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Personality and Prosocial Behavior: A Theoretical Framework and Meta-Analysis

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Decades of research document individual differences in prosocial behavior using controlled experiments that model social interactions in situations of interdependence. However, theoretical and empirical integration of the vast literature on the predictive validity of personality traits to account for these individual differences is missing. Here, we present a theoretical framework that identifies 4 broad situational affordances across interdependent situations (i.e., exploitation, reciprocity, temporal conflict, and dependence under uncertainty) and more specific subaffordances within certain types of interdependent situations (e.g., possibility to increase equality in outcomes) that can determine when, which, and how personality traits should be expressed in prosocial behavior. To test this framework, we meta-analyzed 770 studies reporting on 3,523 effects of 8 broad and 43 narrow personality traits on prosocial behavior in interdependent situations modeled in 6 commonly studied economic games (Dictator Game, Ultimatum Game, Trust Game, Prisoner's Dilemma, Public Goods Game, and Commons Dilemma). Overall, meta-analytic correlations ranged between $-.18 \leq \hat{\rho} \leq .26$, and most traits yielding a significant relation to prosocial behavior had conceptual links to the affordances provided in interdependent situations, most prominently the possibility for exploitation. Moreover, for several traits, correlations within games followed the predicted pattern derived from a theoretical analysis of affordances. On the level of traits, we found that narrow and broad traits alike can account for prosocial behavior, informing the bandwidth-fidelity problem. In sum, the meta-analysis provides a theoretical foundation that can guide future research on prosocial behavior and advance our understanding of individual differences in human prosociality.

Public Significance Statement
This meta-analysis provides a theoretical framework and empirical test identifying when, how, and which of 51 personality traits account for individual variation in prosocial behavior. The meta-analysis shows that the relations between personality traits and prosocial behavior can be understood in terms of a few situational affordances (e.g., a possibility for exploitation, a possibility for reciprocity, dependence on others under uncertainty) that allow specific traits to become expressed in behavior across a variety of interdependent situations. As such, the meta-analysis provides a theoretical basis for understanding individual differences in prosocial behavior in various situations that individuals face in their everyday social interactions.

Keywords: cooperation, games, meta-analysis, personality, prosocial behavior

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Prosocial behaviors such as generosity, cooperation, and reciprocity support the functioning of a wide range of relationships, including dyads (Murray & Holmes, 2009; Rusbult & Van Lange, 2003), groups (Fehr, Fischbacher, & Gachter, 2002), and societies

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at large (Nowak, 2006). Broadly speaking, prosocial behaviors refer to all kinds of actions that benefit others, often at a personal cost to the actor. As such, prosocial behaviors can affect the health and wellbeing of romantic partners (Le, Impett, Lemay, Muise, & Tskhay, 2018), promote the productivity of organizations (Podsakoff, Ahearne, & MacKenzie, 1997), enhance the wealth of societies (Knack & Keefer, 1997), and even provide a key solution to global challenges (e.g., climate change; Alston, 2015; Marx & Weber, 2012). Corresponding to this importance and omnipresence, human prosociality has received considerable attention across scientific disciplines, including biology, economics, sociology, and psychology.

Across the numerous disciplines, researchers have adopted a standardized experimental method to study prosocial behavior: economic social decision-making tasks, or simply *games* (Baumard, André, & Sperber, 2013). These game paradigms were developed to model the complexity of real-life interdependent situations in a precise yet parsimonious approach that allows assessing actual prosocial behavior in standardized experimental settings (Murnighan & Wang, 2016; Pruitt & Kimmel, 1977). One of the most well-known games is the Prisoner's Dilemma (Luce & Raiffa, 1957; Rapoport & Chammah, 1965), a situation involving a conflict of interests between maximizing one's personal gain (defection) and maximizing collective gain (cooperation). However, researchers have developed many different games to study prosocial behavior, each representing a specific type of social interaction that provides a useful testbed for theories of prosocial behavior.

One of the most striking observations from thousands of studies using economic games is that individuals are—contrary to the assumptions of classic economic theory (Luce & Raiffa, 1957; von Neumann & Morgenstern, 1944)—not purely selfish, but indeed willing to forgo personal gains for the sake of others' welfare. Importantly, however, these prosocial tendencies yield substantial interindividual variability: Whereas some individuals are willing to benefit others at personal cost, others are mostly self-interested and motivated to maximize their individual profit (e.g., Camerer, 2003; Engel, 2011; Sally, 1995)—and this tendency exhibits stability across games and over time (e.g., Blanco, Engelmann, & Normann, 2011; Peysakhovich, Nowak, & Rand, 2014; Yamagishi et al., 2013). To explain these stable interindividual differences, research on prosocial behavior has increasingly integrated concepts from personality psychology and considered a great variety of characteristics ranging from the broad (factor-level) traits included in basic trait taxonomies, such as the Five Factor Model (FFM; McCrae & Costa, 1987) and the HEXACO model of personality (Ashton & Lee, 2007), to more narrow (facet-level) traits, such as empathy, risk-taking, and trust propensity.

A sweeping conclusion from this research relating personality traits to prosocial behavior is that "the personality of the player matters" (Boone, De Brabander, & van Witteloostuijn, 1999, p. 367). However, no prior research has offered a broad review of this vast literature to allow for empirical and theoretical integration and to deliver refined insights about how (strongly) different traits relate to prosocial behavior across interdependent situations. Even previous meta-analytic efforts have only focused on a few (classes of) traits, one at a time (Balliet, Parks, & Joireman, 2009; Balliet & Van Lange, 2013b; Kline, Bankert, Levitan, & Kraft, 2019; Pletzer et al., 2018; Zettler, Thielmann, Hilbig, & Moshagen, in press; Zhao & Smillie, 2015). We present the first comprehensive meta-analytic review to summarize the entire 60 year history of research studying the relation between personality traits and prosocial behavior in economic games.

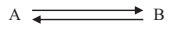
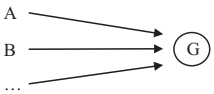
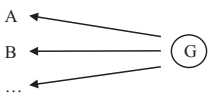
As we elaborate in what follows, the meta-analysis offers four main contributions: First, we aim for a theory-driven, comprehensive understanding of *which* traits (most strongly) relate to prosocial behavior across a variety of interdependent situations. Second, we consider the underlying question of *how* personality relates to prosocial behavior in specific situations in terms of key affordances that allow the expression of corresponding psychological processes in behavior. To do so, we develop and test a theoretical framework informed by Interdependence Theory (Kelley & Thibaut, 1978; Thibaut & Kelley, 1959) and prior research that generates hypotheses about which traits should (not) relate to prosocial behavior in which situations. Third, we provide a comparison of personality concepts and frameworks, illuminating how much specificity it requires on the level of traits to account for individual differences in prosocial behavior. Fourth, and finally, we test how several structural features of social interactions (e.g., degree of conflict of interests, repetition of interaction) and aspects of the experimental design (e.g., behavior-contingent incentives, deception) moderate the relation between personality and prosocial behavior.

In what follows, we first briefly introduce how games are used to model interdependent situations and to study prosocial behavior, and we describe the games included in the meta-analysis. Next, we provide an overview of the traits that have been assessed in studies using games, and so are included in the meta-analysis. Then, we present our theoretical framework that generates predictions about which traits should relate to prosocial behavior across and within situations. We end this section by introducing the distinction between broad versus narrow traits (bandwidth-fidelity dilemma) and the moderators we consider in our analysis.

Economic Games

In essence, economic games "provide a coherent, substantive model of many actual encounters" (Murnighan & Wang, 2016, p. 80) and thereby allow for measuring *actual behavior* (Baumeister, Vohs, & Funder, 2007) in a variety of interdependent situations—wherein each person's behavior can affect their own and others' outcomes—in controlled, experimental settings. Researchers have developed a multitude of different games, all of which are sought to model specific classes of interdependent situations (Kelley et al., 2003; Murnighan & Wang, 2016). In the current meta-analysis, we will focus on a selection of six games that (a) have been most commonly applied in prior research and (b) broadly represent different classes of interdependent situations individuals might encounter in their everyday social interactions. These are the Dictator Game (Forsythe, Horowitz, Savin, & Sefton, 1994), Ultimatum Game (Güth, Schmittberger, & Schwarze, 1982), Trust Game (Berg, Dickhaut, & McCabe, 1995), Prisoner's Dilemma (Luce & Raiffa, 1957; Rapoport & Chammah, 1965), Public Goods Game (Samuelson, 1954), and Commons Dilemma (Hardin,

Table 1
Economic Game Paradigms Included in the Meta-Analysis, With Corresponding Real-Life Examples of Interdependent Situations

Game	Decision path	Structure	Real-life examples of situation modeled
Dictator Game	 A transfers x to B	A (the dictator) freely decides how much x of an endowment to give to B (the recipient). B has no veto power, that is, she cannot react to A's decision.	Donation decisions (e.g., donating money to a charity, donating blood or organs to a hospital)
Ultimatum Game	 A transfers x to B; B can accept or reject x	A (the proposer) decides how much x of an endowment to give to B (the responder). B has veto power, meaning that she can accept or reject A's offer. If B accepts, outcomes are split as proposed by A; if B rejects, both players receive nothing.	Bargaining with "take it or leave it" offers, (e.g., negotiations about a higher salary between a job applicant and an employer, or about the price of a product between a seller and a costumer)
Trust Game	 A transfers x to B and x is multiplied by m; B can return any amount $m*x$	A (the trustor) decides how much x of an endowment to give to B (the trustee). x is multiplied by a constant ($m > 1$) and added to B's endowment. B can return any amount $m * x$ to A.	Loaning money to someone; transaction via online purchase systems; hiring a babysitter to take care of one's child
Prisoner's Dilemma	A (B) transfers x (y) to B (A) and x (y) is multiplied by m	A and B decide independently whether to cooperate (transfer x/y) or defect. x/y is multiplied by a constant ($m > 1$) and added to A/B's endowment.	Military buildup between nations; use of performance-enhancing drugs in elite sports; colleagues working together on a joint task
Public Goods Game	 N members of a group transfer x to a group account G and x is multiplied by m; $\Sigma x*m$ is equally distributed among all N members	Each member of a group of size N decides how much x of an individual endowment to contribute to a group account. Contributions are multiplied by a constant m ($1 < m < N$) and shared equally across all group members, irrespective of their individual contributions.	Paying taxes; contributions to the public-service broadcaster; doing the housework in a flat share
Commons Dilemma	 N members of a group take x out of a group account G; $G - \Sigma x$ is replenished by rate r before next round of extraction starts	Each member of a group of size N decides how much x to take from a common resource. The amount each member takes is no longer available to other group members. After each round, the resource recovers with reproduction rate $r > 1$. The game ends once the resource is depleted, that is, once extraction exceeds replenishment.	Overconsumption of shared, natural resources (e.g., clean air, timber, fish, etc.)

1968). Table 1 provides an overview of these games, including their basic structure and rules as well as real-life examples of interdependent situations the games model.

Games commonly involve multiple individuals (called *players*) who have certain choice options at their disposal. The combination of players' choices incurs certain individual *outcomes* that involve (real or hypothetical) payoffs (e.g., money). Games that are used to study prosocial behavior tend to involve a conflict of interests—that is, negative interdependence—between players' outcomes: Each player can only maximize her individual outcome at the expense of the other player(s), ultimately minimizing their outcome.[1]

Depending on the specific interdependent situation modeled, different types and classes of games can be distinguished. *Resource allocation games* such as the Dictator Game, Ultimatum Game, and Trust Game are sequential games with two players in asymmetric roles. Specifically, one player first decides how to allocate a certain resource between herself and the other player, who then decides how to react to the first player's decision (unless the reacting player is completely powerless, as in the Dictator Game; see Table 1). For example, in the Trust Game, the trustor first decides how much of her endowment to send to the trustee who then decides how much of the (multiplied) amount to return to the trustor.

Social dilemmas such as the Prisoner's Dilemma, Public Goods Game, and Commons Dilemma are games with two or more players in symmetric roles, who independently and (usually) simultaneously decide whether to cooperate or to defect. The most crucial feature of social dilemmas is that cooperation increases *social welfare*—that is, the sum of all players' outcomes, thus being collectively beneficial—while at the same time decreasing a player's own outcome. In the Public Goods Game, for instance, each member of a group decides how much to contribute to a group account; critically, the sum of contributions is multiplied (increasing social welfare) and split equally among all group members, irrespective of each member's individual contribution. Thus, a member contributing nothing receives the highest out-

[1] This meta-analysis focuses on games involving conflicting interests; it does not include coordination games with largely corresponding interests and positive interdependence between players' outcomes (e.g., Abele, Stasser, & Chartier, 2010; Kelley et al., 2003).

come, but social welfare can only be maximized if everyone contributes.

Beyond distinguishing between different classes of interdependent situations, games offer the flexibility to model diverse variations of a situation. For example, social dilemmas can be modified to contain more or less conflict of interests between players (Rapoport & Chammah, 1965; Vlaev & Chater, 2006) and to involve one-shot or repeated interactions with the same partner over time (e.g., Balliet, Mulder, & Van Lange, 2011; Engel, 2011). Overall, a single game can be implemented in many different ways that can ultimately affect players' willingness to act in a prosocial manner (e.g., Ledyard, 1995; Sally, 1995; Zelmer, 2003).

Personality Traits and Prosocial Behavior in Economic Games

By definition, "personality traits are probabilistic descriptions of relatively stable patterns of emotion, motivation, cognition, and behavior, in response to classes of stimuli" (DeYoung, 2015, p. 35; for a similar definition, see, e.g., Roberts, 2009). As sketched above, such stable individual patterns have also been consistently documented when using games, most prominently in terms of interindividual differences in the tendency to act in a prosocial manner (e.g., Camerer, 2003; Engel, 2011; Johnson & Mislin, 2011; Sally, 1995) and of intraindividual consistency within and across games (Baumert, Schlösser, & Schmitt, 2014; Blanco et al., 2011; Galizzi & Navarro-Martinez, 2019; Haesevoets, Reinders Folmer, & Van Hiel, 2015; McAuliffe, Forster, Pedersen, & McCullough, 2019; Peysakhovich et al., 2014; Yamagishi et al., 2013). Specifically, research suggests test-retest reliabilities for behavior within games of around .70 to .80 (e.g., Baumert et al., 2014; Yamagishi et al., 2013) and intercorrelations of behaviors between games of around .40 (e.g., Galizzi & Navarro-Martinez, 2019; Haesevoets et al., 2015; Yamagishi et al., 2013).

Psychologists have turned to personality traits to account for individual differences in prosocial behavior ever since they started to use games. Seminal work in the 1960s and 70s, for instance, commonly considered the effect of personality *in general*—as measured via broad lists of adjectives—on prosocial behavior (e.g., Gallo & Winchell, 1970; Wilson, Chun, & Kayatani, 1965), as well as of trait authoritarianism (e.g., Berkowitz, 1968; Deutsch, 1960; Wilson & Robinson, 1968). With the increasing consideration of different personality traits and development of corresponding scales (Weiner & Greene, 2017), this research has to date accumulated to hundreds of studies examining the links of various traits to prosocial behavior.

Table 2 provides a comprehensive summary of traits that have been repeatedly assessed in combination with games and that are thus included in the current meta-analysis. These traits cover a wide variety of constructs, including broad traits as conceptualized in models of basic personality structure (i.e., FFM and HEXACO) and narrower traits that should, by definition, more uniquely capture certain behavioral, cognitive, and/or motivational aspects.

Situational Affordances for Prosocial Behavior

We propose that personality traits will be more or less relevant for prosocial behavior in interdependent situations, depending on the *situational affordances* (Gibson, 1977; Stoffregen, 2004) the situations provide. Indeed, the concept of situational affordances plays a key role in several theories on the relation between personality and (social) behavior more generally (e.g., De Vries, Tybur, Pollet, & van Vugt, 2016; Holmes, 2004; Mischel & Shoda, 1995; Rauthmann et al., 2014). Specifically, "situations have properties that provide a context for the expression of motives, goals, values, and preferences" (Reis, 2008, p. 316). As such, "situations afford (make possible) the manifestation of the higher-level 'social person factors'" (Kelley et al., 2003, p. 74). By implication, situational affordances may activate certain traits and thereby form the basis for a trait to become expressed in behavior.

Corresponding to this logic, previous research on prosocial behavior has also—though mostly implicitly—adopted the concept of situational affordances and assumed that situations of interdependence may be understood in terms of the affordances they provide (e.g., Kelley & Thibaut, 1978; Rusbult & Van Lange, 2003). Here, we integrate this prior research to identify four broad affordances in interdependent situations—(a) the possibility for exploitation, (b) the possibility for reciprocity, (c) a temporal conflict between short- and long-term interests, and (d) dependence under uncertainty[2]—each of which allows distinct psychological processes to become expressed in behavior. Psychological processes, as we use the term here, comprise all kinds of related factors within a person that may become expressed in behavior in a specific situation, including attitudes, cognitions, emotions, goals, and motives. As such, psychological processes are inherently tied to personality traits, offering clear predictions about which traits should (not) account for individual differences in prosocial behavior in which situations. That is, on the one hand, the well-defined structure of games (Kelley et al., 2003; von Neumann & Morgenstern, 1944) allows to determine the affordances involved in a game (Table 3). On the other hand, the conceptualizations (Table 2) and operationalizations of traits allow to determine whether a trait is conceptually (positively or negatively) linked to one or more of the psychological processes afforded to be expressed in interdependent situations.[3] Below, we describe each of the four broad affordances, the related psychological processes, and the traits associated with them.[4] Moreover, we delineate the overlap of the four affordances with general

[2] Of note, other affordances may as well be involved in certain situations; however, the four broad affordances considered here arguably refer to the key, most general affordances relevant for behavior across a wide variety of interdependent situations (Kelley et al., 2003; Rusbult & Van Lange, 2003).

[3] A detailed summary of operationalizations of the traits, including sample items, is available in the additional material on the OSF (https://osf.io/dbuk6/). For each trait in Table 2, we thoroughly reviewed the conceptualizations and operationalizations of the traits and determined whether the trait has a conceptual (positive or negative) link to one or more of the four broad affordances. Importantly, in this mapping process, we focused on the conceptualizations and operationalizations of the traits, without considering additional empirical evidence that might potentially associate a trait with another affordance as implied by its conceptualization/operationalization. All authors performed this mapping independently, and we discussed any disagreement thoroughly until agreement was reached.

[4] The affordances we propose to be provided in interdependent situations may allow the expression of specific psychological processes which give rise for certain personality traits to influence behavior. Although traits are thus only indirectly linked to affordances—namely through said psychological processes—we will refer to traits as being (conceptually) linked to affordances in what follows, given that affordances ultimately provide the opportunity for traits to become activated and expressed in behavior.

Table 2
Traits Included in the Meta-Analysis, With Definitions and Related Situational Affordances

Trait	Definition	Afforded in the presence of . . .	
		Broad affordance(s)	Subaffordance(s)
Broad traits			
Agreeableness (FFM)	[Individual] differences in the motivation to cooperate (vs. acting selfishly) in resource conflicts (Denissen & Penke, 2008, p. 1285)	exploitation, reciprocity, dependence	max(other), min(|own − other|), max(own + other)
Agreeableness (HEXACO)	The tendency to be forgiving and tolerant of others, in the sense of cooperating with others even when one might be suffering exploitation by them (Ashton & Lee, 2007, p. 156)	reciprocity	max(other), max(own + other)
Conscientiousness	The proactive side of Conscientiousness is seen most clearly in the need for achievement and commitment to work; the inhibitive side is seen in moral scrupulousness and cautiousness (Costa, McCrae, & Dye, 1991, p. 889)	temporal conflict	—
Emotionality (HEXACO)	Tendencies relevant to the construct of kin altruism . . ., including not only empathic concern and emotional attachment toward close others (who tend to be one's kin) but also the harm-avoidant and help-seeking behaviors that are associated with investment in kin (Ashton & Lee, 2007, p. 156)	—	—
Extraversion	[Individual differences in] engagement in social endeavors (such as socializing, leading, or entertaining) (Ashton & Lee, 2007, p. 156)	—	—
Honesty-humility (HEXACO)	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)	exploitation	max(other), min(|own − other|), max(own + other)
Neuroticism (FFM)	A broad domain of negative affect, including predispositions to experience anxiety, anger, depression, shame, and other distressing emotions (Costa, Terracciano, & McCrae, 2001, p. 322)	—	—
Openness to experience	[Individual differences in] engagement in idea-related endeavors (such as learning, imagining, and thinking) (Ashton & Lee, 2007, p. 156)	—	—
Narrow traits			
Active prosociality			
Altruism	A disposition that leads people who have more of it to be more compassionate and caring toward others in distress (Batson, Bolen, Cross, & Neuringer-Benefiel, 1986, p. 212)	exploitation, reciprocity	max(other)
Concern for others	Individual differences in the extent to which . . . other people's interests serve as guides for behavior (Gerbasi & Prentice, 2013, p. 495)	exploitation, reciprocity	max(other), max(own + other)
Empathy	Reactions of one individual to the observed experiences of others (Davis, 1983, p. 113)	exploitation, reciprocity	max(other)
Inequality aversion	[Individual differences in] perceptions of and reactions to observed . . . or committed injustice (Schmitt, Baumert, Gollwitzer, & Maes, 2010, p. 212); an individual is inequity averse if he dislikes outcomes that are perceived as inequitable (Fehr & Schmidt, 1999, p. 820)	exploitation, reciprocity	min(|own − other|)

Table 2 (*continued*)

