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Ego Depletion Decreases Trust in Economic Decision Making

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THE FLORIDA STATE UNIVERSITY
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EGO DEPLETION DECREASES TRUST IN ECONOMIC DECISION MAKING

By

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ABSTRACT

Three experiments tested the effects of ego depletion on economic decision-making in the investment game. Participants completed a self-control task or simplified version not requiring self-control. Then participants divided \$10 between themselves and another person. The ostensible other person received triple the amount given and could return any portion to the participant. Giving less money, and therefore not trusting the other person, is the safe, self-interested response. Participants who had exerted self-control and were depleted gave the other person less money than those in the non-depletion condition (Experiment 1). This effect, however, was only observed among participants who were told they would never meet the other person. Amounts given did not differ for depleted and non-depleted participants who expected to eventually meet the other person (Experiment 2). Additionally, depletion did not cause decreased trust when participants believed they were interacting with a person very similar to themselves (Experiment 3). The implication is that self-control facilitates trust and enables people to override uncertainty in favor of socially constructive actions, especially when there are no other situational cues that motivate people to prioritize collective (versus individual) outcomes. The decrease in trust observed among depleted participants was strongest among neurotics.

INTRODUCTION

Self-control is linked to a variety of outcomes that enable people to thrive in groups (Baumeister, 2005). Self-control promotes relationship satisfaction and psychological adjustment and discourages socially undesirable behaviors, such as cheating and aggression (DeWall, Baumeister, Stillman, & Gailliot, 2007; Finkel & Campbell, 2001; Finkel, DeWall, Slotter, Oaten, & Foshee, 2009; Gino, Schweitzer, Mead, & Ariely, 2011; Tangney, Baumeister, & Boone, 2004; Stucke & Baumeister, 2006; Vohs, Finkenauer, & Baumeister, 2011). Thus, self-control facilitates group life by providing people with the strength to resist socially destructive behaviors and to enact socially constructive behaviors. In addition to self-control, trust is a crucial ingredient for successful group life. Trust promotes healthy interpersonal relationships, fluid economic exchanges, and cooperation (Berg, Dickhaut, & McCabe, 1995; Holmes & Rempel, 1989; Zaheer, McEvily, & Perrone, 1998).

The purpose of the current investigation is to test the hypothesis that self-control facilitates trust. Specifically, we predicted that self-regulatory depletion leads to diminished trust. Across three experiments, participants underwent a manipulation designed to either deplete or preserve self-regulatory resources and then completed the investment game, which provides a behavioral measure of trust (Berg, Dickhaut, & McCabe, 1995). In the investment game, participants receive an allocation of money and are told that they can send any amount of that money to the other person. The amount sent, if any, is tripled by the experimenter, and the other person can then decide whether to send any of the tripled amount back to the participant.

Participants can achieve the highest financial payoff in the investment game by sending a high proportion of the initial allocation of money to the other person and expecting the other person to send back an amount that is higher than the initial allocation. Nonetheless, participants who send money risk exploitation because the other person may choose to keep all the money and return nothing to the participant. Therefore, sending more (versus less) money in the investment game indicates higher levels of trust. Participants who keep the money for themselves in the investment game have chosen a response that requires no trust but also prevents the other person from receiving any money at all.

We theorize that self-control promotes trust because self-control can be used to override impulses that would otherwise lead to distrust. Specifically, self-control may be used to override

impulses to choose the safe response (i.e., keeping the initial allocation) at the expense of pursuing an uncertain, yet potentially more rewarding outcome (i.e., trusting the other person to send back more the initial allocation). Self-control may also enable people to override selfish impulses and instead consider the outcome of the other person when deciding whether to trust. This would promote increased trust in the investment game. Because self-control may be used to override impulses favoring certain (versus uncertain) rewards and selfish (versus socially constructive) decision-making, we predicted that self-regulatory depletion would lead to decreased trust.

What is trust?

Trust is a cultural phenomenon that allows people to obtain positive outcomes that would be impossible without depending on others. Although conceptualizations of trust have varied widely across the social sciences, one agreed upon aspect is that people who choose to trust expect the person they trust to act favorably toward them. One definition, for example, states that trust is “confidence that [one] will find what is desired [from another] rather than what is feared” (Deutsch, 1973, p. 148). A similar definition defines trust as the “expectation, assumption, or belief about the likelihood that another’s future actions will be beneficial, favorable, or at least not detrimental to one’s interests” (Robinson, 1996, p. 576).

