trust game as trustor.

[a] This study showed a significant relation between perceiver effects for communion and prosocial behavior when controlling for covariates. Here, we depict the zero-order correlations which were non-significant in this study.

[b] The average effect size from round robin and O-TAPE was calculated.

[c] As noted above, the results of this analysis were not reported in the original article. We therefore provide the data, data analyses and results on the OSF.

draw on the same logic as the regression models with perceiver effects and we made the analogous predictions regarding the regression weights. Note that we refrained from including a model with honesty-humility as the sole predictor since we already implemented this exact model in our main study (see above).

Results

Table 4 summarized the results from the regression analyses. As hypothesized, generalized trust emerged as a predictor of prosocial behavior in the PGG (with and without covariates) but, other than hypothesized, it did not in the TG-Trustor (neither with nor without covariates). With a zero-order correlation of $r = .13$, the effect size in the PGG was comparable to meta-analytic findings ($r = .16$, 95%-CI [.12, .20], for trust propensity; Thielmann, Spadaro, et al., 2020). In the TG-Trustor, however, the zero-order correlation of $r = .08$ was significantly lower than meta-analytic estimates ($r = .16$, 95%-CI [.11, .20], for trust propensity; Thielmann, Spadaro, et al., 2020). Furthermore, this effect essentially vanished once controlling for demographics and honesty-humility ($\beta = .01$).[6] In turn, as expected, generalized trust did not incrementally predict behavior in the TG-Trustee and the MG. Taken together, three of our four hypotheses were supported. Nonetheless, the results are somewhat ambiguous as to whether generalized expectations as measured by generalized trust uniquely predict prosocial behavior in situations that involve dependence under uncertainty above and beyond trait prosociality.

General Discussion

This investigation pursued two innovative approaches to examine the influence of beliefs about others' prosociality on prosocial behavior in interdependent situations characterized by dependence on others under uncertainty. In our main study, perceiver effects failed to predict prosocial behavior in economic games involving dependence under uncertainty. This was confirmed by a meta-analysis across five studies yielding a close to zero correlation between perceiver effects and prosocial behavior. Given that these findings are at odds with prior evidence supporting a relation of generalized expectations with prosocial behavior in these games (Balliet & Van Lange, 2013; Thielmann, Spadaro, et al., 2020), we extended our investigation in a follow-up analysis. By measuring generalized expectations outside of the game-context, this analysis overcame shortcomings of previous studies. Results were mixed, however, as generalized trust as a measure of generalized expectations incrementally predicted behavior only in one relevant game

(the PGG), but not the other (the TG-Trustor). One possible explanation for this discrepancy is that dependence under uncertainty might have not been as salient in the TG-Trustor in our study as in the PGG. More specifically, the TG-Trustor not only involves dependence under uncertainty, but also provides a possibility for exploitation (vs. generosity) because the trustor can increase the trustee's outcome at personal cost by transferring money to the trustee. Possibly, trustors in our study perceived this game rather in terms of the latter affordance. This would also explain the relatively strong relation between honesty-humility and trustors' transfers ($r = .14$) compared to meta-analytic estimates (i.e., $r = .11$, 95%-CI [.06, .16]; Thielmann, Spadaro, et al., 2020). To tackle this, future studies should try to increase the salience of individuals' dependence on others' behavior. One way to do this might be to highlight the potential of being exploited by one's interaction partner(s) in the instructions, given that the framing of economic games has been shown to influence players' behavior considerably (Chaudhuri et al., 2016; Sun et al., 2019). Taken together, we interpret our results as tentative evidence that generalized expectations uniquely predict prosocial behavior in economic games that afford dependence under uncertainty, whereas perceiver effects do not. Given that both perceiver effects and generalized expectations are supposed to measure beliefs about others' prosociality, how can these differential associations with behavior be explained?

First, as mentioned above, the (positivity of) perceiver effects and generalized expectations were significantly, albeit modestly related ($r = .19$). It is conceivable that their overlap might have been stronger if perceiver effects were operationalized more narrowly in terms of trustworthiness instead of general positivity. However, given that the correlation between perceiver effects and generalized trust was essentially the same when using the more specific perceiver effect for honesty-humility instead of general positivity ($r = .20$), we consider it rather unlikely that the weak overlap between perceiver effects and generalized expectations was due to the former being too broad. Thus, while both operationalizations have something in common, the two constructs appear to be largely distinct. We therefore speculate that beliefs about others' prosociality might be conceptualized as a two-part construct comprising both implicit aspects (measurable via perceiver effects) and explicit aspects (measurable via generalized expectations like generalized trust).