Trait	Definition	Afforded in the presence of . . .	
		Broad affordance(s)	Subaffordance(s)
Pro-environmentalism	The collection of beliefs, affect, and behavioral intentions a person holds regarding environmentally related activities or issues (Schultz, Shriver, Tabanico, & Khazian, 2004, p. 31)	exploitation, temporal conflict	max(own + other)
Social value orientation	The weights people assign to their own and others' outcomes in situations of interdependence (Balliet, Parks, & Joireman, 2009, p. 533)	exploitation	max(other), min(|own − other|), max(own + other)
Reactive prosociality			
Forgiveness (vs. retaliation)	Disposition to forgive interpersonal transgressions over time and across situations (Berry, Worthington, O'Connor, Parrott, & Wade, 2005, p. 183)	reciprocity	max(other), min(|own − other|)
Positive reciprocity	Positive reactions to positively valued behaviours with the emphasis on rewarding someone else's behaviour (Perugini, Gallucci, Presaghi, & Ercolani, 2003, p. 274)	reciprocity	max(other), min(|own − other|)
Antisocial tendencies			
Aggression	Trait aggressiveness . . . identifies people who are prone to hostile cognitions and angry affect as well as a readiness to engage in physical and verbal aggression (Bettencourt, Talley, Benjamin, & Valentine, 2006, p. 752)	reciprocity, temporal conflict	min(other)
Competitiveness	Individuals' desire to do better than others, their desire to win in interpersonal situations, and their enjoyment of interpersonal competition (Houston, McIntire, Kinnie, & Terry, 2002, p. 286)	exploitation, reciprocity	max(own − other)
Envy	[Tendency to experience a] sense of inferiority . . . [and] ill will, frustration, and a subjective sense of injustice prompted by unflattering comparison (Smith, Parrott, Diener, Hoyle, & Kim, 1999, p. 1010)	exploitation, reciprocity	max(own − other)
Greed	An insatiable desire for more resources, monetary or other (Krekels & Pandelaere, 2015, p. 225)	exploitation, reciprocity	max(own)
Machiavellianism	A duplicitous interpersonal style, characterized by a cynical disregard for morality and a focus on self-interest and personal gain (Muris, Merckelbach, Otgaar, & Meijer, 2017, p. 184)	exploitation	max(own), max(own − other)
Narcissism	A grandiose view of the self, a strong sense of entitlement and superiority, a lack of empathy, and a need for social admiration, as well as tendencies to show dominant, charming, bragging, impulsive, and aggressive behaviors (Back et al., 2013, p. 1014)	exploitation, reciprocity, temporal conflict	max(own), max(own − other)
Psychopathy	A personality trait characterized by enduring antisocial behavior, diminished empathy and remorse, and disinhibited or bold behavior (Muris et al., 2017, p. 184)	exploitation, reciprocity, temporal conflict, dependence	max(own), min(other)
Sadism	The term *sadistic personality* describes a person who humiliates others, shows a longstanding pattern of cruel or demeaning behavior to others, or intentionally inflicts physical, sexual, or psychological pain or suffering on others in order to assert power and dominance or for pleasure and enjoyment (O'Meara, Davies, & Hammond, 2011, p. 523)	exploitation, reciprocity	min(other)
Beliefs			
Belief in a just world	[Individuals' tendency] to believe that they live in a world where people generally get what they deserve (Lerner & Miller, 1978, p. 1030)	exploitation, dependence	min(|own − other|)

(*table continues*)

Table 2 (*continued*)

Trait	Definition	Afforded in the presence of . . .	
		Broad affordance(s)	Subaffordance(s)
Trust propensity	A person's general willingness to trust others (Mayer, Davis, & Schoorman, 1995, p. 714) [based on the] expectation of partner's goodwill and benign intent (Yamagishi & Yamagishi, 1994, p. 131)	dependence	—
Morality			
Guilt proneness	Predisposition to experience negative feelings about personal wrongdoing, even when the wrongdoing is private (T. R. Cohen, Panter, & Turan, 2012, p. 355)	exploitation	max(other)
Integrity	Integrity involves honesty, trustworthiness, fidelity in keeping one's word and obligations, and incorruptibility, or an unwillingness to violate principles regardless of the temptations, costs, and preferences of others (Schlenker, 2008, p. 1081)	exploitation, reciprocity	max(other), min(|own − other|)
Identity- and society-related attitudes			
Collectivism	One's tendency to give priority to the collective self over the private self, especially when these two come into conflict (Yamaguchi, Kuhlman, & Sugimori, 1995, p. 659)	exploitation, temporal conflict	max(own + other)
Individualism	Individualists will see themselves as more differentiated and separate from others, and place more importance on asserting their individuality (Bochner, 1994, p. 274)	exploitation	max(own), max(own − other)
Power	Desire for power and a drive to come out on top in a status hierarchy (Grina, Bergh, Akrami, & Sidanius, 2016, p. 114)	exploitation	max(own − other)
Right-wing authoritarianism	Opposing any change in the social status quo, . . . favouring tough punishment of deviance, nonconformity, or innovation, [and] favouring traditional, old-fashioned lifestyles, behavioural norms, and values (Duckitt, Bizumic, Krauss, & Heled, 2010, p. 691)	exploitation, reciprocity	max(own − other)
Social dominance orientation	Individual differences in the preference for group based hierarchy and inequality (Ho et al., 2015, p. 1003)	exploitation	max(own − other)
Self-regulation			
Impulsivity	Tendency to deliberate less than most people of equal ability before taking action (Dickman, 1990, p. 95)	temporal conflict	—
Self-control	The ability to override or change one's inner responses, as well as to interrupt undesired behavioral tendencies (such as impulses) and refrain from acting on them (Tangney, Baumeister, & Boone, 2004, p. 274)	temporal conflict	—
Self-presentation	The extent to which individuals can and do monitor their self-presentation, expressive behavior, and non-verbal affective display (Snyder, 1974, pp. 526/527), [potentially motivated by] the identity concern of one's . . . evaluation (De Cremer & Tyler, 2005, p. 121)	temporal conflict	—
Risk attitudes			
Risk-taking	One's general degree of comfort with facing uncertain gains or losses (Ehrlich & Maestas, 2010, p. 658)	dependence	—
Thinking style			
Intuition	Reliance on and enjoyment of feelings and intuitions in making decisions [and] a high level of ability with respect to one's intuitive impressions and feelings (Pacini & Epstein, 1999, p. 974)	—	—

Table 2 (*continued*)

Trait	Definition	Afforded in the presence of . . .	
		Broad affordance(s)	Subaffordance(s)
Reflection	Reliance on and enjoyment of thinking in an analytical, logical manner [and] a high level of ability to think logically and analytically (Pacini & Epstein, 1999, p. 974)	—	—
Affect			
Anxiety	The stable tendency to attend to, experience, and report negative emotions such as fears, worries, and anxiety across many situations (Gidron, 2013, p. 1989)	—	—
Negative affect	Individual differences in the tendency to experience negative moods and feelings, including sadness, worry, and anger (Stanton & Watson, 2014, p. 556)	—	—
Positive affect	Individual differences in the tendency to experience positive emotions and feeling states (Stanton & Watson, 2014, p. 556)	—	—
Shame proneness	High shame-prone individuals attribute transgressions and negative outcomes to characterological faults, experiencing global feelings of self-debasement and enduring negative affect (Thompson, Altmann, & Davidson, 2004, p. 613)		
Motivation			
Achievement	Recurrent concern with a standard of excellence and the disposition to derive satisfaction from the mastery of challenging tasks (Schönbrodt & Gerstenberg, 2012, p. 726)	—	—
Affiliation	[Desire] to establish and/or maintain warm and friendly interpersonal relations (French & Chadwick, 1956, p. 296)	—	—
Approach	Proneness to engage in goal-directed efforts and to experience positive feelings when the person is exposed to cues of impending reward (Carver & White, 1994, p. 319)	—	—
Avoidance	Sensitivity to the presence or absence of negative outcomes [and] vigilant avoidance of losses or failures (Lockwood, Jordan, & Kunda, 2002, p. 854)	—	—
Other			
Emotional intelligence	Extent to which [individuals] attend to, process, and utilize affect-laden information of an intrapersonal (e.g., managing one's own emotions) or interpersonal (e.g., managing others' emotions) nature (Petrides & Furnham, 2006, p. 553)	—	—
Locus of control[a]	The degree to which persons expect that a reinforcement or an outcome of their behavior is contingent on their own behavior or personal characteristics versus the degree to which persons expect that the reinforcement or outcome is a function of chance, luck, or fate, is under the control of powerful others, or is simply unpredictable (Rotter, 1990, p. 489)	—	—
Optimism	Generalized expectations of the occurrence of good outcomes in one's life (Scheier & Carver, 1985, p. 239)	—	—
Self-esteem	Individual differences in the evaluation of one's self-worth and self-respect (Gnambs, Scharl, & Schroeders, 2018, p. 14)	—	—

Note. FFM = Five Factor Model; max() = possibility to maximize; min() = possibility to minimize; other = others' outcomes; own = own outcomes.
[a] In our analysis, higher levels of locus of control imply higher internal locus of control.

Table 3
Relation Between Characteristics of Interdependent Situations and Broad Situational Affordances

Affordance	Situation characteristics
Possibility for exploitation	Power (low asymmetrical dependence); One-shot interaction; Simultaneous interaction *or* final move in sequential interaction; Conflict of interests
Possibility for reciprocity	Repeated interaction; Sequential interaction as individual reacting to other player(s)
Temporal conflict	Repeated interaction; One-shot *and* sequential interaction as player acting first[a]
Dependence under uncertainty	Low power (high asymmetrical dependence) *or* mutual (symmetrical) dependence; Simultaneous choice *or* sequential interaction as player acting first

[a] This only applies when the second player can react to both a first player's prosocial and selfish behavior. In the Trust Game, for example, the trustee can only react when the trustor behaves in a prosocial manner (i.e., transfers a nonzero amount). Thus, the Trust Game as trustor does not involve temporal conflict as defined here.

taxonomies of situational affordances, namely the DIAMONDS (Rauthmann et al., 2014) and the situation, trait, and outcome activation (STOA) model (De Vries et al., 2016). However, note that the affordances specified here are narrower in scope as they specifically refer to situations of interdependence.

First, interdependent situations may provide an opportunity to exploit others. *Exploitation* is possible whenever an individual can increase her outcome at others' costs, and particularly so if she does not need to fear retaliation by the interaction partner(s). In terms of basic dimensions of interdependence as specified in Interdependence Theory (Kelley & Thibaut, 1978; Thibaut & Kelley, 1959), exploitation is possible in situations of high power (i.e., asymmetry of dependence) and high conflict of interests (i.e., low degree of correspondence), as well as in one-shot interactions (Table 3). In fact, all games included in the meta-analysis provide a possibility for exploitation, except the Ultimatum Game as responder in which the player can either accept the proposer's split or reject it so that both players get nothing (Table 1). In turn, whenever exploitation is possible, the situation allows the expression of unconditional concern for others' welfare (e.g., Rusbult & Van Lange, 2008; Van Lange, 2000). As summarized in Table 2, several traits included in the meta-analysis are associated with this psychological process (e.g., envy, honesty-humility, Machiavellianism, sadism), and so predicted to be expressed in games involving exploitation. The exploitation affordance has conceptual links to DIAMONDS-Deception and STOA-Exploitation.

Second, interdependent situations may provide an opportunity to react to another's prior behavior, that is, to (positively or negatively) reciprocate (e.g., Axelrod & Hamilton, 1981; Trivers, 1971). For example, *reciprocity* is possible in sequential interactions when individuals act as second (reacting) player (e.g., Ultimatum Game as responder, Trust Game as trustee) or when individuals interact repeatedly with each other (Table 3). By contrast, simultaneous decisions in one-shot interactions do not involve reciprocity. When reciprocity is possible, this allows the expression of conditional concern for others' welfare (e.g., Perugini, Gallucci, Presaghi, & Ercolani, 2003), which is related to traits such as aggression, agreeableness, envy, and forgiveness (Table 2). The reciprocity affordance has conceptual links to DIAMONDS-Adversity and STOA-Obstruction.

Third, interdependent situations often involve a *temporal conflict* whereby immediate self-interest (e.g., consuming a resource, taking revenge) can conflict with long-term individual and/or collective interests (e.g., conserving a resource, maintaining a profitable relationship; Parks, Joireman, & Van Lange, 2013; Van Lange, Joireman, Parks, & Van Dijk, 2013). In games, temporal conflict is present during repeated interactions (e.g., in social dilemmas) or when players acting first in sequential games need to consider others' potential reactions to their selfish behavior (e.g., in the Ultimatum Game as proposer; Table 3). When a situation involves temporal conflict, it affords the expression of self-regulation of immediate impulse gratification (e.g., Ainsworth & Baumeister, 2013; Carver & Scheier, 1982), which is associated with traits such as conscientiousness, impulsivity, and self-control (Table 2). The temporal conflict affordance has conceptual links to DIAMONDS- and STOA-Duty.

Finally, interdependent situations may differ in the extent to which one's outcome is dependent on others' unknown behavior. One's outcome may be independent (one has full power), somewhat dependent (all have shared power), or fully dependent (one has no power) on others' actions (see Kelley et al., 2003, for a formalization of symmetric and asymmetric dependence in games).[5] Additionally, one may (or may not) have knowledge about others' behavior in the situation prior to making a decision oneself. When an individual does not have full power (her outcome is dependent on others' behavior) and she only learns about others' behavior after having made her decision, the situation involves *dependence under uncertainty*.

[5] Dependence can vary across situations *symmetrically*—in the case of mutual dependence, whereby each individual's outcomes are equally affected by each other's behavior—and *asymmetrically*, such as with power: More power means that one's outcomes depend relatively less on others' actions (Balliet, Tybur, & Van Lange, 2017; Kelley et al., 2003). Thus, dependence can increase across situations that involve higher amounts of mutual dependence (i.e., when individuals have equal power), and when individuals have relatively less power. Power also determines the degree to which a situation provides a possibility for exploitation. Specifically, if one has full power over the distribution of outcomes (e.g., in the Dictator Game), one can easily exploit the other without fearing negative consequences. By contrast, if interaction partners have shared power (e.g., in the Ultimatum Game), the situation provides much less possibility to exploit others (see Table 3 and Table 5).

In games, dependence under uncertainty is, for instance, present in simultaneous interactions (e.g., social dilemmas) or in sequential interactions for players acting first (e.g., Trust Game as trustor; Table 3). Whenever a situation involves dependence under uncertainty, it affords beliefs about others' prosociality to guide behavior (e.g., Balliet & Van Lange, 2013a, 2013b; Pruitt & Kimmel, 1977; Thielmann & Hilbig, 2015c), which are associated with traits such as belief in a just world, psychopathy, and trust propensity (Table 2). The dependence affordance is the only affordance that has no direct counterpart in other situational taxonomies. As such, this affordance appears to be specific to interdependent situations, as also suggested by prior research relating perceptions of major dimensions of interdependence to the DIAMONDS (Gerpott, Balliet, Columbus, Molho, & De Vries, 2018).

Importantly, situations may not only differ with regard to whether an affordance is present or absent, but also with regard to the *degree* to which an affordance is present. For example, interdependent situations may vary on the degree to which exploitation is possible, depending on factors such as power and conflict of interests (Table 3; see also Footnote 5). To illustrate, in the Ultimatum Game as proposer, exploitation is possible to a relatively weaker degree because the recipient can punish the proposer for selfish behavior (and thus, the proposer has less power than the dictator in the Dictator Game, for instance). By implication, traits linked to an affordance should show relatively smaller (higher) relations with prosocial behavior depending on whether the affordance is present to a relatively weaker (stronger) degree.

Taken together, the above reasoning directly implies that the relations of traits to prosocial behavior in interdependent situations can be expected to result from the broad, situation-specific affordances and corresponding trait activation: Traits that are linked to the psychological processes we propose to be afforded in interdependent situations (i.e., unconditional and conditional concern for others, self-regulation, and beliefs about others' prosociality) may be expressed in prosocial behavior, particularly—or even exclusively—in situations providing the respective affordance(s), and more strongly so in situations providing the affordance to a relatively strong degree. Conversely, traits that are not linked to any of these psychological processes (see Table 2) should show no associations with prosocial behavior, simply because these traits should not be activated in interdependent situations.

Additional Specific (Sub)Affordances, Social Motives, and Trait Expression

Although the four broad affordances introduced previously are arguably necessary to activate certain traits in an interdependent situation, the mere presence of two of these affordances—exploitation and reciprocity—may not be sufficient for a trait to become activated and expressed in behavior. Specifically, even if two interdependent situations provide the same broad (exploitation and/or reciprocity) affordance(s), there may remain some variability in the outcome structure of the situations that can still determine which psychological processes may be expressed. For example, a trait like inequality aversion, which is related to unconditional concern for others, may not be expressed in prosocial behavior in a situation that provides a possibility for exploitation, but in which at the same time prosocial behavior *maximizes* inequality in outcomes (e.g., in the Trust Game as trustor in which equality in outcomes is usually established by default; Berg et al., 1995). We refer to such a feature related to the outcome structure of a situation as a *subaffordance* of the exploitation and reciprocity affordances.[6]

Following Interdependence Theory, we identify six subaffordances that allow for the expression of specific *social motives*—and related personality traits—in prosocial behavior (Kelley & Thibaut, 1978; Thibaut & Kelley, 1959). Social motives refer to how individuals weigh own outcomes in relation to others' outcomes (Griesinger & Livingston, 1973; Messick & McClintock, 1968) and they thus refer to specific aspects of the psychological processes of unconditional and conditional concern for others that can be expressed in the presence of the subaffordances. Correspondingly, for all traits linked to unconditional and/or conditional concern for others, we further specified in the presence of which subaffordance(s) they should become activated and expressed (see Table 2), following the same approach as for the mapping of traits and broad affordances (see Footnote 3). Table 4 provides an overview of the six subaffordances and the related social motives we consider here; Figure 1 further provides a graphical illustration of the social motives (see Liebrand, 1984, for a similar visualization).[7] Importantly, although some of the social motives are termed in the same way as personality traits (e.g., altruism, individualism), the (same-named) motives and traits refer to different concepts.

As for the broad affordances, the well-defined structure of interdependent situations and formalization within Game Theory (von Neumann & Morgenstern, 1944) and Interdependence Theory (Kelley & Thibaut, 1978) allows for the identification of the subaffordances and corresponding social motives at play in a game (Thielmann, Böhm, & Hilbig, 2015) to derive predictions about which traits may be activated to become expressed in behavior. Table 5 summarizes which subaffordances (for prosocial vs. selfish behavior) are provided by each game included in this meta-analysis.[8] Specifically, interdependent situations often provide a possibility to maximize others' outcomes (i.e., *max(others)*), which affords the motive of altruism to guide prosocial behavior and which applies to all games considered here. The same holds for the possibility to minimize others' outcomes (i.e., *min(others)*), which affords the motive of spite to guide selfish behavior. Inter-

[6] The exploitation and reciprocity affordances provide opportunities for actions that are targeted at increasing or decreasing own and/or others' outcomes; in turn, the outcomes that can be achieved are determined by the outcome structure of the situation. By contrast, the affordances of temporal conflict and dependence under uncertainty do not provide opportunities for actions that are targeted at achieving certain outcomes for oneself versus others; rather, temporal conflict provides an opportunity to self-regulate one's impulse to behave in a selfish manner, without any reference to the specific outcomes that can be achieved, and dependence under uncertainty provides an opportunity to express one's beliefs about which outcomes others may want to achieve for the self and others.

[7] Social motives are also represented in the model of social value orientation, which can be understood as the dispositional (i.e., stable) tendency to let certain social motives guide behavior (e.g., Liebrand & McClintock, 1988; McClintock, 1972; Murphy & Ackermann, 2014; Van Lange, 1999).

[8] Given that the Prisoner's Dilemma, the Public Goods Game, and the Commons Dilemma involve the same (sub)affordances, we summarize across these three social dilemma games (see also the identical predictions for trait-behavior relations in the preregistration; https://osf.io/dbuk6/). However, we report the meta-analytic correlations separated for each game in the online supplemental materials (Tables S9–S11).

Table 4
Relation Between Characteristics of Interdependent Situations, Subaffordances, and Social Motives

Situation allows to . . .	Subaffordance	Social motive
. . . maximize others' outcomes	max(other)	altruism
. . . minimize the (absolute) difference between own and others' outcomes	min(lown − otherl)	fairness
. . . maximize the sum of own and others' outcomes	max(own + other)	social welfare
. . . maximize one's own outcome	max(own)	individualism
. . . maximize the difference between own and others' outcomes	max(own − other)	competitiveness
. . . minimize others' outcomes	min(other)	spite

Note. Subaffordances are only relevant in situations providing the broader affordances of exploitation and reciprocity. Subaffordances for prosocial motives in the upper part of the table, subaffordances for selfish motives in the lower part of the table. Although the names of some social motives are equivalent to the names of some of the traits (see Table 2), motives and traits refer to distinct constructs. max() = possibility to maximize; min() = possibility to minimize; other = others' outcomes; own = own outcomes.

dependent situations also often provide a possibility to maximize one's own outcome (i.e., *max(own)*) which affords the motive of individualism, and this predicts selfish behavior whenever the prosocial choice brings about individual costs (e.g., in the Dictator Game and social dilemmas), but it can also predict prosocial behavior when the prosocial choice brings about individual benefits (e.g., in the Ultimatum Game as responder). Interdependent situations may also provide a possibility to minimize the difference between own and others' outcomes (i.e., *min(own − other)*), as is, for instance, the case in the Dictator Game and the Trust Game as trustee. These situations afford the expression of the motive of fairness. Conversely, situations may provide a possibility to maximize inequality in outcomes (i.e., *max(own − other)*) which affords the motive of competitiveness to guide selfish behavior, as holds for all games considered here. Finally, interdependent situations may provide a possibility to increase the sum of players' outcomes (i.e., *max(own + other)*; e.g., in social dilemmas), affording the motive of social welfare to guide behavior.

Taken together, the fine-grained structural differences between interdependent situations with regard to which outcomes can be achieved for the self and others provide specific subaffordances for prosocial versus selfish behavior. By implication, other games than the ones considered here may provide very different sets of subaffordances, including situations in which the social motives of altruism, competitiveness, and spite may not guide behavior. Moreover, most (game) situations actually involve multiple subaffordances (see Table 5) and thus multiple social motives can guide the same behavior. Indeed, isolating one specific motive as underlying mechanism of behavior will often require comparison of choices across several games involving different subaffordances (e.g., Bardsley, 2008; Engelmann & Strobel, 2004; Hilbig, Kieslich, Henninger, Thielmann, & Zettler, 2018; Poppe & Utens, 1986; Yamagishi & Sato, 1986) or directly asking individuals about the motives for their choices (e.g., Barrett & Dannenberg, 2012; Colman & Stirk, 1998; Haesevoets, Reinders Folmer, Bostyn, & Van Hiel, 2018; Insko, Wildschut, & Cohen, 2013).