Whereas early conceptualizations defined trust in terms of dispositional characteristics of a single actor (Rotter, 1971), more recent research conceptualizes trust as an interpersonal phenomenon that exists between two people in a relationship (Holmes & Rempel, 1989; Rempel, Holmes, & Zanna, 1985; for a review see Simpson 2007). These interpersonal conceptualizations of trust are called dyadic models. Dyadic models of trust suggest that trust depends not only on characteristics of the actor (the truster) and the other person (the trustee) but also on characteristics of the relationship between them.

In the current investigation, we defined trust as a dyadic process that occurs when three criteria are met (Righetti & Finkenauer, 2011). The first criterion is interdependence (see Kelley & Thibaut, 1978). That is, trust is only needed when the outcome of the truster depends on the behavior of the trustee. This criterion emphasizes that trust depends on the structure of the relationship between people.

The second criterion of trust is risk. Not all instances of interdependence create equal risk. Risk is low in when positive interdependence is achieved because positive interdependence

means that the desired outcomes of both people are aligned. The alignment of desired outcomes decreases the risk associated with depending on another person because that person is motivated by self-interest to pursue the preferred outcome of the first person.

The risk of depending on another person is much higher in interactions characterized by negative (versus positive) interdependence. Negative interdependence occurs when the desired outcomes of two people conflict. The relationship of home buyers and real estate agents who work off of commission provides one example of negative interdependence. Whereas the home buyer benefits from closing on a home at the lowest possible price, the real estate agent benefits by closing at the highest price that the home buyer is willing to pay (because this increases the commission). In this situation, the home buyer must decide whether to trust the real estate agent to negotiate the best possible price. This is somewhat risky because the real estate agent may benefit personally by closing at a higher price. Note that in this example, and many other examples of negative interdependence, even though the interests of both parties conflict, the decision not to trust would ultimately lead to a worse outcome for both. The home buyer would lose the opportunity to buy a desirable house and the real estate agent would lose potential income.

The third criterion of trust is that the truster must make the decision to trust freely and without coercion. When confronted with interpersonal uncertainty, people may choose whether to trust others and thereby make themselves vulnerable to the actions of the other person. If a person is coerced or forced to rely on another person, then that is not evidence of trust. To summarize the preceding paragraphs, we defined trust as a dyadic process in which the truster freely chooses to accept risk by depending on another person to achieve a desirable outcome.

Does self-control facilitate trust?

Self-control is defined as the self's ability to alter its responses in order to bring them in line with a standard (Baumeister, Heatherton, & Tice, 1994). People use self-control to override impulses that would otherwise lead to socially undesirable behaviors (Ainsworth & Baumeister, in press; Baumeister, 2005; Heatherton & Vohs, 1998; Hofmann, Friese, & Strack, 2009; Vohs & Baumeister, 2004). The strength model of self-control suggests that the self's capacity to alter its responses is limited. All acts of self-control rely on a common resource, and this resource is depleted through repeated use, leading to a state called ego depletion (Baumeister, Bratslavsky, Muraven, & Tice, 1998). Experimental manipulations of ego depletion are achieved by asking

participants to perform an initial self-control task designed to deplete their self-control resources. This method provides a valuable way to test how decreased self-control affects behavior.

Self-control can be used to override impulses that would be destructive to social relationships (Vohs & Baumeister, 2004) and because of this, high levels of trait or state self-control help people achieve their relationship goals (e.g., Finkel & Campbell, 2001; Fitzsimons & Finkel, 2011). Trust is also an important component of successful interpersonal relationships, and the link between self-control and trust is evident when considering the competing motivations that are elicited by process of deciding whether to trust other people. Broadly construed, decisions about whether to trust others represent a special kind of social dilemma (Messick & Brewer, 1983). Social dilemmas arise when individual interests and collective interests conflict.

Analogous to social dilemmas, the process of deciding whether to trust another person creates a subtle conflict between individual and collective interests. An individual may or may not be better off trusting another person—the individual's outcome depends on how the trustee responds. Even if an individual does not profit from his or her decision to trust, his or her decision advanced collective interests by creating the possibility that both parties could benefit. Stated differently, if a person refuses to trust, then that person is denying potential benefits not only to him or herself, but also to the trustee.