Implicit-explicit dualities have a long tradition in research on attitudes (e.g., Nosek, 2007) and motives (e.g., McClelland et al., 1992) where the two different opera-

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6 We also computed a model that included only generalized trust and honesty-humility (but not age and gender) as predictors. This model yielded essentially the same results as Model 3. Specifically, in the PGG, generalized trust emerged as a significant predictor of prosocial behavior ($b = 0.12$, $p = .018$) whereas honesty-humility did not ($b = 0.08$, $p = .089$). In all other games, honesty-humility predicted game behavior but generalized trust did not (TG-Trustor: generalized trust: $b = 0.03$, $p = .231$; honesty-humility: $b = 0.12$, $p = .001$; TG-Trustee: generalized trust: $b = 0.01$, $p = .200$; honesty-humility: $b = 0.03$, $p = .001$; MG: generalized trust: $b = -0.03$, $p = .628$; honesty-humility: $b = 0.46$, $p < .001$).

Table 4. Generalized Trust as Predictor of Game Behavior in the Follow-up Analysis

Predictor	Model 1		Model 2		Model 3	
	b [95%-CI]	p	b [95%-CI]	p	b [95%-CI]	p
	Public Goods Game (n = 329; 0–4€)					
Generalized trust (z-scores)	0.13 [0.02, 0.23]	.009	0.12 [0.02, 0.23]	.012	0.11 [0.00, 0.22]	.022
Gender [a] (0 = female, 1 = male)			0.25 [0.02, 0.47]	.031	0.27 [0.04, 0.50]	.019
Age (z-scores)			0.05 [-.07, 0.16]	.422	0.03 [-0.09, 0.15]	.607
Honesty-humility (z-scores)					0.09 [-0.03, 0.20]	.072
	Trust Game as Trustor (n = 338; 0–3€)					
Generalized trust (z-scores)	0.06 [-0.02, 0.15]	.058	0.05 [-0.03, 0.13]	.119	0.02 [-0.07, 0.10]	.351
Gender [a] (0 = female, 1 = male)			0.13 [-0.03, 0.30]	.114	0.15 [-0.01, 0.32]	.070
Age (z-scores)			0.07 [-0.01, 0.15]	.086	0.06 [-0.03, 0.14]	.174
Honesty-humility (z-scores)					0.13 [0.04, 0.21]	.001
	Trust Game as Trustee (n = 353; 0–1)					
Generalized trust (z-scores)	0.02 [-0.00, 0.03]	.054	0.02 [-0.00, 0.04]	.049	0.01 [-0.01, 0.03]	.182
Gender [a] (0 = female, 1 = male)			0.00 [-0.04, 0.04]	.849	0.02 [-0.02, 0.06]	.446
Age (z-scores)			-0.01 [-0.03, 0.01]	.601	-0.01 [-0.03, 0.01]	.281
Honesty-humility (z-scores)					0.04 [0.02, 0.06]	<.001
	Mind Game [b] (n = 1020)					
Generalized trust (z-scores)	0.06 [-0.13, 0.24]	.272	0.03 [-0.16, 0.22]	.396	-0.05 [-0.24, 0.15]	.629
Gender [a] (0 = female, 1 = male)			-0.55 [-0.97, -0.13]	.008	-0.51 [-0.93, -0.06]	.026
Age (z-scores)			0.34 [0.13, 0.54]	<.001	0.29 [0.08, 0.50]	.005
Honesty-humility (z-scores)					0.42 [0.22, 0.63]	<.001

Note. For generalized trust and honesty-humility, one-sided *p*-values are reported.

[a] We excluded the two participants identifying as diverse in Models 2 and 3, which resulted in sample sizes of *n* = 329 for the public goods game, *n* = 336 for the trust game as trustor, *n* = 353 for the trust game as trustee and *n* = 1018 for the mind game.