Mapping Affordances in Games Onto Personality Traits: Overview of Hypotheses

As detailed previously, our framework rests on the notions that (a) the structural features of interdependent situations determine the affordances a situation provides and (b) traits may be activated in the presence of (some of) the affordances depending on their conceptualization and operationalization. Figure 2 provides an overview of this framework, summarizing which broad affordances and subaffordances allow for the expression of which psychological processes, social motives, and related traits. Integrating these perspectives provides several predictions about which traits should (not) relate to prosocial behavior in which games, as summarized in Table 5.

Specifically, if a trait was linked to a broad affordance and—in case of the affordances of exploitation and reciprocity—a subaffordance provided in a game, we predicted that the trait will relate to prosocial behavior in this game. To illustrate, empathy is predicted to have a positive association with prosocial behavior in all games included in the meta-analysis because this trait should be expressed in the presence of the broad affordances of exploitation and reciprocity—and each game included here either provides a possibility for exploitation, reciprocity, or both—and the subaffordance of max(other), which is again provided in all games considered here. By contrast, we predicted that a trait will not relate to prosocial behavior in a game if (a) the trait was not linked to any of the four broad affordances (e.g., emotional intelligence, extraversion, positive affect), (b) the trait was linked to the affordances of exploitation and/or reciprocity, but not to any of the corresponding subaffordances in the game, or (c) the trait was linked to the affordances of exploitation and/or reciprocity and to multiple subaffordances in the game which, however, afforded conflicting (i.e., prosocial vs. selfish) behaviors. Returning to our example from above, even though inequality aversion is conceptually linked to the affordance of exploitation, we predicted no (positive) association with prosocial behavior in the Trust Game as trustor (which provides a possibility for exploitation). This is because the game does not allow one to minimize the difference between own and others' outcomes—because equality in outcomes is established by default (trustor and trustee receive the same endowment; Berg et al., 1995)—which is, however, the only subaffordance that should allow inequality aversion to become expressed. Likewise, we predicted no (negative) relation between narcissism and prosocial behavior in the Ultimatum Game as responder even though narcissism is related to all (broad and sub)affordances provided in this game. However, the two subaffordances afford different behaviors (i.e., whereas max(own) affords prosocial behavior, max(own −

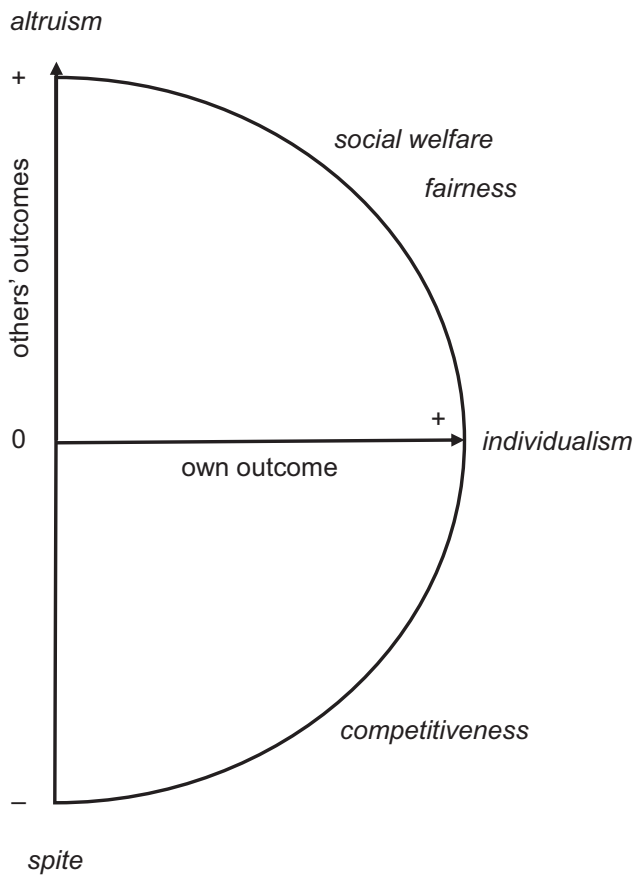


Figure 1. Social motives guiding behavior in interdependent situations in the presence of corresponding subaffordances. Motives above the *x* axis constitute prosocial motives (i.e., individuals positively weigh others' outcomes in their decisions); motives at or below the *x* axis constitute selfish motives (i.e., individuals neglect or even negatively weigh others' outcomes in their decisions). Motives that negatively weigh one's own outcome are not depicted here or considered in our theoretical framework because these motives are rarely expressed in behavior in games (Kuhlman & Marshello, 1975; Liebrand & Van Run, 1985) and are thus also usually not assessed (Murphy & Ackermann, 2014). Although the names of some social motives are equivalent to the names of some of the traits (see Table 2), motives and traits refer to distinct constructs.

other) affords selfish behavior), which is why narcissism should not relate to behavior in this game.

Moreover, we considered the *degree* to which a (broad) affordance is present in a game to further specify whether one would expect a relatively strong (++/− −) or a relatively weak (+/−) relation between a trait and prosocial behavior in a game. As sketched above, the Ultimatum Game as proposer and the Trust Game as trustor, for instance, provide a relatively weaker possibility for exploitation because in both these games the second player (i.e., the recipient and trustee, respectively) has the opportunity to react to the first player's choice—and thus to impose costs on her. Therefore, traits linked to exploitation (e.g., social value orientation) should have a weaker association with behavior in these games than with behavior in the other games in which interaction partners cannot react to one's behavior and the affordance of exploitation is thus present to a stronger degree (e.g., Dictator Game, Trust Game as trustee; see also Table 3).

Taken together, for each trait we first considered whether it was related to a broad affordance present in a game.[9] If a trait was related to the exploitation and/or reciprocity affordances, we further specified whether the trait was also related to a subaffordance provided in the game and if so, whether multiple subaffordances linked to the trait afforded the same or opposing behaviors. Finally, if a trait was identified to relate to behavior in a game, we further specified whether the relation should be relatively strong or weak, depending on the degree to which the related (broad) affordance was present in the game. Figure 3 provides a graphical illustration of this sequential process of generating hypotheses in terms of a decision tree, and Table 6 further demonstrates the application of this decision tree for a few example traits and games. Moreover, Table S2 in the online supplemental materials provides a detailed (verbal) description about how we arrived at the predictions for each trait listed in Table 5. Comparing these predictions with the results of the meta-analysis offers a critical test of whether traits that are conceptually linked to any of the four broad affordances (and subaffordances)—or several of them—are more strongly related to prosocial behavior. As such, the meta-analysis can enhance our understanding of *when* (i.e., in the presence of which affordances) and *how* (i.e., through which social motives) associations between certain personality traits and prosocial behavior in interdependent situations may come about.

Bandwidth-Fidelity Dilemma and Models of Basic Personality Structure

Traits can differ in their breadth or *bandwidth*, respectively: Whereas narrow traits are relatively specific, homogenous, and facet-like, broad traits are more general, heterogeneous, and factor-like. The choice between narrow and broad traits is traditionally referred to as the bandwidth-fidelity dilemma (Cronbach & Gleser, 1965; Ones & Viswesvaran, 1996): "the more fine-grained, narrow, and specifically defined personality variables are, the greater the conceptual clarity and interpretability of empirical results due to greater homogeneity in the construct being tapped into" (Ones & Viswesvaran, 1996, p. 620). This increased specificity of narrow traits may, in turn, result in a stronger overlap with the to-be-predicted criterion, an argument that has also been raised to account for differences in the relation between attitudes and behavior (e.g., Fishbein & Ajzen, 1975). In line with this reasoning, narrow traits may indeed outperform broad traits in their predictive ability (e.g., Ashton, Paunonen, & Lee, 2014; A. De Vries, De Vries, & Born, 2011; McAbee, Oswald, & Connelly, 2014; Paunonen, Haddock, Forsterling, & Keinonen, 2003; Steel, Schmidt, Bosco, & Uggerslev, 2019).

Transferred to interdependent situations, narrow traits may yield particularly strong relations to prosocial behavior because they may specifically tap into any of the psychological processes afforded in these situations. However, one may likewise argue that

[9] Given that evidence on the intuitive nature of cooperation (Bouwmeester et al., 2017; Rand et al., 2012) has generally questioned whether traits (and states) related to more deliberate versus intuitive processing should at all relate to prosocial behavior, our analysis of traits linked to self-regulation is thus mostly exploratory (see also our preregistration).

Table 5
Situational Affordances Involved in the Games and Corresponding Hypotheses About the Relations of Traits With Prosocial Behavior in These Games

Game	Dictator Game	Ultimatum Game proposer	Ultimatum Game responder	Trust Game trustor	Trust Game trustee	Social Dilemmas
Broad affordances	EX	(EX), TC, DE	RE, TC	(EX), DE	EX, (RE)[a]	EX, (RE), (TC), DE
Subaffordances for prosocial behavior	max(other), min(|own − other|)	max(other), min(|own − other|)	max(other), max(own), max(own + other)	max(other), max(own + other)	max(other), min(|own − other|)	max(other), max(own + other)
Subaffordances for selfish behavior	max(own), max(own − other), min(other)	max(own), max(own − other), min(other)	max(own − other), min(other)	max(own − other), min(other)	max(own), max(own − other), min(other)	max(own), max(own − other), min(other)
Traits						
Broad traits						
Conscientiousness		++	++			+[b]
FFM agreeableness	++	+	++	++	++	++
HEXACO agreeableness			++		+	+[b]
Honesty-humility	++	+		+	++	++
Narrow traits						
Active prosociality						
Altruism, concern for others, empathy	++	+	++	+	++	++
Inequality aversion	++	+			++	
Pro-environmentalism		+	+	+		++
Social value orientation	++	+		+	++	++
Reactive prosociality						
Forgiveness, positive reciprocity			++		+	+[b]
Antisocial tendencies						
Aggression		−	− −		−	−[b]
Competitiveness, envy, sadism	− −	−	− −	−	− −	− −
Greed	− −	−	++	− −	− −	− −
Machiavellianism	− −	−		−	− −	− −
Narcissism	− −	− −		−	− −	− −
Psychopathy	− −	− −	− −	− −	− −	− −
Beliefs						
Belief in a just world	++			++	++	++
Trust propensity		−		++		++
Morality						
Guilt proneness	++	+		+	++	++
Integrity	++	+	++	+	++	++
Identity- and society-related attitudes						
Collectivism		+	+	+		++
Individualism, power, social dominance orientation	− −	−		−	− −	− −
Right-wing authoritarianism	− −	−	− −	−	− −	− −

Table 5 (*continued*)

Game	Dictator Game	Ultimatum Game proposer	Ultimatum Game responder	Trust Game trustor	Trust Game trustee	Social Dilemmas
Self-regulation						
Impulsivity		– –	– –			–[b]
Self-control		++	++			+[b]
Self-presentation		++	++			+[b]
Risk attitudes						
Risk-taking		– –		++		++

Note. DE = dependence; EX = exploitation; RE = reciprocity; TC = temporal conflict. Affordances put in parentheses are provided to a relatively weaker degree (i.e., EX for the proposer in the Ultimatum Game and the trustor in the Trust Game; RE for the trustee in the Trust Game) or only apply if the game is played repeatedly (i.e., RE and TC for social dilemmas). max() = possibility to maximize; min() = possibility to minimize; other = others' outcomes; own = own outcomes. Subaffordances are only relevant in situations providing the broader affordances of exploitation and reciprocity. FFM = Five Factor Model. ++/– – = (relatively) strong positive/negative relation, +/– = (relatively) weak positive/negative relation; predictions apply to expected patterns of relations of certain traits (rows) with prosocial behavior in the different games (columns). If we predicted correlations of similar size for all relevant games, we consistently refer to these by "++" and "– –".
[a] Although trustee behavior in the Trust Game represents a reaction, the trustee's endowment is only partly dependent on the trustor's behavior given that trustor and trustee receive the same initial endowment (at least in the original version of the game; Berg, Dickhaut, & McCabe, 1995). [b] Only if the game involves repeated interaction with feedback. Given that the majority of studies used one-shot social dilemmas (see main text), we do not consider them as providing the affordances of reciprocity and temporal conflict in the moderation tests by game type (see Table 8).

broad traits can have higher predictive validity than narrow traits due to capturing several relevant psychological processes at once. In turn, if broad traits relate as strongly to prosocial behavior as narrow traits, this would call for an account of individual differences in prosocial behavior based on broad traits. Specifically, broad traits can be expected to explain a greater variety of behaviors than narrow traits, and specifying more and more narrow traits will necessarily result in construct inflation, at least across criteria. The meta-analysis allows for comparison of the predictive validity of narrow versus broad traits to inform how much specificity is needed on the level of traits to account for individual variation in prosocial behavior.

In a similar vein, we also aimed at offering a critical test of the two most established models of basic personality structure—the FFM (McCrae & Costa, 1987, 1999) and the HEXACO model (Ashton & Lee, 2007; Ashton, Lee, & De Vries, 2014)—with regard to how (well) they account for individual differences in prosocial behavior. Whereas the FFM has become the most frequently used personality model since its conception in the 1980s (Ozer & Benet-Martínez, 2006), the HEXACO model has been proposed more recently based on lexical studies across a variety of languages (Ashton & Lee, 2007; Ashton et al., 2004). A key difference between the two models refers to how trait prosociality is conceptualized.[10] In the FFM, prosocial tendencies are basically a question of agreeableness, which globally captures "the motivation to cooperate (vs. acting selfishly) in resource conflicts" (Denissen & Penke, 2008, p. 1285). By contrast, in the HEXACO model, two types of prosocial tendencies are distinguished—unconditional and conditional tendencies (Trivers, 1971)—and these are captured in honesty-humility and agreeableness (see Table 2 for definitions).

Whether this distinction between unconditional (nonexploitative) and conditional (nonretaliatory) tendencies (Hilbig, Thielmann, Klein, & Henninger, 2016; Hilbig, Zettler, Leist, & Heydasch, 2013) indeed justifies inclusion of an additional (sixth) basic personality dimension, or whether honesty-humility simply represents a blend of FFM agreeableness, has evoked some debate: "honesty and humility correspond conceptually and empirically to the Straightforwardness and Modesty facets of Agreeableness [. . .], as assessed by the Revised NEO Personality Inventory" (McCrae & Costa, 2008, p. 167; for similar arguments, see, e.g., DeYoung, 2015; van Kampen, 2012). The meta-analysis can inform this debate by testing the predictions of the HEXACO model vis-à-vis the FFM in the context of prosocial behavior. Specifically, according to the conceptualizations of honesty-humility and agreeableness in the HEXACO model, honesty-humility should specifically relate to behavior in situations providing an opportunity to exploit others (e.g., Dictator Game). By contrast, HEXACO agreeableness should specifically relate to behavior in situations providing an opportunity to react to others' behavior (e.g., Ultimatum Game as responder; Table 5). FFM agreeableness, in turn, should yield comparable relations to prosocial behavior in all situations: Given the broad nature of FFM agreeableness capturing

[10] Moreover, the HEXACO model incorporates a modified (rotated) version of FFM neuroticism, termed emotionality in the HEXACO model (e.g., Ashton et al., 2014). We therefore consider these two dimensions as separate traits in our meta-analysis.

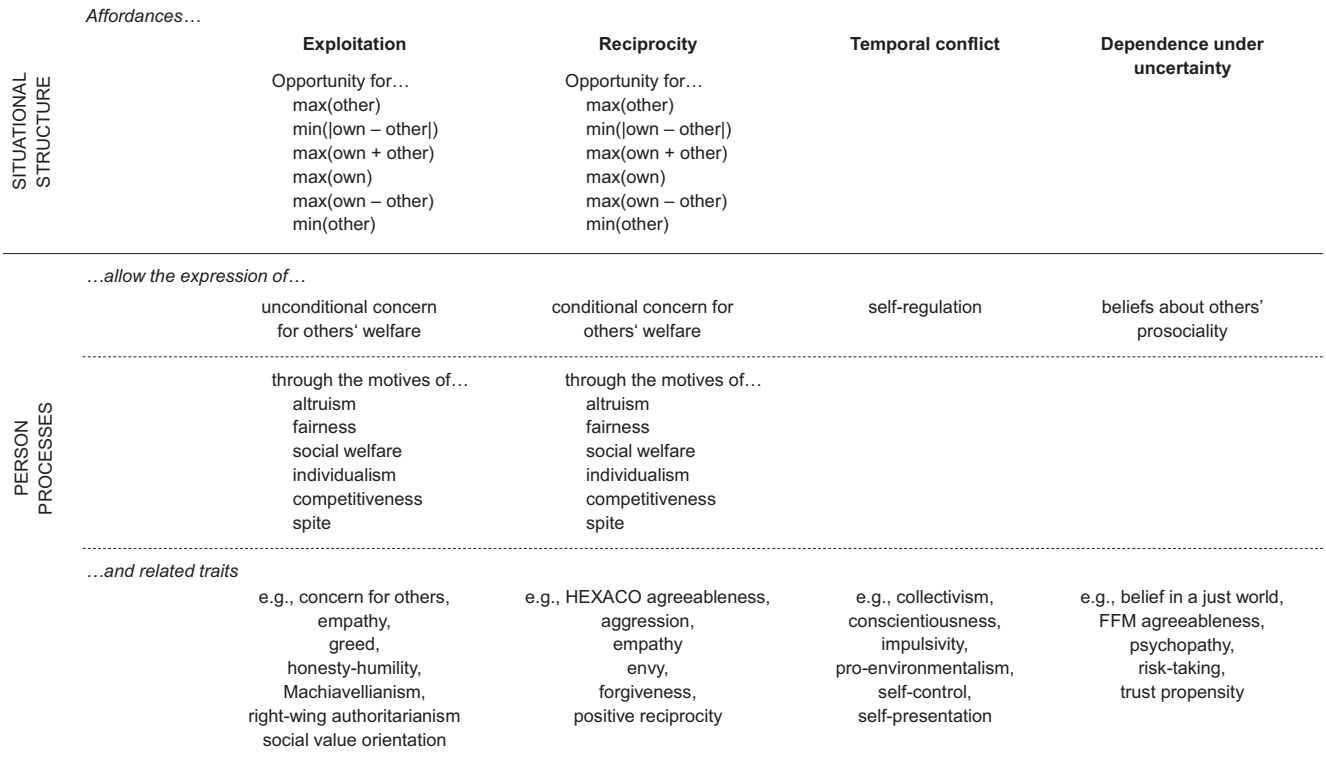


Figure 2. Overview of the affordance-based theoretical framework of individual differences in prosocial behavior. FFM = Five Factor Model; max() = possibility to maximize; min() = possibility to minimize; other = others' outcomes; own = own outcomes.

both unconditional and conditional prosocial tendencies (Costa, McCrae, & Dye, 1991), it should be expressed in situations providing a possibility to exploit *and* in situations providing a possibility to reciprocate. Taken together, we therefore expected that HEXACO honesty-humility and agreeableness will show stronger and more differentiated relations with prosocial behavior across games than FFM agreeableness.

Moderators of the Relation Between Personality and Prosocial Behavior

Interdependent situations as modeled in games can be implemented in different ways, which may ultimately affect behavior. We therefore also aimed at examining how different structural and methodological implementations of the games—including the degree of conflict of interests, repetition of interaction, behavior-contingent incentives, and experimental deception—may influence the observed relations between traits and prosocial behavior.

Conflict of Interests

A critical feature of interdependent situations modeled in social dilemmas is the degree of conflict of interests: The higher the conflict of interests, the more tempting is exploitation as compared to cooperation. Variation in conflict of interests should thus particularly affect the expression of traits related to unconditional concern for others as afforded by the possibility to exploit (e.g., Hilbig et al., 2018; Zettler, Hilbig, & Heydasch, 2013).

Specifically, we tested the hypothesis that traits positively linked to unconditional concern for others (e.g., social value orientation) yield stronger (more positive) relations with prosocial behavior when conflict of interests is high (i.e., individuals high on these traits may even—and specifically—cooperate when exploitation is tempting). Conversely, for traits negatively linked to unconditional concern for others (e.g., Machiavellianism), one can derive two alternative hypotheses based on prior research. On the one hand, these traits may yield stronger (more negative) relations to prosocial behavior when conflict of interests is *high*, thus showing a reversed pattern as traits positively linked to unconditional concern for others. This hypothesis is implied by the strong negative relation between traits that are positively versus negatively linked to unconditional concern for others (e.g., between honesty-humility and the Dark Triad traits narcissism, Machiavellianism, and psychopathy; Lee et al., 2013; Muris, Merckelbach, Otgaar, & Meijer, 2017). On the other hand, traits that are negatively linked to unconditional concern for others may also yield stronger (more negative) relations with prosocial behavior when conflict of interests is *low*. This hypothesis is implied by evidence on the dark core of personality (Moshagen, Hilbig, & Zettler, 2018), which suggests that dark traits are more than the negative pole of bright traits because they are "additionally defined by inflicting disutility on others" (p. 682). In other words, traits negatively linked to unconditional concern for others seem to particularly capture variance in spiteful (and related) behavior, suggesting

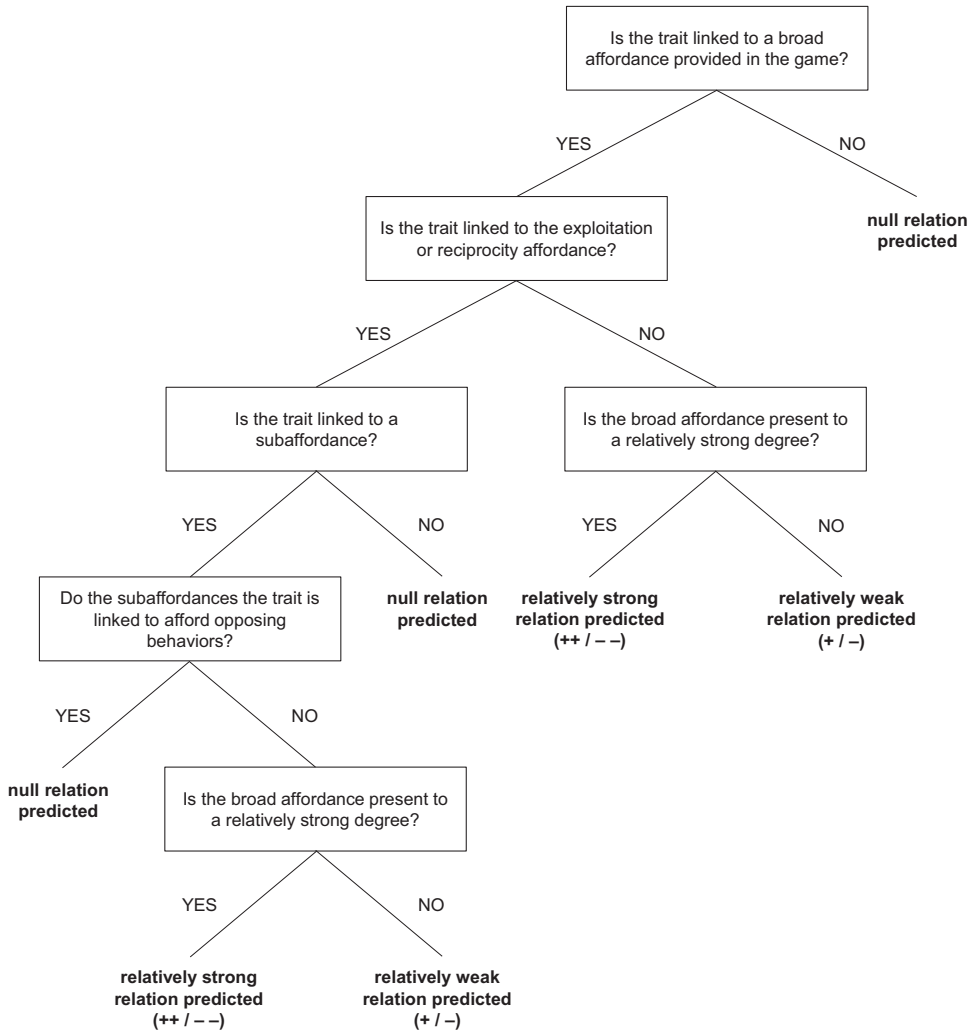


Figure 3. Decision tree for generation of hypotheses.

that individuals high on these traits may even be less willing to cooperate than individuals low on these traits when conflict of interests is low and when their uncooperative behavior can thus create discord in situations that lack it.

Repetition of Interaction

Another key feature of interdependent situations is repetition of interaction. In one-shot interactions, the same individuals interact with each other only once; in repeated interactions, the same individuals interact with each other for several rounds, (usually) knowing about others' behavior in previous rounds. Thus, games involving repeated interaction (and feedback about own and/or others' prior behavior) provide an opportunity to reciprocate as well as to self-regulate one's impulse to behave in a selfish manner (to prevent that others will retaliate, creating a temporal conflict). We therefore tested whether traits related to conditional concern for others and/or self-regulation will show stronger relations with prosocial behavior in repeated interactions (with feedback) than in one-shot interactions.

Behavior-Contingent Incentives

The use of behavior-contingent incentives versus hypothetical decisions is another potentially critical variation in the implementation of games (Baron, 2001; Camerer & Hogarth, 1999; Gneezy, Meier, & Rey-Biel, 2011) that may moderate the effect of personality traits on prosocial behavior. On the one hand, the relation between traits and prosocial behavior may be stronger if behavior is only hypothetical. Specifically, hypothetical decisions may be prone to the same type of socially desirable responding (e.g., Baron, 2001; Moshagen, Hilbig, & Musch, 2011; Thielmann, Heck, & Hilbig, 2016) as self-reports of (evaluative) personality traits (e.g., Dunning, Heath, & Suls, 2004; Robins & John, 1997; Sedikides, 1993). Thus, especially for evaluative traits, correlations might be inflated in hypothetical games. On the other hand, the relation between personality and prosocial behavior may be weaker in hypothetical games: Given that hypothetical behavior is costless, individuals may generally behave more prosocially to appear nice and/or to protect their positive self-image (Mazar, Amir, & Ariely, 2008; Ploner & Regner, 2013), and this tendency

Table 6
Examples of Hypotheses Using the Decision Tree (Figure 3)

Trait	Game	Is the trait related to a broad affordance in the game?	Is the trait linked to EX and/or RE?	Is the trait linked to a subaffordance in the game?	Do the subaffordances afford opposing behaviors?	Is the broad affordance present to a relatively strong degree?	Prediction
Honesty-humility	DG	YES	YES	YES	NO	YES	++
	UG responder	NO	−	−	−	−	Ø
	TG trustor	YES	YES	YES	NO	NO	+
Inequality aversion	DG	YES	YES	YES	NO	YES	++
	UG responder	YES	YES	NO	−	−	Ø
	TG trustor	YES	YES	NO	−	−	Ø
Narcissism	DG	YES	YES	YES	NO	YES	− −
	UG responder	YES	YES	YES	YES	−	Ø
	TG trustor	YES	YES	YES	NO	NO	−
Trust propensity	DG	NO	−	−	−	−	Ø
	UG responder	NO	−	−	−	−	Ø
	TG trustor	YES	NO	−	−	YES	++

Note. EX = exploitation affordance; RE = reciprocity affordance; DG = Dictator Game; TG = Trust Game; UG = Ultimatum Game. ++/− − = (relatively) strong positive/negative relation, +/− = (relatively) weak positive/negative relation, Ø = no relation.

may even be more pronounced in selfish individuals (Hilbig, Moshagen, & Zettler, 2015). However, evidence on the moderating role of incentives on the link between personality traits and prosocial behavior is mixed (Balliet et al., 2009; Ben-Ner, Kramer, & Levy, 2008; Lönnqvist, Verkasalo, & Walkowitz, 2011), thus calling for a large-scale meta-analytic test across traits and interdependent situations.

Experimental Deception

Finally, we considered experimental deception as a potential moderator of the relation between personality and prosocial behavior in games. Deception is typically understood as the intentional and explicit misinformation of participants about a study's purpose or the experimental task and setup (e.g., Hertwig & Ortmann, 2008a, 2008b). In economic games, experimenters may, for instance, misinform individuals that they are interacting with a real other although they are actually interacting with a computer that follows a preprogrammed strategy. In (social) psychology, the use of deception appears to be common practice (Hertwig & Ortmann, 2008a, 2008b), whereas there is a proscription against deception in economics (Hertwig & Ortmann, 2001). Indeed, research suggests that deception can have unintended effects on individuals' behavior by triggering suspicion and second-guessing (Ortmann & Hertwig, 2002). Correspondingly, we tested whether deception to some extent suppresses the expression of personality in prosocial behavior.

Method

The overall objectives and hypotheses as well as the inclusion criteria and analytic procedure were preregistered before any analyses were conducted.[11]

Search for Studies

The search for eligible studies involved multiple steps (for a corresponding PRISMA flow diagram, see Figure S1 in the online supplemental materials). First, we searched for studies on personality and prosocial behavior in resource allocation games. Therefore, in January 2018, we searched several scientific databases (i.e., Academic Search Premier, Business Source Premier, EconLit, PsycINFO, PsycARTICLES, Web of Science) as well as Google Scholar and ProQuest for relevant English-language articles, working papers, theses, and proceedings using the following search string: ("Dictator game" OR "Ultimatum game" OR "Trust game" OR "Investment game") AND ("Personality" OR "Trait"). Moreover, we searched the references of prior meta-analyses on personality and prosocial behavior for additional studies (Balliet et al., 2009; Balliet & Van Lange, 2013b; Kline et al., 2019; Pletzer et al., 2018; Zettler et al., in press; Zhao & Smillie, 2015). Overall, this resulted in 1,200 documents (after excluding duplicates).

Second, we screened all English-language documents included in the *Cooperation Databank* (Spadaro, Tiddi, Columbus, & Balliet, 2019) for relevant studies on personality and prosocial behavior in social dilemmas. This database comprises the entire history of research on human cooperation, and it is currently under development at the Amsterdam Cooperation Lab. Literature searches for

[11] The preregistration can be accessed via https://osf.io/dbuk6/. Although we derived our predictions based on the proposed theoretical framework, we acknowledge that this framework (including the four broad affordances) is not yet detailed in the preregistration. Moreover, in the process of data collection, we identified additional trait categories that are conceptually linked to the relevant affordances, but for which we did not specify predictions in the preregistration (e.g., morality, identity- and society-related attitudes). Based on our general theoretical approach, we specified hypotheses for these traits, too. Likewise, we refined the preregistered predictions that were based on the level of broad trait categories to conform with the features of the specific traits belonging to a category. Thus, some predictions detailed in the preregistration slightly differ from those presented here, and new predictions are added (see Table 5). For example, for all traits in the active prosociality category but social value orientation, we slightly adapted the predictions for certain games based on the specific conceptualizations and operationalizations of the traits. Nonetheless, all hypotheses were specified a priori, that is, before any analyses were conducted.

the Cooperation Databank had been conducted in September and October 2015 as well as in January 2018, including the following steps: (a) searching the PsycINFO, Web of Science, and Google Scholar databases as well as online university library repositories using the search string ("Public goods dilemma*" OR "Public good*" OR "Public good* game*" OR "Prisoner's dilemma*" OR "Voluntar* contribut* experiment*" OR "Voluntary contribution mechanism" OR "Social dilemma" OR "Mixed-motive game*" OR "Resource dilemma*" OR "Matrix games" OR ("Cooperation" AND "Experiment") OR "Common pool game" OR "Give-some dilemma" OR "Take-some dilemma" OR "Give-some game" OR "Take-some game"); and (b) checking the references of several published review articles and chapters, meta-analyses, and books on social dilemmas. Overall, these searches yielded 2,664 English-language documents (after excluding duplicates).

Next, we screened all 3,864 documents concerning their eligibility for the meta-analysis and identified 692 documents that reported one or multiple relevant studies[12] assessing at least one personality trait together with behavior in at least one of the six games considered here. However, for several of these studies, information on (some of) the zero-order correlations between personality traits and prosocial behavior was missing (e.g., because certain traits and/or trait measures were beyond the scope of interest in the current document or because only results from multiple regression analyses were reported). We therefore contacted 385 corresponding authors of 456 documents and asked for the missing effect sizes. If authors did not reply within four to six weeks, we sent a reminder (and usually a second one after another four to six weeks). Overall, 236 authors (61.2%) responded to our request, and 196 (50.9%) were able to provide the requested data for 312 studies in total.

Finally, in June 2018, we sent out several calls for (published and unpublished) data via the listservs of the Economic Science Association, the European Association for Decision Making, the European Association of Personality Psychology, the European Association of Social Psychology, the German Psychological Association, the International Conference on Social Dilemmas, and the Society for Judgment and Decision Making as well as via social-media postings (e.g., Twitter) and the website of the Amsterdam Cooperation Lab. Moreover, whenever contacting authors for missing data in a published document (see above), we asked them for additional published or unpublished data. Overall, this yielded another 94 eligible documents, 31 of which were published articles or working papers (which were not identified in one of the previous literature searches) and 63 of which were unpublished articles, theses, or raw data sets. Collection of data closed on November 30, 2018.

In sum, we identified 786 documents comprising 1,001 studies including data relevant for the current meta-analysis. However, for 191 studies, no useful data on the relation between personality and prosocial behavior was (made) available. Moreover, another 40 studies had to be excluded because they only considered traits for which there was insufficient data available across studies to perform meta-analysis (a list of all traits for which data was insufficient is provided in the additional materials on the OSF; https://osf.io/dbuk6/). Thus, the meta-analysis was based on a total number of 590 documents comprising 770 studies and 3,523 unique effect sizes involving $N = 152{,}077$ participants.

Inclusion Criteria

To be included in the meta-analysis, studies had to fulfill the following criteria:

1. At least one personality trait according to the definition from above (DeYoung, 2015) had to be assessed, using established multiple- or single-item scales, ad hoc created scales, or behavioral measures. We only excluded behavioral risk-taking measures (e.g., lottery-choice decisions; Holt & Laury, 2002) based on evidence showing that these measures "may capture states rather than a general and stable trait" (Frey, Pedroni, Mata, Rieskamp, & Hertwig, 2017, p. 8; see also Pedroni et al., 2017).

2. At least one of the following games (i.e., Dictator Game, Ultimatum Game, Trust Game, Prisoner's Dilemma, Public Goods Game, Commons Dilemma) had to be used to measure prosocial behavior. We also included studies using slight variations of a relevant game if (and only if) the interdependent structure modeled was sufficiently similar to the standard game, in the sense that it involved the same (sub)affordances. For example, we excluded studies in which participants acted as second player in social dilemmas with sequential protocol and feedback (i.e., players choosing one after the other, with knowledge about the previous players' choices) given the change in the interdependent structure (i.e., no dependence under uncertainty involved). We also excluded *team games* (Bornstein, 2003) in which groups interact with each other.

3. The game(s) had to involve a social interaction among humans, at least allegedly. That is, we only included studies in which participants interacted (or believed to interact) with another person rather than knowing that they interacted with a computer or robot.

4. Data had to be based on adult participants (aged 18 and above).

5. There had to be sufficient data available (either in the document/corresponding supplemental materials or provided upon request) to code the effect size(s).

Coding of Effect Sizes

We used Pearson's product-moment correlation coefficient r as the measure of effect size. Whenever effect sizes were reported in different metrics, we transformed them into r using appropriate conversion formulas (e.g., Borenstein, Hedges, Higgins, & Rothstein, 2011; Lakens, 2013). Moreover, whenever a study reported multiple effects contributing to the same meta-analytic effect size estimate (e.g., if a study assessed one and the same construct using two different measures, or if a study reported separate effects of a

[12] In the screening process, we took great care to identify potential sample overlap between studies due to data being used repeatedly in multiple documents. This led to the exclusion of 43 documents reporting the same data as another (included) document.

trait in two variants of the same game), we averaged these effects, taking into account the intercorrelation(s) of the to-be-averaged variables (Hunter & Schmidt, 2004). If these intercorrelations were not available, we conservatively assumed perfect redundancy. Likewise, when meta-analyzing effects across all games, we aggregated the corresponding effects in all studies assessing behavior in multiple games, conservatively assuming perfect convergence across the games. Overall, this procedure ensured that each independent sample contributed only once to a given meta-analytic effect size estimate. The R script for transformation and aggregation of effect sizes is available in the additional materials on the OSF (https://osf.io/dbuk6/).

To build (classes of) traits consisting of sufficiently equivalent constructs that can be meaningfully aggregated in the meta-analysis, we thoroughly reviewed the definitions and operationalizations of all constructs assessed in the single studies. Moreover, two experts in personality psychology independently reviewed our initial classification which we revised correspondingly based on their feedback. Table 2 summarizes the 51 traits we identified through this procedure; in the additional materials on the OSF (https://osf.io/dbuk6/) we further provide information on the measures each trait is composed of.

To aggregate effect sizes, we relied on random-effects psychometric meta-analysis with sample-size weights (Hunter & Schmidt, 2004). Whenever possible, we applied a correction for attenuation (Spearman, 1904) based on Cronbach's alpha estimate of internal consistency to account for unreliability of the trait measures. If Cronbach's alpha was not available or if effect sizes involved single item measures, we conservatively assumed perfect reliability, thus refraining from disattenuation. Moreover, no correction for attenuation was applied to effect sizes derived from latent variable models (e.g., structural equation models) given that such models inherently correct for measurement error. Effect sizes per study (disattenuated correlations) are provided in the additional materials (https://osf.io/dbuk6/).

Coding of Study Characteristics

Coding of the data was conducted by the first author and the team of the *Cooperation Databank*. The latter (databank) coding was thoroughly checked by the first author to fit the coding of study characteristics for the current analysis. Nonetheless, we report Cohen's κ (Cohen, 1960; *irr* package in R; Gamer, Lemon, Fellows, & Singh, 2019) as index of interrater agreement for the key study characteristics, based on a subset of (social dilemma) studies included in the Cooperation Databank for which the corresponding information was available ($131 \leq k \leq 216$). Importantly, interrater agreement was very high (Landis & Koch, 1977; McHugh, 2012) for all variables ($.85 \leq \kappa \leq .99$). Table S1 in the online supplemental materials provides an overview of all variables coded. However, several of these variables were merely included for exploratory reasons, and they are therefore neglected in what follows.

Game type. The type of game to which an effect size referred was a key variable in our coding. For games with asymmetric player roles (Ultimatum and Trust Game), we further distinguished between the two roles (i.e., proposer vs. responder, trustor vs. trustee), and we treat these roles as different games in our analysis. Overall, all games were represented well in our analysis, comprising 1,145 effects (32.5%) for social dilemmas, 796 effects (22.6%) for the Dictator Game, 432 effects (12.3%) for the Trust Game as trustor, 410 effects (11.6%) for the Ultimatum Game as responder, 380 effects (10.8%) for the Trust Game as trustee, and 360 effects (10.2%) for the Ultimatum Game as proposer.

Conflict of interests. We coded the degree of conflict of interests between players' payoffs in social dilemmas ($\kappa = .89$ for the Prisoner's Dilemma, $\kappa = .85$ for the Public Goods Game). One way to express conflict of interests is the *K* index (Rapoport & Chammah, 1965; Vlaev & Chater, 2006), which provides a measure of the relation between payoffs resulting from the possible combination of players' choices. Traditionally, *K* is used to describe conflict of interests in the Prisoner's Dilemma; however, it can also be applied to other social dilemmas such as the Public Goods Game[13]—which represents a *N*-player variant ($N > 2$) of the two-player Prisoner's Dilemma. Formally, $K = \frac{(R-P)}{(T-S)}$, with *R* denoting the payoff for mutual cooperation (reward), *P* for mutual defection (punishment), *T* for unilateral defection (temptation), and *S* for unilateral cooperation (sucker). In games with continuous choice—in which players decide *how much* to contribute to a group account—cooperation means to contribute the maximum amount possible whereas defection means to contribute nothing. The *K* index ranges between 0 and 1, given that social dilemmas with conflicting interests are characterized by $T > R > P > S$. The higher *K* is, the lower is the relative gain from defection over cooperation (i.e., $T - R$ and $P - S$)—and thus the temptation to defect. In the studies considered in the meta-analysis, the mean level of *K* was $M = 0.4$ ($SD = 0.1$). We tested whether conflict of interests (as measured by *K*) moderates the relation between personality and prosocial behavior in the Prisoner's Dilemma and the Public Goods Game.

Repetition and feedback. We coded whether a game involved one-shot interaction (i.e., the same players interact with each other only once) or repeated interaction (i.e., the same players interact with each other for several rounds; $\kappa = .94$). Whenever a game involved repeated interaction, we further coded whether participants received feedback about others' behavior in previous rounds ($\kappa = .88$). We investigated the potential moderation by repetition of interaction (with feedback) on the relation between personality and prosocial behavior in social dilemmas, given that repeated interaction has been restricted almost exclusively to these games (i.e., 93.9% of all instances of repeated interaction in our meta-analysis came from social dilemmas). Among those studies using social dilemmas, 244 (56.6%) implemented one-shot interaction whereas 138 (32.0%) implemented repeated interaction with feedback ($Md = 18$ iterations; $M = 28.4$, $SD = 37.5$; for 49 studies, i.e., 11.4%, the status of repetition was unknown).

Group size. Games can be played in dyads or in groups (of variable size). We therefore coded the number of players interacting with each other in a game ($\kappa = .99$). The majority of

[13] A more common way to express the degree of conflict of interests in the Public Goods Game is the marginal per-capita return (MPCR; Isaac, Walker, & Thomas, 1984), which refers to the ratio of the factor *m*, by which contributions to the group account are multiplied, to the group size *N* (i.e., $\frac{m}{N}$). In the current analysis, MPCR and *K* showed a strong positive correlation ($r = .59$), reflecting that both are indicators of conflict of interests.

games involved dyads (77.7%; for 3.8% of games group size was unknown). In turn, interactions involving groups were almost exclusively implemented in social dilemmas. Group sizes in social dilemmas ranged up to 1,000, with a median of 4.

Incentives. We coded whether a game involved behavior-contingent incentives or hypothetical decisions ($\kappa = .93$). Incentives could be provided to all participants for all decisions (full-payment incentive scheme), to all participants for some decisions (random-payment incentive scheme), to some participants for all decisions (random-lottery incentive scheme), or to some participants for some decisions (random-payment-and-lottery incentive scheme), and they could be of any type (including, e.g., small gifts, although most were monetary in nature). Games in which participants were only led to believe that they will receive behavior-contingent incentives but actually received a flat fee or no incentives at all were conservatively excluded from the moderation analyses. Overall, most of the games (72.2%) were implemented with behavior-contingent incentives; 16.2% were played truly hypothetically, and for 5.9% of games it was unknown whether incentives were provided.

Experimental deception. We coded whether a study involved deception ($\kappa = .89$). Deception was defined as intentionally misinforming participants about any aspect of the game (e.g., the interaction partner, the payment). Importantly, a study was not considered to involve deception if certain information about the (background of the) study was withheld from participants (see, e.g., Hertwig & Ortmann, 2008a). Most studies (60.1%) did not involve deception; around one third (34.5%) involved deception, and for 5.3% it was unknown.

Additional study characteristics. To provide more detailed information on the studies included in the meta-analysis, we coded several additional variables for which we provide a summary in what follows: Females and males were almost equally represented in the samples, with 54.0% female participants. The average age of participants was 26.3 years ($SD = 7.76$; $Md = 23.0$). Studies came from 46 different countries, with the majority coming from the U.S. (33.4%), Germany (22.6%), the Netherlands (9.4%), and Great Britain (5.6%). Most of the studies collected data in the laboratory (72.8%) or on the Internet (20.5%); only a few studies collected data in the classroom (2.5%) or in the (lab in the) field (2.1%).

Year of publication of documents ranged from 1960 to 2019, with a median of 2014. This clearly shows the recent upsurge of interest in the study of individual differences in prosocial behavior. The majority of documents were journal articles (81.0%), followed by (published or unpublished) theses (7.0%), unpublished (raw) data sets (5.1%), and (published or unpublished) working papers (4.6%). In turn, demonstrating the success of our efforts to include as much unpublished data as possible, 54.8% of all effect sizes were unpublished at the time of data collection. Almost all effect sizes (92.6%) were (made) available as correlation coefficient r, thus requiring no transformation at all. Otherwise, most effects were available as standardized regression coefficient β (2.6%) or as standardized mean difference Cohen's d (1.8%). Finally, regarding the nature of trait measurement, almost all effects were based on self-reports of personality traits (95.9%).