[b] We reverse-keyed regression weights for the mind game such that positive values reflect honest behavior, thus being keyed in the same (socially desirable) direction as behavior the other games.

tionalizations are assumed to tap different modes of information processing (associative vs. rule-based) and, hence, predict different classes of outcomes (Smith & DeCoster, 2000). According to dual-process models, individuals' behavioral choices in the associative mode occur quickly, effortlessly, and preconsciously, and are based on associations learned over past experiences. In the rule-based mode, by contrast, behavior is assumed to result from slow, effortful, and conscious deliberation, and is based on explicitly represented rules. The higher someone's cognitive capacity and motivation are, the more likely are they to process information in a rule-based mode (Smith & DeCoster, 2000). In economic games, this mode arguably governs individuals' thinking given that they fully focus on an economic decision: There is no time pressure or distraction that would hamper cognitive capacity and there are high stakes (actual money) that leverage motivation. Thus, the reason why perceiver effects fail to predict economic game behavior might be a mismatch between processing modes of the involved variables.

How could a behavioral measure of prosociality look like that matches the implicit nature of perceiver effects? Perhaps, a more naturalistic, socially enriched situation such as a group setting where people are given the opportunity to self-disclose or to approach others might do the job. For instance, sharing a personal weakness with others or standing by a group member who behaved in a socially undesirable way should involve similar affordances as transferring money in the PGG or TG-Trustor: Such behavior increases others' welfare but is costly if others do not reciprocate. However, such spontaneous interpersonal behavior likely hinges more on the associative mode than economic game behavior. As such, it might be more contingent on deep-seated beliefs about others' prosociality, which might be measurable by perceiver effects. Indeed, recent evidence suggests that the positivity of perceiver effects is closely tied to popularity in actual face-to-face groups (Rau, Carlson, et al., 2022). Although speculative, this might be how positive perceivers who invest in prosocial interpersonal behavior are socially paid off.

Conclusion

The present study provides strong evidence that a tendency to judge others positively (rather than negatively) in first impressions does not predict prosocial decision making in economic games. Our study addressed various limitations of prior research by (a) including a large and heterogenous sample of participants, (b) measuring perceiver effects in a way that rules out confounding influences of a group's social reality, and (c) investigating multiple games with and without dependence under uncertainty. Together with a meta-analytic summary of studies on this issue, the current work establishes a robust empirical basis providing evidence that perceiver effects do not influence prosocial behavior in economic games.

At the same time, we found tentative evidence that generalized expectations uniquely predict prosocial behavior in these contexts, over and above trait prosociality. However, given that we found this relation in only one of two rele-

vant games, and considering the methodological issues of earlier research that we discussed, we appeal to researchers to further investigate this relation while taking trait prosociality into account as a control variable. Furthermore, the completion of the generalized expectations questionnaires should be separated from the economic games to preclude that the relation between prosocial behavior and generalized expectations is overestimated due to state-like expectations towards interaction partners.

Future studies should investigate whether this likely discrepancy between perceiver effects and generalized expectations arises from the more implicit vs. explicit operationalization of beliefs about others' prosociality by these two measures and, thus, their potentially different consequences for associative and rule-based behavior. This could include comparing the predictive utility of both of these approaches for diverse outcomes that hinge not only on rule-based but also on associative decision making. If successful, a double dissociation would go a long way in furthering our understanding of human prosociality.

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Contributions

Contributed to conception and design: MS, IT, RR
Contributed to acquisition of data: IT, RR
Contributed to analysis and interpretation of data: MS, IT, RR
Drafted and/or submitted version for publication: MS, IT, RR
Approved the submitted version for publication: MS, IT, RR

Funding Information

Competing Interests

The authors declare that they have no conflict of interest.

Supplemental Material

The following online supplemental material can be retrieved from the project page of this paper on the Open Science Framework (https://osf.io/qhu9r/): 1) detailed results of the analyses including the correlation matrix of all variables and the regression analyses of both the main study and the follow-up analysis (Supplement 1); 2) the supplemental analysis of trait-specific perceiver effects as predictor of prosocial behavior (Supplement 2); 3) the supplemental analysis of the factorial structure of the General Trust Scale and the Trait Cynicism Scale as measures of generalized expectations and regression analyses using their common factor from a bifactor model to predict prosocial behavior (Supplement 3).

Data Accessibility Statement

The data analyzed in this study and the R-code to reproduce all analyses can be found on the project page of this paper on the Open Science Framework (https://osf.io/qhu9r/). A full description of all measures included in this study is provided on the project page of the Prosocial Personality Project on the Open Science Framework (https://osf.io/m2abp/).

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