Results

Analytic Strategy

All analyses were conducted using the *metafor* package (Viechtbauer, 2010) in R (R Core Team, 2018). We first estimated the disattenuated, zero-order correlations of all 51 traits with prosocial behavior aggregated across games as well as separately for each game, using random-effects meta-analysis with sample-size weights (Hunter & Schmidt, 2004). Moreover, we assessed the presence of heterogeneity in effect sizes (Cochran's Q), the extent of between-study variance (T^2), and the percentage of between-study variance that can be attributed to true heterogeneity (I^2). To detect potential publication bias, we applied the rank correlation method (Begg & Mazumdar, 1994), Egger's regression test (Egger, Smith, Schneider, & Minder, 1997), and the trim-and-fill-method (Duval & Tweedie, 2000a, 2000b). However, reflecting that more than 50% of effect sizes included were unpublished, there was almost no evidence of publication bias: For only 11 of the 284 correlations estimated (i.e., 3.9%), publication bias was implied by more than a single indicator. Nonetheless, it should be noted that there was indeed some evidence that published effect sizes were larger than unpublished ones (i.e., for 8 of 43 traits we found a significant moderation by publication status). This generally supports the importance of considering unpublished data in meta-analyses to prevent systematic overestimation of effect sizes due to publication bias. We report all statistics from the publication bias tests in the online supplemental materials (Tables S18 and S19 and Figure S8).

To test whether the effects of certain traits on prosocial behavior vary as a function of relevant differences in the implementation of games, we performed moderation analyses using multivariate multilevel random-effects regression. Specifically, we predicted the disattenuated correlations observed for a trait or group of traits in certain games by the moderator in question (as fixed effect), specified control variables (as fixed effects), and a unique study identifier (as random effect). This allowed us to include multiple effects per study whenever the moderator was manipulated within a study and separate correlations were available for different levels of the moderator. To ensure sufficient data for the moderator analyses, we required effect sizes from at least 10 studies for which the level of the moderator was known. Moreover, there had to be some variation in the level of the moderator across studies. That is, we required availability of at least four studies with a certain level of the moderator for binary moderators (i.e., repeated interaction: yes vs. no; incentives: yes vs. no; deception: yes vs. no) and within a certain range for continuous moderators (i.e., relatively high vs. low conflict of interests; $K < 0.4$ vs. $K \geq 0.4$). For moderator analyses of game type, at least three effects (i.e., $k \geq 3$) had to be available for at least four games.

Personality and Prosocial Behavior Across Games

First, we investigated the disattenuated, meta-analytic correlations of all traits with prosocial behavior aggregated across all games. Figure 4 summarizes the correlations and corresponding number of independent samples (k); Table 7 provides more detailed information on the sample sizes (N), standard errors (SE) and 95% prediction intervals (PI) of the disattenuated correlations,

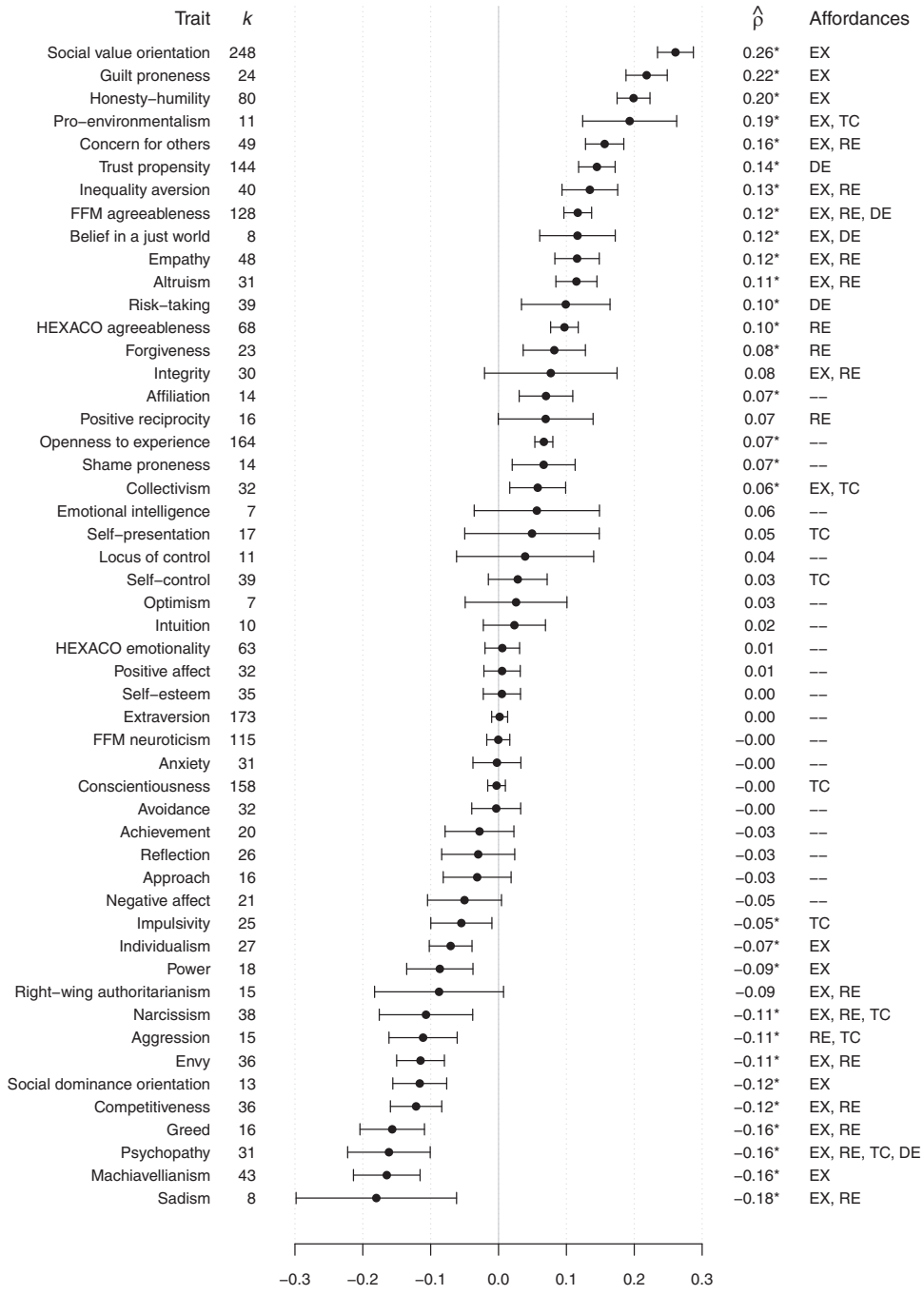


Figure 4. Meta-analytic correlations ($\hat{\rho}$) for all traits with prosocial behavior aggregated across all games, with number of independent samples (k) and broad affordances linked to the traits. Error bars indicate 95% CIs. FFM = Five Factor Model; DE = dependence; EX = exploitation; RE = reciprocity; TC = temporal conflict. * $p < .05$.

exact p values, heterogeneity in effect sizes (Q, T^2, and I^2), and uncorrected (i.e., bare-bones) correlations (r). As is apparent, the number of independent samples varied substantially across the traits, ranging from 7 samples for emotional intelligence as well as optimism to 248 samples for social value orientation. Likewise, there was variation in the correlations of the traits with prosocial behavior, varying between $\hat{\rho} = -.18$ (for sadism) to $\hat{\rho} = .26$ (for social value orientation).

For each trait, we specified whether the trait is associated with one of the four broad affordances provided in interdependent situations (see Table 2 and Figure 4). This affordance-based account predicts that only those traits linked to any of the affordances

Table 7
Meta-Analysis of Correlations Between Personality Traits and Prosocial Behavior Across Games

Trait	*k*	*N*	$\hat{\rho}$ (*SE*)	95% CI	95% PI	*p*	*Q*	T^2	I^2	*r* (*SE*)
Broad traits										
Agreeableness (FFM)	128	24,282	.12* (.01)	[.10, .14]	[.02, .21]	<.001	170.60*	.002	24.80	.10* (.01)
Agreeableness (HEXACO)	68	13,674	.10* (.01)	[.08, .12]	[.05, .15]	<.001	74.43	.001	8.57	.09* (.01)
Conscientiousness	158	31,919	−.01 (.01)	[−.02, .01]	[−.04, .03]	.658	165.30	.001	4.39	−.01 (.01)
Emotionality (HEXACO)	63	12,024	.01 (.01)	[−.02, .03]	[−.10, .11]	.670	87.04*	.003	27.44	.01 (.01)
Extraversion	173	32,753	.01 (.01)	[−.01, .01]	[−.01, .01]	.787	172.68	0	0	.01 (.01)
Honesty-humility (HEXACO)	80	16,903	.20* (.01)	[.17, .22]	[.08, .32]	<.001	130.15*	.004	38.35	.17* (.01)
Neuroticism (FFM)	115	22,713	−.00 (.01)	[−.02, .02]	[−.06, .06]	.963	132.71	.001	13.18	−.01 (.01)
Openness to experience	164	32,284	.07* (.01)	[.05, .08]	[.03, .10]	<.001	171.22	.001	4.19	.06* (.01)
Narrow traits										
Active prosociality										
Altruism	31	8,853	.11* (.02)	[.08, .14]	[.03, .20]	<.001	44.83*	.002	30.16	.11* (.01)
Concern for others	49	10,783	.16* (.01)	[.13, .18]	[.06, .25]	<.001	66.34*	.002	25.63	.14* (.01)
Empathy	48	9,252	.12* (.02)	[.08, .15]	[.01, .22]	<.001	68.46*	.003	29.17	.11* (.02)
Inequality aversion	40	5,584	.13* (.02)	[.09, .18]	[−.02, .29]	<.001	67.22*	.005	40.05	.13* (.02)
Pro-environmentalism	11	1,819	.19* (.04)	[.12, .26]	[.04, .35]	<.001	18.59*	.004	39.90	.18* (.03)
Social value orientation	248	42,779	.26* (.01)	[.23, .29]	[−.00, .53]	<.001	1,010.23*	.018	75.36	.26* (.01)
Reactive prosociality										
Forgiveness (vs. retaliation)	23	8,740	.08* (.02)	[.04, .13]	[−.05, .21]	<.001	51.07*	.004	53.38	.07* (.02)
Positive reciprocity	16	4,568	.07 (.04)	[−.00, .14]	[−.11, .25]	.051	44.50*	.007	61.76	.06 (.03)
Antisocial tendencies										
Aggression	15	3,358	−.11* (.03)	[−.16, −.06]	[−.22, .00]	<.001	22.94	.003	33.00	−.11* (.02)
Competitiveness	36	6,085	−.12* (.02)	[−.16, −.08]	[−.26, .02]	<.001	56.67*	.004	36.34	−.11* (.02)
Envy	36	4,729	−.11* (.02)	[−.15, −.08]	[−.20, −.03]	<.001	42.87	.002	15.78	−.11* (.02)
Greed	16	3,627	−.16* (.02)	[−.20, −.11]	[−.27, −.05]	<.001	23.95	.003	31.76	−.15 (.02)
Machiavellianism	43	6,858	−.16* (.03)	[−.21, −.12]	[−.34, .01]	<.001	89.34*	.008	50.67	−.16* (.02)
Narcissism	38	9,295	−.11* (.04)	[−.18, −.04]	[−.38, .17]	.002	189.05*	.019	79.28	−.10* (.03)
Psychopathy	31	5,381	−.16* (.03)	[−.22, −.10]	[−.35, .02]	<.001	68.53*	.008	52.63	−.15* (.03)
Sadism	8	2,651	−.18* (.06)	[−.30, −.06]	[−.42, .06]	.003	35.43*	.011	72.46	−.18* (.06)
Beliefs										
Belief in a just world	8	1,432	.12* (.03)	[.06, .17]	[.06, .17]	<.001	6.73*	0	0	.11* (.03)
Trust propensity	144	35,445	.14* (.01)	[.12, .17]	[−.04, .33]	<.001	411.28*	.009	64.74	.13* (.01)
Morality										
Guilt proneness	24	5,881	.22* (.02)	[.19, .25]	[.16, .27]	<.001	26.90	.001	10.64	.20* (.01)
Integrity	30	9,372	.08 (.05)	[−.02, .17]	[−.30, .46]	.122	312.83*	.035	90.09	.07 (.05)
Identity- and society-related attitudes										
Collectivism	32	5,928	.06* (.02)	[.02, .10]	[−.08, .19]	.006	49.23*	.004	34.67	.05* (.02)
Individualism	27	5,856	−.07* (.02)	[−.10, −.04]	[−.10, −.04]	<.001	25.38	0	0	−.06* (.01)
Power	18	4,315	−.09* (.02)	[−.14, −.04]	[−.21, .04]	<.001	30.19*	.003	38.96	−.08* (.02)
Right-wing authoritarianism	15	2,799	−.09 (.05)	[−.18, .01]	[−.35, .18]	.071	53.52*	.016	70.59	−.09 (.05)
Social dominance orientation	13	3,001	−.12* (.02)	[−.16, −.08]	[−.16, −.08]	<.001	9.32	0	0	−.11* (.02)

(*table continues*)

Table 7 (*continued*)

Trait	*k*	*N*	$\hat{\rho}$ (*SE*)	95% CI	95% PI	*p*	*Q*	T^2	I^2	*r* (*SE*)
Self-regulation										
Self-control	39	11,550	.03 (.02)	[−.01, .07]	[−.12, .18]	.200	99.56*	.006	59.59	.03 (.02)
Self-presentation	17	2,710	.05 (.05)	[−.05, .15]	[−.25, .35]	.330	64.87*	.021	72.86	.04 (.05)
Impulsivity	25	3,352	−.05* (.02)	[−.10, −.01]	[−.15, .04]	.017	29.73	.002	15.14	−.05* (.02)
Risk attitudes										
Risk-taking	39	8,616	.10* (.03)	[.03, .16]	[−.11, .31]	.003	124.37*	.010	66.82	.09* (.03)
Thinking style										
Intuition	10	3,333	.02 (.02)	[−.02, .07]	[−.05, .10]	.317	12.91	.001	19.46	.02 (.02)
Reflection	26	10,498	−.03 (.03)	[−.08, .02]	[−.19, .13]	.275	80.37*	.006	65.78	−.03 (.03)
Affect										
Anxiety	31	3,370	−.00 (.02)	[−.04, .03]	[−.04, .03]	.894	23.66	0	0	−.00 (.02)
Negative affect	21	2,216	−.05 (.03)	[−.10, .00]	[−.18, .08]	.071	28.31	.004	25.37	−.05 (.03)
Positive affect	32	6,471	.01 (.01)	[−.02, .03]	[−.02, .03]	.703	30.22	0	0	.01 (.01)
Shame proneness	14	3,105	.07* (.02)	[.02, .11]	[−.02, .16]	.005	18.00	.002	21.78	.06* (.02)
Motivation										
Achievement	20	2,731	−.03 (.03)	[−.08, .02]	[−.13, .07]	.278	23.99	.002	16.15	−.03 (.02)
Affiliation	14	3,251	.07* (.02)	[.03, .11]	[.02, .11]	<.001	14.32	0	1.89	.06* (.02)
Approach	16	1,814	−.03 (.03)	[−.08, .02]	[−.08, .02]	.217	15.36	0	0	−.03 (.02)
Avoidance	32	3,692	−.00 (.02)	[−.04, .03]	[−.04, .03]	.853	29.75	0	0	−.00 (.02)
Other										
Emotional intelligence	7	533	.06 (.05)	[−.04, .15]	[−.04, .15]	.231	2.37	0	0	.05 (.04)
Locus of control	11	1,683	.04 (.05)	[−.06, .14]	[−.19, .27]	.447	24.55*	.011	53.83	.03 (.04)
Optimism	7	843	.03 (.04)	[−.05, .10]	[−.05, .10]	.499	2.13	0	0	.02 (.03)
Self-esteem	35	5,992	.00 (.01)	[−.02, .03]	[−.02, .03]	.725	24.73	0	0	.00 (.01)

Note. *k* = number of independent samples; *N* = total sample size; $\hat{\rho}$ = mean true-score correlation corrected for unreliability; *SE* = standard error; CI = confidence interval; PI = prediction interval; *Q* = Cochran's *Q* statistic; T^2 = between-study variance; I^2 = variation across samples attributable to true heterogeneity; *r* = mean (bare-bones) correlation; FFM = Five Factor Model.
* $p < .05$.

will have an association with prosocial behavior across the games (because—on the whole—the games include all four affordances and additional subaffordances). Strikingly, the pattern of correlations was largely in line with this prediction: Traits that were hypothesized to be expressed in the presence of any of the four broad affordances mostly showed stronger and statistically significant correlations with prosocial behavior than traits that were not hypothesized to be expressed in the presence of any of these affordances—with all of the latter traits yielding (close to) zero correlations (see Figure 4). In other words, whereas 30 of the 33 traits that are conceptually linked to at least one of the four affordances showed correlations of $\hat{\rho} \geq |.05|$ (27 of which significantly differed from zero), this occurred for only 5 of the 18 traits that are not conceptually linked to any of these affordances (three of which significantly differed from zero).

The strongest correlations were apparent for traits associated with unconditional concern for others that were expected to be expressed when one can exploit others. Specifically, the three traits yielding the largest effects overall—social value orientation ($\hat{\rho} = .26$), guilt proneness ($\hat{\rho} = .22$), and honesty-humility ($\hat{\rho} = .20$)—are all exclusively linked to the exploitation affordance. However, it should be noted that the strong correlation for social value orientation is likely—at least to some extent—attributable to its measurement based on hypothetical, game-like distribution decisions (Murphy & Ackermann, 2014). Conversely, traits exclusively linked to self-regulation and the affordance of temporal conflict—self-presentation ($\hat{\rho} = .05$), self-control ($\hat{\rho} = .03$), conscientiousness ($\hat{\rho} = -.003$), and impulsivity ($\hat{\rho} = -.06$)—all showed (close to) zero correlations with prosocial behavior across the games. Somewhat in between fell the traits (exclusively) linked to the affordances of reciprocity and dependence under uncertainty for which the strongest absolute correlations emerged for trust propensity ($\hat{\rho} = .15$; dependence), followed by risk-taking ($\hat{\rho} = .10$; dependence) and HEXACO agreeableness ($\hat{\rho} = .10$; reciprocity). Overall, the findings thus imply that it is particularly the possibility to exploit that affords the expression of certain personality traits in prosocial behavior across interdependent situations.

Personality and Prosocial Behavior Within Games

Depending on the specific interdependent structure modeled in each game—and corresponding (sub)affordances involved—we derived more refined predictions about which traits should relate to behavior in which games (Table 5). Thus, we next investigated whether the relations of traits to prosocial behavior within the games also followed the predicted pattern. This provides information on whether the fine-grained structural differences between games can be used to predict which traits relate to prosocial behavior in which situations. Here, we focus on 33 traits for which we can derive hypotheses on when (i.e., in which games) these traits should relate to prosocial behavior (see Table 5).

Table 8 shows the disattenuated, meta-analytic correlations for all trait-game combinations for which $k \geq 3$ (for additional statistics as well as correlations of all 51 traits with behavior per game, including separate estimates for the three social dilemmas, see Tables S3–S11 and Figures S2–S7 in the online supplemental materials). Moreover, Table 8 summarizes the results from meta-analytic multilevel regression testing the moderation by game type. Specifically, we conducted an overall regression for each trait, testing whether correlations significantly differed across the games by predicting the disattenuated correlations for a trait by (up to) five dummy variables coding the type of game (against the Dictator Game as baseline). Results are indicated by + and − superscripts in Table 8 as well as by the Q statistic; more detailed results for these analyses are provided in Table S12 in the online supplemental materials. In addition, for all traits for which correlations with behavior were hypothesized to systematically differ across the games based on the (sub)affordances involved (in the sense that correlations were expected to occur in some games, but not in others; Table 5), we used multilevel regression and tailored contrast or dummy coding to test whether correlations followed the predicted pattern. If we predicted no effect in at least one game and effects of different size (e.g., ++ vs. +) in the other games (e.g., for social value orientation), we used Helmert contrasts (see, e.g., Cohen, Cohen, West, & Aiken, 2003) to code the type of game: One variable specified the expected presence versus absence of an effect, without considering the relative strength of effects (e.g., +/++ = 0.5, no effect = −1); the other variable specified the relative strength of effects (e.g., + = −1, ++ = +1, no effect = 0). In turn, if we predicted effects in all games that should only differ in size (e.g., for FFM agreeableness), we used dummy coding (e.g., ++ = 1, + = 0). Overall, the coding variables allowed to specifically test the hypothesized pattern of correlations across games. Note that all regression weights were tested one-tailed given the directed hypotheses.

Broad traits. As is apparent in Table 8, the pattern of correlations was indeed in line with predictions for most traits. Among the broad traits, honesty-humility yielded a significant positive correlation with prosocial behavior in all games but the Ultimatum Game as responder ($.09 \leq \hat{\rho} \leq .26$ vs. $\hat{\rho} = .02$; see also Figure 5). Correspondingly, both contrast variables (one comparing the Ultimatum Game as responder with all other games and one comparing the Ultimatum Game as proposer and Trust Game as trustor with the Dictator Game, Trust Game as trustee, and social dilemmas) revealed the expected moderation by game type, $B = .10$, $p < .001$ and $B = .07$, $p < .001$, respectively. For FFM agreeableness, the pattern was likewise largely in line with hypotheses, showing positive correlations with prosocial behavior in all games. However, correlations were weak overall ($.07 \leq \hat{\rho} \leq .16$), and the moderation test did not support the expected rank order of correlations (Ultimatum Game as proposer < others), $B = .04$, $p = .074$. A similar picture emerged for HEXACO agreeableness: Descriptively, results were in line with expectations, showing the largest correlation in the Ultimatum Game as responder ($\hat{\rho} = .12$). However, differences in correlations were small ($.06 \leq \hat{\rho} \leq .12$) and the moderation did not reach statistical significance. That is, correlations were not significantly stronger for games providing a possibility to reciprocate (i.e., Ultimatum Game as responder and Trust Game as trustee) versus other games, $B = .01$, $p = .179$, and for the Ultimatum Game as responder versus the Trust Game as trustee, $B = .01$, $p = .364$.

In the context of these broad traits, we also aimed to specifically test the prediction that HEXACO honesty-humility and agreeableness will show a more differentiated pattern of correlations across the games than FFM agreeableness. To this end, for each of these traits, we (a) calculated the proportion of variance (R^2) explained by the type of game (i.e., five dummy variables, with the Dictator Game as baseline) and (b) compared the regression model including the game type variables as predictors against the null model including no predictor at all using likelihood ratio tests as well as

Table 8
Meta-Analytic Correlations ($\hat{\rho}$) Between Traits and Prosocial Behavior Within Each Game, Including the Number of Independent Samples (k; in Parentheses) and Results of Moderation Tests for Game Type

Trait	Games						Q (df = 5)	Test of predicted moderation by game type
	DG	UG proposer	UG responder	TG trustor	TG trustee	SDG		
Broad traits								
Conscientiousness	−.00 (68)	.02 (25)	.02 (25)	−.05*− (34)	.00 (31)	−.01 (57)	16.10*	(UG-A, UG-B) > others: B = .04*
FFM agreeableness	.16* (51)	.08*− (16)	.07*− (18)	.09*− (28)	.13* (28)	.07*− (47)	31.34*	UG-A < others: B = .04
HEXACO agreeableness	.11* (37)	.06* (14)	.12* (12)	.09* (12)	.11* (7)	.08* (22)	5.10	(UG-B, TG-B) > others: B = .01; UG-B > TG-B: B = .01
Honesty-humility	.26* (43)	.09*− (16)	.02− (15)	.11*− (12)	.22* (7)	.18*− (27)	126.66*	UG-B < others: B = .10*; (DG, TG-B, SDG) > (UG-A, TG-A): B = .07*
Narrow traits								
Active prosociality								
Altruism	.14* (21)	.08*− (10)	.04− (12)	.09*− (7)	.15* (6)	.14* (9)	31.69*	(UG-A, TG-A) < others: B = .04*
Concern for others	.15* (10)	.12* (4)	.07* (4)	.16* (7)	.17* (4)	.17* (38)	5.38	(UG-A, TG-A) < others: B = .01
Empathy	.15* (31)	.09* (7)	−.01− (12)	.06*− (10)	.13* (4)	.08− (9)	29.53*	(UG-A, TG-A) < others: B = .02
Inequality aversion	.22* (20)	.13*− (9)	.01− (11)	.08*− (10)	.12*− (10)	.12*− (9)	54.08*	(DG, UG-A, TG-B) > others: B = .08*; (DG, TG-B) > UG-A: B = .03*
Pro-environmentalism	—	—	—	—	—	.19* (11)	—	—
Social value orientation	.32* (37)	.24*− (24)	−.03− (25)	.27*− (15)	.40* (6)	.28*− (182)	226.37*	UG-B < others: B = .19*; (DG, TG-B, SDG) > (UG-A, TG-A): B = .04*
Reactive prosociality								
Forgiveness	.16* (10)	.04− (9)	.09* (9)	.09* (10)	.13* (7)	.05* (11)	10.27	(UG-B, TG-B) > others: B = .01; UG-B > TG-B: B = −.01
Positive reciprocity	.08* (6)	.07* (5)	.06 (4)	.09 (6)	.10* (5)	.03 (9)	0.62	(UG-B, TG-B) vs. others: B = .001; UG-B > TG-B: B = −.01
Antisocial traits								
Aggression	—	—	−.08* (5)	—	—	−.15* (7)	—	—
Competitiveness	—	—	—	−.06 (4)	—	−.13* (33)	—	—
Envy	−.15* (11)	−.11* (3)	−.10* (7)	−.10* (12)	−.08* (10)	−.09* (10)	4.34	(UG-A, TG-A) > others: B = .01
Greed	−.15* (6)	—	—	—	—	−.16* (10)	—	—
Machiavellianism	−.20* (16)	−.04+ (6)	−.02+ (8)	−.16* (10)	−.20* (11)	−.16* (20)	19.57*	UG-B > others: B = .09*; (UG-A, TG-A) > (DG, TG-B, SDG): B = .02
Narcissism[a]	−.16* (12)	−.11* (5)	.00+ (8)	—	—	−.07+ (24)	16.09*	UG-B > others: B = .11*
Psychopathy	−.19* (15)	−.05 (8)	−.04+ (12)	−.00 (3)	−.12 (3)	−.13* (17)	7.58	N/A
Sadism	—	—	—	—	—	−.04 (6)	—	—
Beliefs								
Belief in a just world	.14* (6)	—	—	—	—	—	—	—
Trust propensity	.13* (19)	.04− (9)	.05* (9)	.16* (44)	.11* (27)	.15* (93)	38.59*	(UG-A (reversed), TG-A, SDG) > others: B = −.03; (TG-A, SDG) > UG-A (reversed): B = .06*
Morality								
Guilt proneness	—	—	—	.16* (3)	.22* (19)	.13 (3)	—	—

Table 8 (*continued*)

Trait	Games						Q (df = 5)	Test of predicted moderation by game type
	DG	UG proposer	UG responder	TG trustor	TG trustee	SDG		
Integrity	.02 (13)	−.02 (3)	−.10 (3)	.12* (6)	.20* (10)	.14* (9)	3.55	(UG-A, TG-A) < others: B = .03
Identity- and society-related attitudes								
Collectivism	.11 (3)	—	—	—	—	.06* (32)	—	—
Individualism	—	—	—	—	—	−.08* (27)	—	—
Power[a]	−.16* (9)	−.16* (5)	−.08*+ (8)	—	—	−.02+ (7)	12.70*	UG-B > others: B = .05*; UG-A > (DG, SDG): B = .02
Right-wing authoritarianism	—	—	—	−.19* (5)	—	−.09 (13)	—	—
Social dominance orientation	−.18* (5)	−.13* (5)	−.03+ (4)	−.12* (3)	—	−.12* (10)	11.40*	UG-B > others: B = .08*; (UG-A, TG-A) > (DG, SDG): B = .01
Self-regulation								
Impulsivity	−.04 (9)	.01 (6)	−.05 (8)	−.00 (4)	−.06 (6)	−.04 (11)	1.89	(UG-A, UG-B) > others: B = −.001
Self-control	.02 (21)	−.02 (5)	.05+ (4)	.04 (9)	.00 (8)	.02 (24)	7.85	(UG-A, UG-B) > others: B = .02
Self-presentation	.04 (8)	−.14 (3)	.09 (3)	.05 (3)	.02 (3)	.04 (12)	7.24	(UG-A, UG-B) > others: B = .01
Risk attitudes								
Risk-taking[a]	.02 (3)	—	—	.11* (11)	.04 (4)	.11* (26)	6.30	(TG-A, SDG) > others: B = .08*

Note. Meta-analytic correlations are only displayed in the table and considered in the moderation tests if $k \geq 3$ for a given trait-game combination. Moderation tests of game type testing the predicted correlational pattern (Table 5) are only performed if (a) relations of a trait to behavior were predicted to differ across the games (otherwise "N/A") and (b) correlations of a trait with behavior were available for at least four of the six games (otherwise "−"). B = regression coefficient for effect of game type (dummy or contrast variables; see main text for details) in multilevel regression model; DG = Dictator Game; SDG = social dilemma games; TG = Trust Game; TG-A = Trust Game as trustor; TG-B = Trust Game as trustee; UG = Ultimatum Game; UG-A = Ultimatum Game as proposer; UG-B = Ultimatum Game as responder.

[a] Q (df = 3) given that there was insufficient data for some games (as indicated by "—").

* $p < .05$ (one-tailed for regression coefficients B of predicted moderation by game type).

+ correlation is significantly larger ($p < .05$) as compared to the Dictator Game (baseline); − correlation is significantly smaller ($p < .05$) as compared to the Dictator Game (baseline). Results are based on meta-analytic regression analyses testing the overall effect of game type on trait-behavior relations (see Q statistic for overall effect of game type; see Table S12 in the online supplemental materials for details).

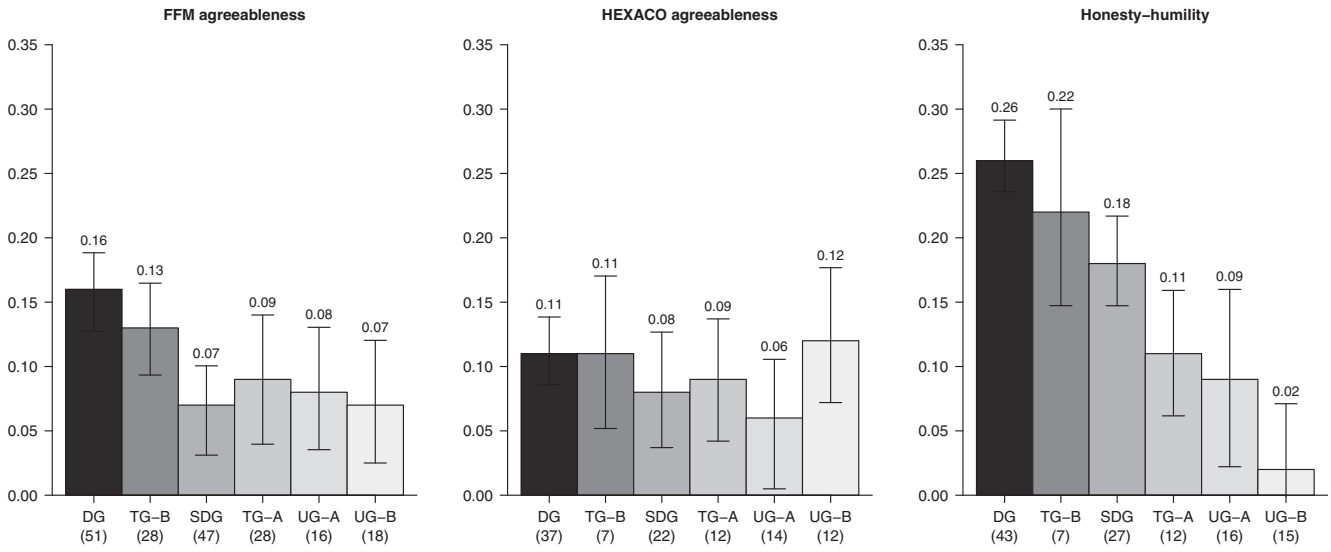


Figure 5. Meta-analytic correlations ($\hat{\rho}$) of selected broad traits from the Five Factor Model (FFM) and the HEXACO model with prosocial behavior in different games. Error bars indicate 95% CIs. Number of independent samples (k) are provided in parentheses. DG = Dictator Game; SDG = social dilemma games; TG-A = Trust Game as trustor; TG-B = Trust Game as trustee; UG-A = Ultimatum Game as proposer; UG-B = Ultimatum Game as responder.

differences in the Bayesian Information Criterion (ΔBIC), which we interpreted following Raftery (1995).[14] As follows from our hypothesis, R^2 should be higher for the two HEXACO dimensions as compared with FFM agreeableness, and this should likewise be mirrored in the model comparisons. For honesty-humility, the type of game indeed explained a large portion of variance in effects (R^2 = 71.4%). Correspondingly, model comparisons provided very strong support in favor of the alternative model, $\chi^2(5) = 116.59$, $p < .001$, ΔBIC = 92.65. For HEXACO agreeableness, however, there was no support for the predicted differences in effect sizes: Game type did not explain any variance in correlations (R^2 = 0.0%) and the model comparison provided very strong support in favor of the null model, $\chi^2(5) = 5.21$, $p = .391$, ΔBIC = −18.01. Finally, for FFM agreeableness, we found positive support for the explanatory power of game type (R^2 = 31.9%), $\chi^2(5) = 30.45$, $p < .001$, ΔBIC = 4.27. Overall, results thus supported our predictions for honesty-humility and FFM agreeableness, but not for HEXACO agreeableness, even though correlations followed the predicted rank order for all three traits (see Figure 5).

Narrow traits. Within the category of active prosociality, most traits followed the predicted pattern of correlations across games. For social value orientation, for example, the (descriptively) strongest correlations emerged in games providing a clear possibility to exploit (i.e., the Dictator Game, Trust Game as trustee, and social dilemmas; $.28 \leq \hat{\rho} \leq .40$), followed by games providing a somewhat lower possibility to exploit (i.e., Ultimatum Game as proposer and Trust Game as trustor; $\hat{\rho} = .27$ and $\hat{\rho} = .24$), and it showed an essentially zero relation in the Ultimatum Game as responder ($\hat{\rho} = -.03$) which provides no possibility to exploit. Correspondingly, both game type contrasts turned out significant in the moderation analysis, $B = .19$, $p < .001$ and $B = .04$, $p < .001$. For inequality aversion, in turn, correlations were largest in those games that provide an opportunity to exploit and in which one can minimize the difference between own and others' outcomes, yielding = .22 in the Dictator Game, $\hat{\rho} = .13$ in the Ultimatum Game as proposer, and $\hat{\rho} = .12$ in the Trust Game as trustee (as well as in social dilemmas). Correspondingly, moderation tests revealed that correlations were stronger in these games than in the others, $B = .08$, $p < .001$, and they were also stronger in the Dictator Game and Trust Game as trustee (with a clear possibility to exploit) than in the Ultimatum Game as proposer, $B = .03$, $p = .018$.

For traits within the category of reactive prosociality (i.e., forgiveness and positive reciprocity), by contrast, results did not support our predictions. Specifically, much like HEXACO agreeableness, we hypothesized these traits to yield the strongest (positive) effects in situations providing a possibility for reciprocity, and thus in the Ultimatum Game as responder and (albeit less so) in the Trust Game as trustee. However, moderation analyses showed no significant effects whatsoever (see Table 8).

The antisocial traits all displayed negative (or null) relations with prosocial behavior within games. Supporting the predicted correlational pattern, narcissism, for instance, showed small to medium-sized negative relations in all games (for which sufficient data were available; $-.16 \leq \hat{\rho} \leq -.07$) except the Ultimatum Game as responder ($\hat{\rho} = .00$). Although the Ultimatum Game as responder provides an opportunity to reciprocate, the two subaffordances linked to narcissism (i.e., max(own) and max(own −

[14] For the model comparisons, we relied on maximum likelihood estimation (ML) – rather than restricted maximum likelihood (REML), which we used for all other estimations—because estimates from REML are not readily comparable across models specifying different fixed effects. According to Raftery (1995, Table 6), ΔBIC > 10 provides very strong evidence for the alternative (less restrictive) model, 6 < ΔBIC ≤ 10 provides strong evidence, 2 < ΔBIC ≤ 6 provides positive evidence, and ΔBIC ≤ 2 provides weak evidence.

other)) afford opposing (i.e., prosocial vs. selfish) behaviors in this game, which is why we did not expect narcissism to relate to behavior. For Machiavellianism, in turn—a trait that should be expressed when there is a possibility to exploit by increasing one's own outcome in absolute (i.e., max(own)) and/or relative (i.e., max(own − other)) terms—we found the weakest, close-to-zero relation in the Ultimatum Game as responder ($\hat{\rho} = -.02$) in which there is no possibility to exploit, $B = .09$, $p < .001$. However, in contrast to our predictions, the correlations with behavior in the Ultimatum Game as proposer ($\hat{\rho} = -.04$) and the Trust Game as trustor ($\hat{\rho} = -.16$)—in which exploitation is possible to a relatively weaker degree—were not significantly smaller in size (i.e., less negative) than the correlations with behavior in the Dictator Game, the Trust Game as trustee, and social dilemmas ($-.20 \leq \hat{\rho} \leq -.16$), $B = .02$, $p = .074$. Finally, envy—a trait that should be expressed in the presence of exploitation and reciprocity and when one can increase the difference between own and others' outcomes (i.e., max(own − other))—showed negative relations of similar size across all games ($-.15 \leq \hat{\rho} \leq -.08$), although we expected its link to be somewhat weaker in the Ultimatum Game as proposer and the Trust Game as trustor (given the weaker possibility for exploitation), $B = .01$, $p = .332$.

We also tested whether traits linked to beliefs about others' prosociality (e.g., trust propensity, risk-taking) show stronger relations to prosocial behavior in games involving dependence under uncertainty, that is, in the Ultimatum Game as proposer, the Trust Game as trustor, and social dilemmas. For trust propensity, for instance, results indeed showed the descriptively strongest (positive) relations in the Trust Game as trustor ($\hat{\rho} = .16$) and in social dilemmas ($\hat{\rho} = .15$) in which positive beliefs about others' prosociality should drive prosocial behavior. However, there was no evidence for a (negative) link with proposer behavior in the Ultimatum Game ($\hat{\rho} = .04$) in which positive beliefs about others' prosociality should drive selfish behavior. Also contrary to predictions, trust propensity had a positive relation with behavior in the Dictator Game ($\hat{\rho} = .13$) and the Trust Game as trustee ($\hat{\rho} = .11$), neither of which involves dependence under uncertainty because players have full power over the final outcome distribution. Correspondingly, moderation tests provided no support for a stronger effect of trust propensity in games involving dependence under uncertainty, $B = -.03$, $p = .99$, although there was support for the expected difference in effects when comparing the Trust Game as trustee and social dilemmas with the Ultimatum Game as proposer, $B = .06$, $p < .001$. For risk-taking, in turn, the pattern of correlations descriptively matched the predictions, showing the highest relations in the Trust Game as trustee and social dilemmas (both $\hat{\rho} = .11$), but no relations in other games for which $k \geq 3$ (Table 8), yielding the expected moderation by game type, $B = .08$, $p = .028$.

Additional Moderator Analyses

Conflict of interests. We tested whether conflict of interests in the Prisoner's Dilemma and the Public Goods Game moderates the relation between personality and prosocial behavior. This provides another test of our prediction that traits related to unconditional concern for others should be more or less relevant for prosocial behavior depending on how strongly a situation affords exploitation. In line with this reasoning, we focus on traits related to unconditional concern for others (and to the social motives of altruism, social welfare, competitiveness, individualism, and/or spite, all of which may guide behavior in social dilemmas). We applied multivariate regression analyses predicting the disattenuated correlations observed for a given trait or group of traits (i.e., traits positively or negatively linked to unconditional concern for others) by the *K* index. In addition, we included group size (continuous), repetition of interaction (dummy-coded; 0 = one-shot, 1 = repeated), and incentives (dummy-coded; 0 = hypothetical, 1 = incentivized) as predictors in the regression model, all of which are design features that could be confounded with *K* (for intercorrelations of the design features, see Table 9). Moreover, when considering groups of traits, we included dummy variables coding the types of traits as predictors. In the following report of results, however, we will focus on the effect of *K*, which we tested one-tailed for traits positively linked to unconditional concern for others given our directed hypotheses.

First, we tested the moderation by *K* across all traits positively linked to unconditional concern for others (e.g., altruism, FFM agreeableness, social value orientation) and all traits negatively linked to this psychological process (e.g., envy, Machiavellianism, narcissism). As expected, for traits positively linked to unconditional concern for others, correlations were significantly stronger (i.e., more positive) when *K* was relatively small, $B = -.21$, $p < .001$ ($k = 211$), that is, in high-conflict situations. Conversely, for traits negatively linked to unconditional concern for others, correlations were significantly stronger (i.e., more negative) when *K* was relatively large, $B = -.36$, $p = .021$ ($k = 123$), that is, in low conflict situations. This pattern also occurred on the level of single traits. Figure 6 summarizes the results of the moderator analyses for those eight traits for which sufficient data were available, together with their zero-order correlations with prosocial behavior in high versus low conflict situations (i.e., $K < 0.4$ vs. $K \geq 0.4$, corresponding to the mean of *K*). Table S13 in the online supplemental materials provides more detailed statistics of the moderation tests. As is apparent, moderation by *K* was significant for five of these traits, three of which are positively linked to unconditional concern for others (i.e., FFM agreeableness, honesty-humility, social value orientation) and two of which are negatively linked to unconditional concern for others (i.e., competitiveness, Machiavellianism). Moreover, to rule out that correlations are not *generally* affected by conflict of interests—meaning

Table 9
Intercorrelations of Design Features of the Games Included in the Multivariate Moderator Analyses

	Correlations			
Variable	*K* index	Repeated interaction	Feedback	Incentives
K index				
Repeated interaction	−.13*			
Feedback	−.01	.62*		
Incentives	.05	.04	.16*	
Group size	−.03	−.05	.05	−.11

Note. Number of independent samples varied between $174 \leq k \leq 322$. Repeated interaction, feedback, and incentives are all dummy variables.
* $p < .05$.

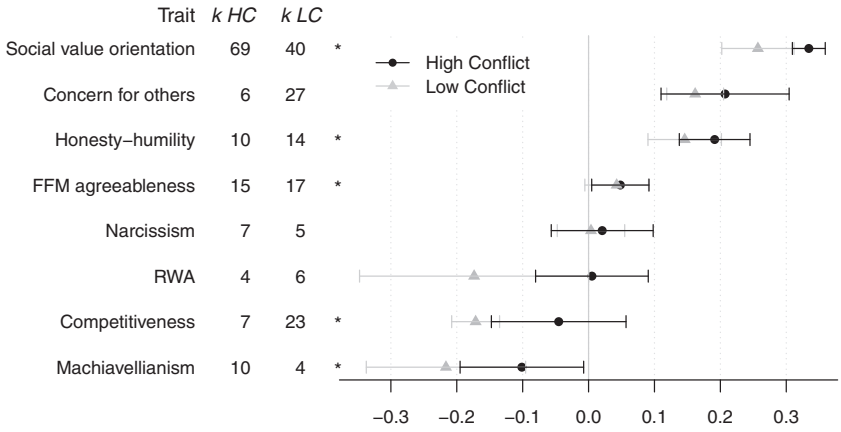


Figure 6. Meta-analytic correlations ($\hat{\rho}$) between selected traits and prosocial behavior in the Prisoner's Dilemma and Public Goods Game, separated for games involving high conflict of interests (HC; $K < 0.4$) and low conflict of interests (LC; $K \geq 0.4$). Error bars indicate 95% CIs. * $p < .05$ (indicating a significant moderation by conflict of interests; one-tailed for traits positively linked to unconditional concern for others, i.e., social value orientation, concern for others, honesty-humility, and FFM agreeableness); k = number of independent samples underlying an effect size; FFM = Five Factor Model; RWA = right-wing authoritarianism.

that the effect of K may not be restricted to traits linked to unconditional concern for others—we also tested the moderation by K for other traits. Importantly, for none of these, there was evidence for a moderating effect of conflict of interests on their relation to prosocial behavior (see Table S13 in the online supplemental materials for details).

Repetition of interaction. We investigated whether repetition of interaction moderates the relation between personality and prosocial behavior. This provides another test of our prediction that traits related to conditional concern for others and/or to self-regulation should be more or less relevant for prosocial behavior depending on how strongly a situation involves the affordances of reciprocity or temporal conflict, respectively. Thus, we focus on traits linked to conditional concern for others (and to the social motives of altruism, social welfare, competitiveness, individualism, and/or spite, all of which may guide behavior in social dilemmas) and traits linked to self-regulation for which we hypothesized stronger effects in repeated games. Using multivariate regression analyses, we predicted the disattenuated correlations observed for a given trait or group of traits by repeated interaction (dummy-coded; 0 = one-shot interaction, 1 = repeated interaction and feedback), controlling for group size (continuous) and incentives (dummy-coded; 0 = hypothetical, 1 = incentivized).[15] Moreover, when considering groups of traits, we included dummy variables coding the specific types of traits as predictors. We tested the moderation effects of repeated interaction one-tailed given our directed hypotheses.

First, we tested the moderation by repetition of interaction across all traits linked to conditional concern for others (e.g., HEXACO agreeableness, forgiveness) and all traits linked to self-regulation (e.g., conscientiousness, impulsivity, self-control), reversing correlations for traits with negative links to these psychological processes. For neither group of traits, there was evidence for a moderation by repetition of interaction, $B = .02$, $p = .219$ (for traits linked to conditional concern for others; $k = 220$) and $B = -.00$, $p > .999$ (for traits linked to self-regulation; $k = 151$). These results were also reflected on the level of specific traits. As is apparent in Figure 7, for only one trait for which sufficient data for the moderation tests were available (i.e., HEXACO agreeableness), there was a significant moderating effect of repeated interaction (see Table S14 in the online supplemental materials for details). That is, as expected, HEXACO agreeableness yielded a stronger relation with prosocial behavior in repeated as compared to one-shot games, $B = .11$, $p = .035$. Of note, however, for most traits the number of effects and samples sizes were relatively small for repeated interaction (see Figure 7).

Incentives. We tested the influence of behavior-contingent incentives on the relation between personality and prosocial behavior. Therefore, we applied multivariate multilevel regression, predicting the disattenuated correlations observed for a given trait by incentives (dummy-coded; 0 = hypothetical, 1 = incentivized), controlling for the type of game (five dummy variables, with the Dictator Game as baseline), group size (continuous), and repetition of interaction (dummy-coded; 0 = one-shot, 1 = repeated). Analyses could be performed for 28 of the 51 traits for which sufficient data were available.

Figure 8 displays the correlations as a function of incentives (see Table S15 in the online supplemental materials for further details). Strikingly, for almost all traits, correlations were virtually identical for hypothetical and incentivized games. Correspondingly, moderation analyses yielded significant effects of incentives for three traits only, namely the Dark Triad traits, showing larger negative correlations in hypothetical games for Machiavellianism ($B = .14$, $p = .012$), narcissism ($B = .14$, $p = .024$), and psychopathy

[15] We did not control for conflict of interests given that we considered all social dilemmas in the analyses, including the Commons Dilemma for which K is not defined. Repeating the analyses with K as a predictor (excluding the Commons Dilemma) yielded similar results for most traits. For psychopathy, however, the moderation by repetition now became significant, showing a stronger (more negative) effect in repeated games, $B = -.28$, $p = .021$.

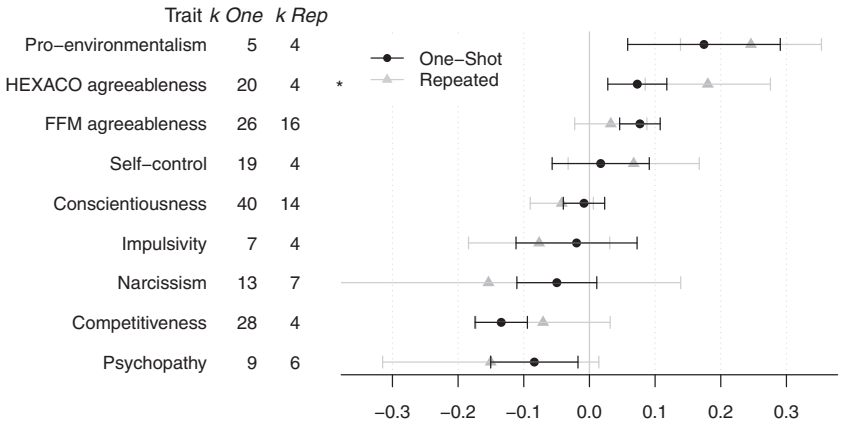


Figure 7. Meta-analytic correlations ($\hat{\rho}$) between selected traits and prosocial behavior in social dilemma games, separated for one-shot (One) versus repeated (Rep) interaction. Error bars indicate 95% CIs. * $p < .05$ (indicating a significant moderation by repetition of interaction; one-tailed); k = number of independent samples underlying an effect size; FFM = Five Factor Model.

($B = .12$, $p = .001$). By contrast, for other traits that are also highly evaluative, such as altruism, honesty-humility, or social value orientation, there was no indication for a moderation by incentives (all $p > .10$).

Deception. We tested the influence of experimental deception on the relation between personality and prosocial behavior. Therefore, we applied multivariate multilevel regression, predicting the disattenuated correlations observed for a given trait by deception (dummy-coded; 0 = no deception, 1 = deception), controlling for type of game (five dummy variables, with the Dictator Game as baseline), group size (continuous), repetition of interaction (dummy-coded; 0 = one-shot, 1 = repeated), and incentives (dummy-coded; 0 = hypothetical, 1 = incentivized).[16] Data for these analyses were sufficient for 36 of the 51 traits.

Figure 9 displays the correlations as a function of experimental deception (see Table S16 in the online supplemental materials for further details). As is apparent, results were mixed overall: For some traits, absolute correlations were (descriptively) smaller when a study involved deception whereas for others traits absolute correlations were (descriptively) larger. For even other traits, there was virtually no difference in correlations. Moderation tests yielded significant effects of deception for three traits, two of which showed larger effects under deception, namely affiliation, $B = .10$, $p = .011$, and trust propensity, $B = .07$, $p = .044$, and one of which showed a smaller effect under deception, namely altruism, $B = -.09$, $p = .006$.

Discussion

Although the study of individual differences in prosocial behavior has received great attention across scientific disciplines, there is a lack of empirical and theoretical integration about how (well) various personality traits can account for this interindividual variation. The current meta-analysis provides the first comprehensive summary of associations between 8 broad and 43 narrow personality traits with prosocial behavior in diverse interdependent situations as modeled in six of the most commonly studied economic games. The meta-analysis thereby offers a unique testbed to advance theory of individual differences in prosocial behavior. Specifically, we developed and tested a theoretical framework about (a) which traits relate (most strongly) to prosocial behavior across interdependent situations, and whether this pattern can be accounted for by broad affordances provided in these situations, and (b) how personality relates to prosocial behavior within interdependent situations, taking into account the (degree to which) these broad affordances (and more specific subaffordances) are provided. Moreover, the meta-analysis has theoretical implications for conceptualizations of trait prosociality, including a comparison of broad versus narrow traits and of the two most prominent models of basic personality structure (i.e., FFM vs. HEXACO). Further, we examined how structural differences within certain games (i.e., degree of conflict of interests, repetition of interaction) and variation of experimental methods (i.e., behavior-contingent incentives, deception) moderate the relation between personality and prosocial behavior.

A Theoretical Framework of Individual Differences in Prosocial Behavior

We proposed an affordance-based account of individual differences in prosocial behavior, suggesting that the relation of personality to prosocial behavior can be explained by activation of certain traits in the presence of certain affordances. Specifically, based on integration of prior literature, we identified four broad situational affordances that may allow certain traits to become expressed in behavior across various interdependent situations: (a) a possibility for *exploitation*, allowing the expression of unconditional concern for others' welfare, (b) a possibility for *reciprocity*, allowing the expression of conditional concern for others' welfare, (c) a *temporal conflict* between short-term and long-term interests, allowing

[16] Although one might assume a negative correlation between the use of experimental deception and behavior-contingent incentives—given that psychologists seem to more commonly use deception in non-incentivized paradigms, whereas economists by default refrain from deception but use incentives (Hertwig & Ortmann, 2001)—the two variables were unrelated in the current analysis, $r = .02$, $p = .613$ ($k = 639$).

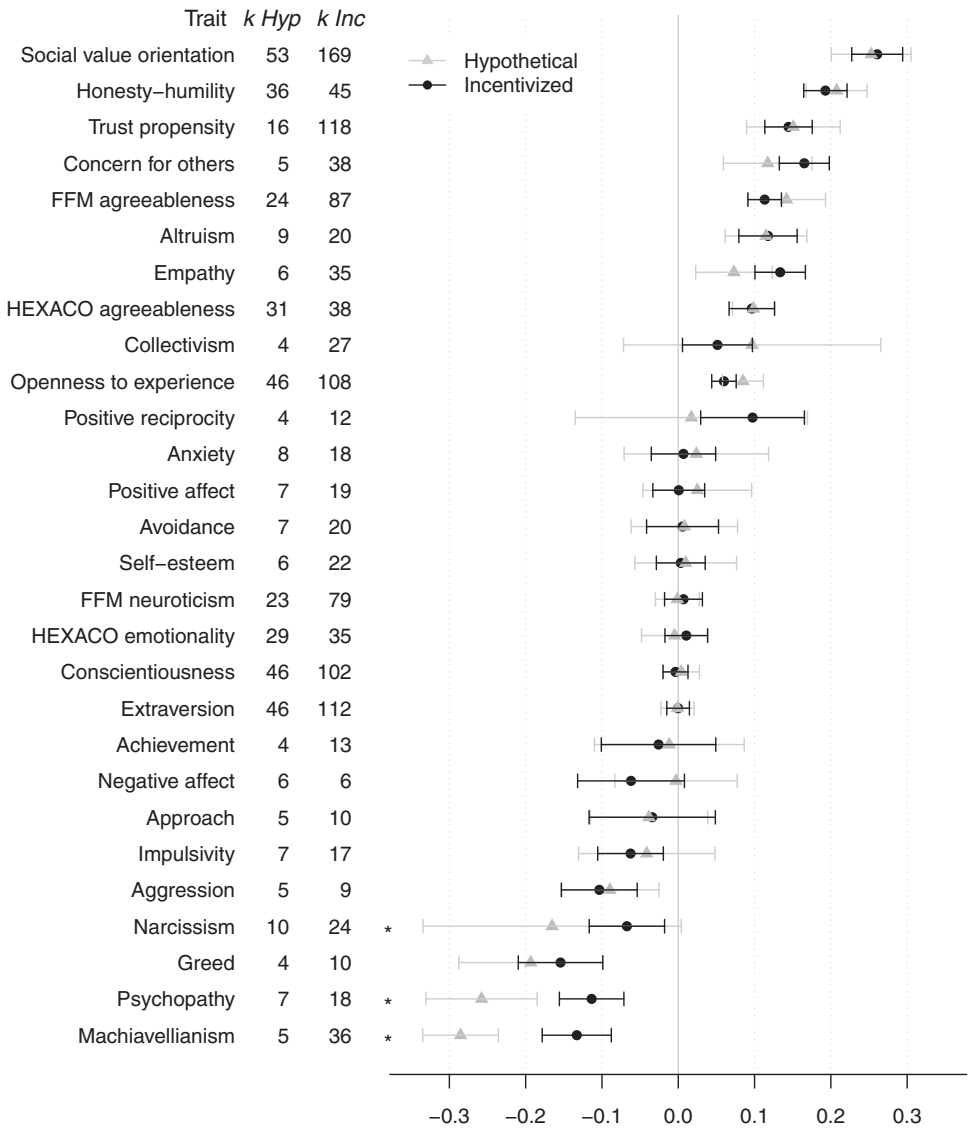


Figure 8. Meta-analytic correlations ($\hat{\rho}$) between selected traits and prosocial behavior across all games, separated for games involving hypothetical (Hyp) and real incentives (Inc). Error bars indicate 95% CIs. * $p < .05$ (indicating a significant moderation by incentives); k = number of independent samples underlying an effect size; FFM = Five Factor Model.

the expression of self-regulation of immediate impulse gratification, and (d) *dependence under uncertainty*, allowing the expression of beliefs about others' prosociality. Moreover, we considered six additional subaffordances that may be provided in the presence of the exploitation and reciprocity affordances and that may allow basic social motives (e.g., altruism, fairness, individualism) to ultimately guide behavior.

To derive predictions about which traits should relate to prosocial behavior across and within situations, we first analyzed the structure of the games referring to Game Theory (von Neumann & Morgenstern, 1944) and Interdependence Theory (Kelley & Thibaut, 1978) to determine the (sub)affordances each game involves. Second, we analyzed the traits based on their conceptualizations and operationalizations to determine their links to the related psychological processes and social motives, that is, *when* the traits should be activated to become expressed in behavior. Integrating these two perspectives provided specific hypotheses about which traits should relate to prosocial behavior in which game, and we tested these hypotheses in our meta-analysis.

Four broad affordances for prosocial behavior. At the broadest level, our framework predicts that traits that are conceptually linked to any of the four broad affordances proposed should relate to prosocial behavior across a variety of interdependent situations providing these affordances, whereas traits that are not linked to any of the affordances should essentially yield zero relations. Supporting this idea, the meta-analysis showed that traits linked to any of the four broad affordances mostly showed stronger relations to prosocial behavior across the games than traits not

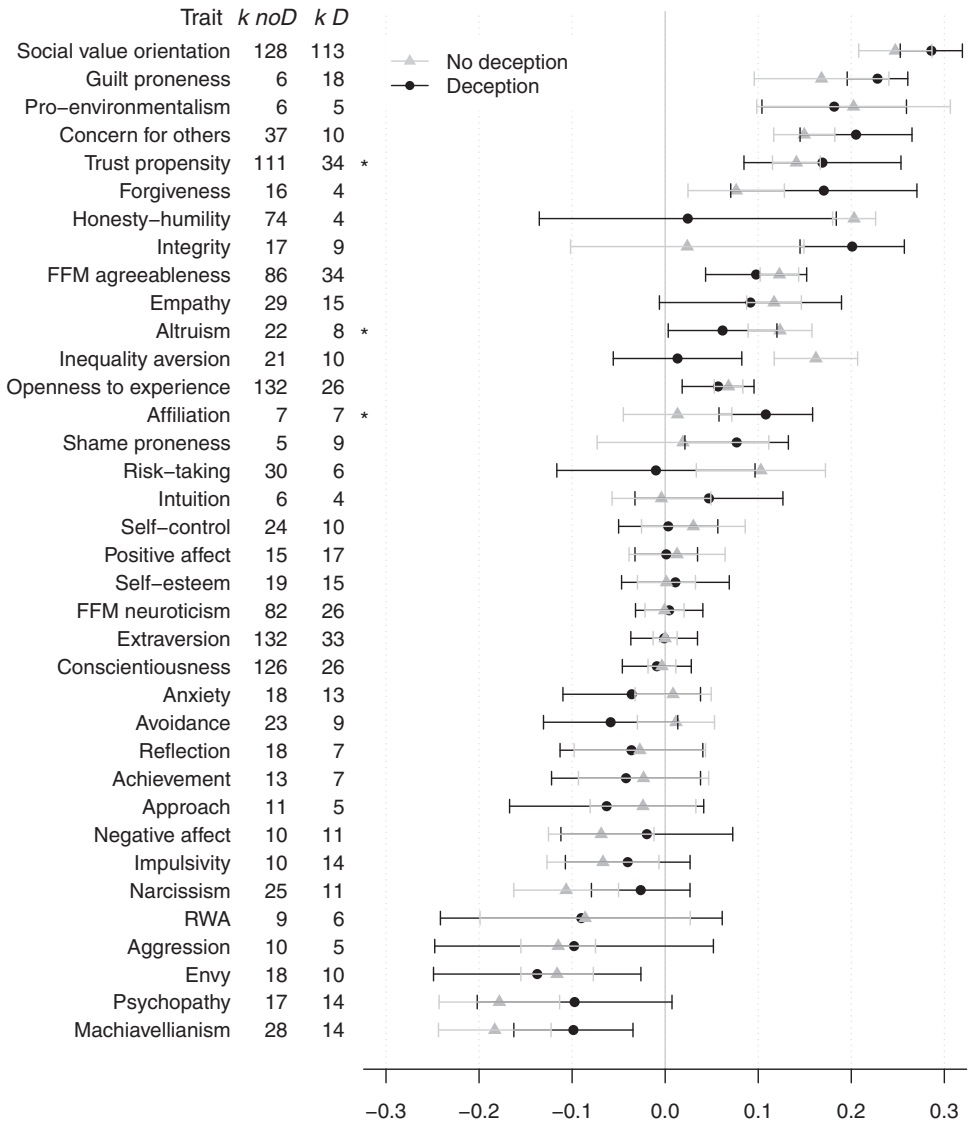


Figure 9. Meta-analytic correlations ($\hat{\rho}$) between selected traits and prosocial behavior across all games, separated for studies involving no deception (noD) versus deception (D). Error bars indicate 95% CIs. * $p < .05$ (indicating a significant moderation by deception); k = number of independent samples underlying an effect size; FFM = Five Factor Model; RWA = right-wing authoritarianism.

linked to any of the affordances (see Figure 4). That is, whereas 81.8% of the traits that we predicted to be activated by at least one of the affordances showed significant correlations with prosocial behavior, this was the case for only 16.7% of traits that we did not predict to be activated by any of the affordances. The strongest correlations were apparent for traits linked to unconditional concern for others which may be expressed when one can exploit others: 9 of the 10 traits yielding the largest absolute correlations across games were linked to unconditional concern for others, and four of these uniquely so. Moderate correlations were, in turn, apparent for traits linked to conditional concern for others and to beliefs about others' prosociality, which may be expressed when reciprocity is possible or when there is dependence under uncertainty, respectively. Finally, correlations close to zero occurred for traits linked to self-regulation, which may be expressed when there is a temporal conflict, meaning that short- and long-term interests are at odds.

Overall, these results demonstrate that situational affordances offer a useful approach to understand the relation between personality and prosocial behavior across various interdependent situations. Most consistent evidence in this regard emerged for the affordance of exploitation, whereas there was no evidence that a temporal conflict between short- and long-term interests represents a key affordance that can account for individual variation in prosocial behavior across interdependent situations. However, it should be noted that the games—and corresponding affordances—were not equally represented in our data. For example, the Dictator Game—which exclusively provides a possibility for exploita-

tion—was the second most applied game in the studies included in the meta-analysis. Thus, one may argue that the advantage of exploitation over the other affordances may be attributable to the fact that games involving this affordance (alone) were better represented in our analysis. To rule out this alternative explanation, we compared the pattern of correlations observed across all games with the pattern of correlations observed in social dilemmas in which all broad affordances are provided, at least when the game involves repeated interaction. Importantly, the rank order of correlations observed across all games was highly similar to the rank order of correlations observed in social dilemmas, Spearman's $\rho = .96$, $p < .001$. This clearly shows that the advantage of exploitation to account for the associations between personality and prosocial behavior across situations can be attributed to the unique importance of this affordance for the expression of personality in prosocial behavior.

Affordances within situations. Our framework further predicts that structural differences between interdependent situations—and corresponding variation in the (sub)affordances provided—can account for differences in the expression of certain traits in behavior across and within situations. That is, we derived and tested specific hypotheses about which traits should relate to prosocial behavior in which games (Table 5) and contingent on which structural features (i.e., conflict of interests, repetition of interaction). Support for the predicted pattern of correlations between games was found for several traits, namely altruism, conscientiousness, honesty-humility, inequality aversion, narcissism, risk-taking, and social value orientation; partial support was further found for Machiavellianism, power, social dominance orientation, and trust propensity (Table 8). For other traits, however, results provided no support for our predictions, either because differences in correlations between games were smaller than expected or because the observed pattern of correlations differed from predictions.

More detailed, most of the traits for which we found support for our predictions were conceptually linked to the exploitation affordance. That is, several traits (exclusively) related to unconditional concern for others (e.g., honesty-humility, social value orientation) showed significant positive relations with prosocial behavior whenever exploitation was possible in a situation, but no relation when it was not (i.e., in the Ultimatum Game as responder). This once again corroborates the unique importance of the exploitation affordance for the expression of personality in prosocial behavior, as also implied by our analyses of behavior across games. Moreover, results supported the hypothesized moderation by conflict of interests—reflecting differences in the degree to which exploitation is tempting—for several traits linked to unconditional concern for others: Traits positively linked to unconditional concern for others (e.g., social value orientation) yielded stronger (more positive) correlations with prosocial behavior when conflict of interests was high. By contrast, traits negatively linked to unconditional concern for others (e.g., Machiavellianism) yielded stronger (more negative) correlations with prosocial behavior when conflict of interests was low (see Figure 6). Overall, individuals with high unconditional concern for others were thus more likely to behave in a prosocial manner than those with low unconditional concern for others, even—and specifically—when the costs of prosocial behavior were high and the temptation to defect large. Conversely, individuals with low unconditional concern for others were more likely to behave in a selfish manner than those with high unconditional concern for others, even—and specifically—when the costs of prosocial behavior were low and the temptation to defect small. This implies that individuals with high unconditional concern for others may want to create peace in hostile environments, whereas individuals with low unconditional concern for others may want to create discord in peaceful environments. Ultimately, these findings are well in line with recent notions that dark personality traits do not simply reflect the negative pole of bright personality traits, even though dark and bright traits are strongly related (e.g., $r = .80$ between honesty-humility and the dark core of personality; Moshagen et al., 2018).

For traits conceptually linked to the reciprocity affordance, in turn, game-specific analyses provided somewhat weaker support for the predicted pattern of trait-behavior relations. For example, forgiveness and positive reciprocity—both traits exclusively related to conditional concern for others—showed, unlike expected, similar correlations across all games. In fact, forgiveness showed its descriptively strongest relation to prosocial behavior in the Dictator Game, which does not provide an opportunity to reciprocate. Likewise, the hypothesized moderation by repetition of interaction was only supported for one trait linked to conditional concern for others, namely HEXACO agreeableness, which showed a stronger relation in repeated games as predicted. This finding is indeed in line with the idea that HEXACO agreeableness should be particularly predictive of forgiving (i.e., nonretaliatory) behavior in ongoing relationships (Ashton & Lee, 2007). In contrast, all other traits related to conditional concern for others yielded comparable relations in one-shot and repeated games (see Figure 7).

Similarly, traits related to beliefs about others' prosociality and the affordance of dependence under uncertainty provided mixed evidence in support of our predictions. Risk-taking, for instance, showed—as expected—positive relations with prosocial behavior whenever dependence under uncertainty was present in a situation (i.e., in the Trust Game as trustor and social dilemmas), but no relation when it was not. Trust propensity, however, yielded—besides the expected positive relations with behavior in the Trust Game as trustor and in social dilemmas—positive relations of about the same size in the Dictator Game and the Trust Game as trustee, both of which should not afford beliefs about others' prosociality to influence behavior.

Finally, for traits conceptually linked to the temporal conflict affordance, results once again failed to provide support for the importance of this affordance for the expression of personality in prosocial behavior. Specifically, correlations of traits (exclusively) linked to self-regulation (e.g., impulsivity, self-control) with prosocial behavior generally hovered around zero, and for most traits there was no difference in effect sizes depending on whether a situation involved temporal conflict or not. Only for conscientiousness, correlations followed the predicted pattern, although again yielding close-to-zero effects. Correspondingly, for none of the traits linked to self-regulation, we found the predicted moderation by repetition of interaction. Interestingly, however, recent evidence on the (low) replicability of the *spontaneous cooperation effect* (Rand, Greene, & Nowak, 2012; Rand, Peysakhovich, et al., 2014)—which proposes that humans are intuitive cooperators who only become more selfish through deliberation—has likewise

questioned that processes related to self-regulation (i.e., "thinking it through") may influence prosocial behavior (Bouwmeester et al., 2017), which is why we also considered our analyses in this regard exploratory (see Footnote 9 and preregistration). Our finding that traits linked to self-regulation showed no consistent relation with prosocial behavior—both across situations and between situations, irrespective of whether temporal conflict was present or not—contributes to this recent research. However, it is plausible that self-regulation capacities will only be expressed in behavior by selfish individuals who have to suppress their immediate impulse to defect (Yamagishi et al., 2017). Prosocial individuals, by contrast, may not need to self-regulate their behavior because they should generally be willing to behave in a prosocial manner. Thus, traits linked to self-regulation might only take effect in interaction with individuals' level of prosociality (e.g., their social value orientation), which may have simply been obscured in our analysis. Future research is needed to investigate this issue.

Importantly, some of the (game-specific) findings for traits related to unconditional and/or conditional concern for others can help understand *how*—that is, through which social motives—their relations to prosocial behavior may come about in the presence of specific subaffordances. For example, inequality aversion—a trait exclusively linked to the motive of fairness—showed stronger (positive) relations with prosocial behavior in games in which equality in outcomes can be achieved than in games in which it cannot. This implies that the motivation of inequality averse individuals to minimize differences between own and others' outcomes underlies their willingness to behave in a prosocial manner. Similarly, narcissism—a trait linked to the motives of competitiveness and individualism—only showed negative relations with prosocial behavior in games in which both these motives drive selfish behavior, but not in the Ultimatum Game as responder in which these motives drive opposing behaviors. This suggests that the (negative) association between narcissism and prosocial behavior is attributable to the motivation of narcissistic individuals to (unconditionally and conditionally) increase own outcomes, both in absolute terms and relative to others.

However, it should be noted that for most traits included in our meta-analysis (that were related to unconditional and/or conditional concern for others), it was impossible to specifically test whether their links to the additional subaffordances (and corresponding social motives) can indeed account for their association with prosocial behavior. This is because several traits had conceptual links to multiple subaffordances and because (some of) the games included in the meta-analysis involve the same subaffordances (i.e., all games involve the subaffordances of max(other), min(own—other), and min(other), affording the motives of altruism, competitiveness, and spite, respectively). Thus, the consideration of the subaffordances had no incremental predictive value beyond the consideration of the four broad affordances for most traits (i.e., for 21 of the 27 relevant traits the predictions remained the same when neglecting the subaffordances). Future research is therefore needed to further and more specifically test the role of the subaffordances—and corresponding social motives—for the expression of personality in prosocial behavior as proposed in our framework. To this end, studies may exploit the well-defined structure of games to isolate certain social motives by tailored manipulations of the interdependent situation at hand (for empirical examples, see Haesevoets et al., 2018; Hilbig et al., 2018; Zhao, Ferguson, & Smillie, 2016, 2017a). Another approach is to directly assess individuals' motives for behavior (e.g., Colman & Stirk, 1998; Insko et al., 2013; Pfattheicher, Landhäußer, & Keller, 2014) and to test whether these self-reported motives mediate the link between traits and prosocial behavior. In this regard, future studies may also consider other psychological factors that can serve as mediators, such as cognitions (e.g., norms, justifications; Dunning, Anderson, Schlösser, Ehlebracht, & Fetchenhauer, 2014; Mellers, Haselhuhn, Tetlock, Silva, & Isen, 2010) and emotions (e.g., anger, regret; Martinez & Zeelenberg, 2015; van der Schalk, Kuppens, Bruder, & Manstead, 2015).

By and large, our analysis of trait-behavior relations between and within games provided further support for our theoretical framework, particularly for the usefulness of considering situation-specific affordances to understand individual differences in prosocial behavior in certain situations. Most consistent evidence again emerged for traits linked to the exploitation affordance. Together with the findings for prosocial behavior across games, this implies that individuals can readily perceive situational cues to exploitation (e.g., high conflict of interests, high power) and correspondingly construe the situations they encounter. Indeed, research suggests that individuals can differentiate situations along the dimensions of conflict of interests and power (Gerpott et al., 2018) and that high levels of both of these dimensions have strong (negative) effects on prosocial behavior (e.g., Camerer, 2003; Sally, 1995; Suleiman, 1996; Vlaev & Chater, 2006). Future research should build on these findings to more directly test whether the high salience of exploitation-related cues in interdependent situations—and in subjective representations thereof—can indeed explain why traits linked to unconditional concern for others are most strongly expressed in these situations.

For other traits, however, the fine-grained differences between interdependent situations with regard to the (sub) affordances involved may not be fully represented in their relations to prosocial behavior. This may have several reasons: First, some games may render certain affordances more or less salient due to specific (structural) features (Betsch, Böhm, & Korn, 2013). For example, evidence suggests that for trustors in the Trust Game, beliefs about others' trustworthiness as well as risk—both of which emphasize the dependence on others under uncertainty—are particularly salient (Dunning, Fetchenhauer, & Schlösser, 2012), and arguably more so than the possibility for exploitation. Second, the strength of associations of affordances with traits may differ within and across traits. That is, whereas a trait may be strongly activated in the presence of one affordance, it may only be weakly activated in the presence of another affordance—although being linked to both affordances. Finally, due to (conceptual and empirical) overlap between traits, a trait may be indirectly linked to other affordances than implied by its conceptualization and operationalization. For example, it has been shown that prosocial individuals (i.e., those high in unconditional concern for others) expect others to be prosocial as well, thus having more optimistic beliefs about their prosociality (e.g., Pletzer et al., 2018; Thielmann, Hilbig, & Zettler, 2018). The unexpected positive relations between trust propensity and prosocial behavior in the Dictator Game

and the Trust Game as trustee may thus result from the link of trust propensity to traits related to unconditional concern for others. Future research is needed to address these issues.

Trait Concepts Accounting for Individual Differences in Prosocial Behavior

Broad versus narrow traits. According to the bandwidth-fidelity dilemma (Cronbach & Gleser, 1965; Ones & Viswesvaran, 1996), it has been argued that narrow (facet-level) traits may have higher predictive validity for related outcomes than broad (factor-level) traits because they specifically and homogeneously tap into certain constructs (e.g., Paunonen et al., 2003). In terms of our affordance-based framework, this implies that narrow traits may be specifically expressed in those interdependent situations involving the (sub)affordances the traits are conceptually linked to. Stated differently, particularly for narrow traits, there should be evidence for the predicted correlational patterns, and to-be-expected correlations should be larger than for broad traits. Indeed, several narrow traits showed correlations that followed the predicted rank order. Most prominently, social value orientation was positively related to prosocial behavior in all games except the Ultimatum Game as responder ($\hat{\rho} = -.03$; otherwise $.24 \leq \hat{\rho} \leq .40$; Table 8), reflecting that social value orientation should be exclusively expressed when one can exploit others. Moreover, social value orientation yielded the strongest relation (i.e., $\hat{\rho} = .26$) with prosocial behavior across games among all traits considered. However, we once more emphasize that social value orientation may not only correlate strongly with prosocial behavior due to shared content variance, but also because of shared method variance because of its assessment based on game-like paradigms.

Among the broad traits, the strongest relation with prosocial behavior across games was apparent for honesty-humility ($\hat{\rho} = .20$; Figure 4), which indeed yielded the second largest correlation among all traits for which data was available for all games[17] and which also showed the predicted pattern of correlations between games. That is, much like social value orientation, honesty-humility was the strongest predictor of prosocial behavior among broad traits in all games but the Ultimatum Game as responder ($\hat{\rho} = .02$; otherwise $.09 \leq \hat{\rho} \leq .26$; Table 8). In this game, in turn, HEXACO agreeableness showed the strongest link among all (narrow and broad) traits considered in our analysis ($\hat{\rho} = .12$).

Taken together, the meta-analysis shows that no single trait—neither a narrow trait, nor a broad trait—yielded meaningful relations ($\hat{\rho} \geq .10$) with prosocial behavior in all games. This implies that no single trait can be expressed in prosocial behavior across all types of interdependent situations, even though several of the narrow traits are conceptualized so as to capture prosocial versus selfish tendencies *in general* (e.g., altruism, empathy, envy). As such, the findings demonstrate that the distinction between the affordances of exploitation and reciprocity is useful and should be captured in corresponding trait conceptualizations. Moreover, the meta-analysis shows that narrow traits may not generally outperform broad traits in predicting prosocial behavior. Indeed, narrow and broad traits alike can—and do—account for individual variation in prosocial behavior.

Basic personality models. As summarized previously, honesty-humility was the strongest predictor of prosocial behavior among broad traits in all games, except the Ultimatum Game as responder in which HEXACO agreeableness yielded the strongest association among all traits (Table 8). The findings for honesty-humility were thus fully in line with its conceptualization in the HEXACO model (Ashton & Lee, 2007; De Vries et al., 2016), supporting that honesty-humility specifically captures individual differences in tendencies related to unconditional concern for others (i.e., nonexploitation). For HEXACO agreeableness, results likewise supported that this dimension captures individual differences in tendencies related to conditional concern for others (i.e., nonretaliation) better than any other dimension. However, differences in correlations across games were very weak (albeit following the predicted rank order), calling for additional evidence on the double dissociation of HEXACO agreeableness and honesty-humility (Hilbig, Thielmann, et al., 2016; Hilbig et al., 2013; Zhao & Smillie, 2015). A promising approach in this regard is to take the moderate intercorrelation between these dimensions (Moshagen, Thielmann, Hilbig, & Zettler, 2019) into account, which will likely result in a clearer dissociation (Zettler et al., in press). FFM agreeableness, in turn, yielded positive relations with prosocial behavior in all games ($.07 \leq \hat{\rho} \leq .16$), thereby also supporting the conceptualization of this broad trait to capture individual differences in prosocial tendencies *in general* (Denissen & Penke, 2008). However, effects were relatively small in size (for four of the six games $\hat{\rho} < .10$; Table 8) and indeed smaller than the corresponding relations observed for honesty-humility and HEXACO agreeableness.

Overall, the findings imply that the HEXACO model offers a particularly good representation of individual differences in prosociality in terms of broad trait taxonomies, and that this is attributable to the distinction between unconditional and conditional prosocial tendencies as captured in honesty-humility and agreeableness. Indeed, this essentially replicates the results for the narrow traits summarized above. Future research addressing individual differences in prosocial behavior from the perspective of basic personality models will thus profit from relying on the HEXACO model.

Methodological Implications

Role of incentives. A critical design feature of games is whether behavior is real—in the sense that it incurs actual (e.g., monetary) consequences—or hypothetical. However, prior evidence on the role of incentives for the (strength of) relations between personality and prosocial behavior has been inconclusive (e.g., Balliet et al., 2009; Ben-Ner et al., 2008; Lönnqvist et al., 2011). Our meta-analysis showed that, if at all, effects of incentives on trait-behavior links are very small, even for highly evaluative traits. That is, for almost all traits, relations were similar in incentivized and hypothetical games. The only exception emerged for the Dark Triad traits (i.e., narcissism, Machiavellianism, and psychopathy), for which correlations were stronger (more negative) in hypothetical games (see Figure 8). This is in line with prior notions that high levels of these traits are particularly socially *un*desirable (Moshagen et al., 2018). Individuals may thus report

[17] Only guilt proneness additionally yielded a slightly stronger relation with prosocial behavior than honesty-humility (i.e., $\hat{\rho}. = .22$). However, the correlation for guilt proneness was only based on a subset of games because of insufficient data for other games (Table 8).

lower levels on these traits due to socially desirable responding, and likewise behave socially desirable (prosocial) when behavior is hypothetical, but less so if real incentives are at stake. Overall, however, the findings imply that relations between personality and prosocial behavior can be validly studied in hypothetical games.

Experimental deception. Experimental deception is largely accepted in psychology, whereas it is not in economics (Hertwig & Ortmann, 2001). Indeed, deception may have unintended effects on participants' behavior because it may increase suspiciousness (e.g., Gerlach, Teodorescu, & Hertwig, 2019; Ortmann & Hertwig, 2002). Correspondingly, deception may also affect how personality is expressed in prosocial behavior, in the sense that trait-behavior relations may decrease under deception. In contrast to this reasoning, however, we found no evidence for systematic effects of deception on the link between personality and prosocial behavior (see Figure 9). Although these findings may lead one to conclude that deception does not influence the expression of personality in prosocial behavior, we consider such conclusions premature. Specifically, even though deception may not have immediate effects on trait-behavior relations, it may have adverse effects in the long run when participants learn that deception is common practice and adapt their behavior correspondingly.

Size of correlations. In general, the correlations between traits and prosocial behavior were maximally medium-sized and most of them were small (J. Cohen, 1988). However, typical (bare-bones) effects in social and personality psychology are actually small to medium-sized (i.e., $r \approx .20$; Gignac & Szodorai, 2016; Richard, Bond, & Stokes-Zoota, 2003). Moreover, it should be noted that most studies assessed behavior in single-trial one-shot games, and that correlations with behavior should be larger when behavior is assessed repeatedly in such one-shot situations (Fleeson, 2001). Correspondingly, it has been argued that "the relevance of the cumulation of small effects over time is particularly obvious for research on individual differences, such as . . . personality traits" (Funder & Ozer, 2019, p. 161). Even more importantly, the size (and range) of correlations differed across interdependent situations (see Figures S2–S7 in the online supplemental materials), being largest in the Dictator Game (i.e., $-.20 \leq \hat{\rho} \leq .32$) and the Trust Game as trustee (i.e., $-.20 \leq \hat{\rho} \leq .40$) and smallest in the Ultimatum Game as proposer (i.e., $-.16 \leq \hat{\rho} \leq .24$) and responder (i.e., $-.10 \leq \hat{\rho} \leq .12$). In fact, this pattern mirrors the situational strength of the games (Mischel, 1977; Monson, Hesley, & Chernick, 1982; Snyder & Ickes, 1985): The situations modeled in the Dictator Game and the Trust Game as trustee are comparably weak given that players have full power and do neither need to fear retaliation by the interaction partner, nor take any strategic considerations into account. Thus, behavior may largely be an expression of one's personality. In contrast, the situations modeled in the Ultimatum Game are much stronger: Whereas proposers have to consider that responders might reject a small (i.e., selfish) offer, responders have to consider that rejecting an offer is individually costly. Thus, behavior may be more an expression of strategic considerations than one's personality. We recommend researchers to take these systematic differences in the size of effects of personality on behavior across situations into account when designing their studies, as these have important implications for statistical power.

Operationalizations of the traits. Using different operationalizations to measure the same (latent) personality construct implicitly suggests that all indicators (i.e., measurements) provide equivalent assessments. However, evidence suggests that this equivalence assumption does not necessarily hold, as different trait indicators of allegedly the same construct may have different predictive validity for certain outcomes (e.g., Hilbig, Moshagen, & Zettler, 2016; Miller, Gaughan, Maples, & Price, 2011; Muris et al., 2017; Parks-Leduc, Feldman, & Bardi, 2015; Thalmayer, Saucier, & Eigenhuis, 2011; Thielmann & Hilbig, 2019b). We therefore considered it important to also test for potential moderation by the inventory used to measure a trait. Specifically, for the 10 traits for which most data were available (i.e., the eight FFM and HEXACO traits, social value orientation, and trust propensity), we investigated whether their relations with prosocial behavior across games were moderated by the inventory used to measure the traits. Results are summarized in Table S17 in the online supplemental materials. Indeed, for one trait under scrutiny—FFM agreeableness—analyses yielded significant differences in effect sizes across inventories. Specifically, the correlation of FFM agreeableness with prosocial behavior was larger for the Big Five Aspects Scale (DeYoung, Quilty, & Peterson, 2007) than for any other scale (i.e., $\hat{\rho} = .21$ vs. $.08 \leq \hat{\rho} \leq .12$). This replicates prior studies which likewise showed differences in the predictive validity of FFM agreeableness across indicators (e.g., Decuyper, De Pauw, De Fruyt, De Bolle, & De Clercq, 2009; Hilbig, Moshagen, et al., 2016; Miller et al., 2011; Sibley & Duckitt, 2008). In general, this further supports that the equivalence assumption of indicators sought to measure the same construct does not necessarily hold.

Limitations and Directions for Future Research

Although the meta-analysis provides viable insights into the relation between personality and prosocial behavior, some limitations ought to be acknowledged. First, we exclusively focused on zero-order correlations. However, several traits included in our meta-analysis (most prominently those belonging to the same category; Table 2) are likely to show considerable interrelations. Thus, some traits may have simply yielded nonzero relations with prosocial behavior in (some) games because of their shared variance with other traits, and accounting for this shared variance might provide even clearer support for the proposed affordance-based account. More generally, considering the interrelations between traits will allow to specifically study the unique predictive validity of traits showing meaningful zero-order relations with prosocial behavior when other (related) traits are accounted for. The meta-analysis establishes which traits should be invited to such a comparison in future research.

Closely related, the meta-analysis is mute on the relative importance of personality versus situational variables for prosocial behavior given that we exclusively focused on the role of the person. It is thus unclear how much of the variance in prosocial behavior can be accounted for by the type of a trait versus the type of the interdependent situation at hand. Future research might extend the current analysis to provide further insights into the relative importance of the person and the situation for prosocial behavior. A promising approach may be individual-level meta-analysis (e.g., Steinberg et al., 1997; Stewart & Clarke, 1995), which can offer more fine-grained insights than our synthesis based on summary (effect size) data.

Another limitation of the meta-analysis is that interdependent situations providing a possibility to reciprocate were somewhat underrepresented, only counting the Ultimatum Game as responder, the Trust Game as trustee, and social dilemmas with repeated interaction. However, situations providing a possibility to reciprocate have actually received less attention in prior research. Moreover, we did not consider the type of behavior (i.e., selfish or prosocial) to which individuals reacted in situations providing a possibility to reciprocate; thus, we cannot distinguish between positive and negative reciprocal behavior in our analysis. Both these issues might potentially explain why traits (exclusively) linked to the affordance of reciprocity (e.g., HEXACO agreeableness, forgiveness, positive reciprocity) yielded relatively weak associations with prosocial behavior across situations. The meta-analysis calls for stronger consideration of situations providing opportunities for reciprocity in future studies. This also includes the need to focus more on repeated interactions to provide a deeper understanding of how the relation of personality to prosocial behavior may develop over the course of an ongoing interaction.

Closely related, for some traits data were insufficient to perform meta-analysis in some games (see Table 8), or even in general (see excluded traits in the additional materials on the OSF; https://osf.io/dbuk6/). These gaps, however, reflect that prior research has—at least implicitly—adopted the concept of affordances to some extent in studying the relation between traits and prosocial behavior. For example, dispositional greed has exclusively been studied in the Dictator Game and in social dilemmas in which exploitation is possible to a relatively strong degree. Similarly, trust propensity has mainly been considered in the Trust Game (and mostly so in the trustor role) and social dilemmas, in which beliefs about others' prosociality are relevant for behavior. However, a crucial step in testing a theoretical framework beyond establishing convergent relations is to test discrimination or dissociation, respectively, that is, whether relations are *not* observed when they are *not* to be expected (Campbell & Fiske, 1959; Teuber, 1955). Future research is thus needed to fill the gaps identified by our meta-analysis and to thereby provide further evidence on the proposed theoretical framework.

Finally, we focused on prosocial behavior in (a selection of) games—and corresponding interdependent situations. A crucial advantage of games is that they offer a theory-driven apparatus to measure *actual* behavior in a precise and parsimonious way (Murnighan & Wang, 2016). In this sense, we selected a set of games covering a variety of interdependent situations and involving the affordances relevant for prosocial behavior to different degrees. Thus, although the games may not reflect the entire breadth of interdependent situations in everyday social interactions, they arguably comprise a broad range of relevant situations. Nonetheless, future research may expand the study of (individual differences in) prosocial behavior to other interdependent situations, including real-life settings (Gneezy & Imas, 2017) and situations that more strongly differ on the proposed subaffordances than the games considered here. Importantly, our affordance-based framework provides a theoretical account for the understanding of prosocial behavior *in general*, not only in (a selection of) games. The framework can thus guide such future endeavors in providing a strong theoretical basis.

Conclusion

Individual differences in prosocial behavior have consistently been documented over decades of research using economic games—and personality traits have been shown to account for such individual variation. The present meta-analysis offers an affordance-based theoretical framework that can illuminate *which*, *when*, and *how* personality traits relate to prosocial behavior across various interdependent situations. Specifically, the framework and meta-analysis identify a few situational affordances that form the basis for the expression of certain traits in prosocial behavior. In this regard, the meta-analysis also shows that no single trait is capable to account for individual variation in prosocial behavior across the variety of interdependent situations individuals may encounter in their everyday social interactions. Rather, individual differences in prosocial behavior are best viewed as a result of traits being expressed in response to certain situational features that influence the affordances involved in interdependent situations. In conclusion, research on individual differences in prosocial behavior—and corresponding trait conceptualizations—should consider the affordances provided in interdependent situations to allow for a complete understanding of how personality can shape the many aspects of human prosociality.

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