Motivational conflicts created by decisions about whether to trust can be analyzed at two levels. The first level is the level of the individual. Deciding whether to trust another person requires an individual to choose between a certain outcome and a potentially better, uncertain outcome. A decision not to trust is a choice in favor of the certain outcome because the truster has chosen to maintain the status quo and avoid potential losses (i.e., nothing ventured, nothing lost). A decision to trust, however, is a choice in favor of the uncertain outcome. In this scenario, the truster has exposed himself or herself to the risk of exploitation but potentially will reap benefits that would have been impossible without trusting. Nonetheless, people weigh potential losses more than potential gains in decision making (Tversky & Kahneman, 1991). Due to this, the dominant response when deciding whether to trust may be to focus not on the potential benefits of trusting but rather on the potential losses and the threat of exploitation. Self-control may be needed to overcome the impulse to avoid loss and instead pursue potential benefits. We

theorize that self-control promotes trust because it can be used to overcome the impulse to withdraw from uncertain situations.

The second level of analysis extends beyond the individual to the relationship between individuals. Regardless of the conflict between certainty and uncertainty, decisions to trust also have implications for the collective interests of a group. Decisions not to trust others may be considered selfish to the extent to which the distrust eliminates potential benefits for trustees. Thus, decisions to trust also involve a conflict between selfish and collective interests. An example of this is scientific collaboration. Successful collaboration requires trust because scientists risk exploitation if their collaborators do not contribute fairly to the work or take undue credit. In spite of the risk of exploitation, scientific collaboration produces benefits for the individual, the collaborators, and the larger scientific community. Indeed, an article published in *Science* found that teams of scientists produce more high impact publications than individuals (Wuchty, Jones, & Uzzi, 2007). Trust provides similar collective benefits in most economic transactions and interpersonal relationships. Selfish impulses may promote avoiding the uncertainty associated with trusting, but self-control may be used to override these impulses and instead favor the collective good. Thus, we argue that self-control promotes trust because it allows people to resolve the conflict between selfish and collective interests in favor of collective interests.

To date, empirical tests of the relationship between self-control and trust have been limited. Righetti and Finkenauer (2011) tested how perceptions of a trustee's self-control affected whether the trustee was perceived as trustworthy. Their experiments demonstrated that trusters perceived trustees with low trait or state self-control as less trustworthy than trustees with high trait or state self-control. Additionally, trusters who played the investment game sent less money to a depleted trustee than to a non-depleted trustee. These findings suggest that trusters have more confidence that a high self-control trustee will respond favorably to them. Whereas Righetti and Finkenauer (2011) investigated how decisions to trust are influenced by the self-control of the *trustee*, the current experiments test how decisions to trust are influenced by the self-control of the *truster*.

In the current research, participants underwent a depletion manipulation and then completed the investment game in three experiments. During the investment game, participants received \$10 to invest and were told that they would be paid however much money they earned

at the end of the experiment. Sending more (versus less) money to the other person is evidence of trust. We theorized that self-control can be used to resolve conflicts that arise during decisions to trust. Specifically, the decision to trust may enact a conflict between choosing a certain outcome versus an uncertain, yet potentially more rewarding outcome. Additionally, the decision to trust may enact a conflict between selfish and collective interests. Self-control may enable people to favor the uncertain, yet potentially rewarding outcome and to favor collective interests. We therefore predicted that depletion of self-regulatory resources would lead to decreased trust.

Anticipated Meetings

Our conceptualization of trust indicated that trust depends not only on the individual actors, but also on characteristics of the relationship between them. In some relationship contexts, such as long-time married couples, the decision to trust may involve less uncertainty because it becomes easier to predict another person's behavior the more you know that person. Other relationship contexts are rife with uncertainty. When two strangers interact for the first time, there is no history from which to predict their behavior. In spite of the uncertainty, most people cooperate with strangers because they expect to meet again and because cooperating in these situations is a way to minimize potential costs. It is far more costly to refuse to cooperate with a person with whom one could have formed a mutually beneficial relationship than to cooperate with a person who turns out to be a free rider (Delton, Krasnow, Cosmides, & Tooby, 2011).

Yet not all interactions with strangers are created equally. In some interactions with strangers, people expect to never meet again or perhaps never even to meet in person. In these situations, self-control may be particularly relevant to forging trust because there are fewer personal benefits associated with prioritizing the collective good (i.e., by trusting). When people expect to meet the trustee in the future, they may be motivated to focus not on their own fears of exploitation, but rather on the potential long-term benefit that can be achieved by trusting a stranger. This may be because the truster is aiming to develop a mutually beneficial relationship between him or herself and the trustee. Consistent with this, people display more trust toward ingroup members than outgroup members (e.g., Brewer, 2008; Kramer, 1999; Tanis & Postmes, 2005). One explanation for this is that people are more trusting when interacting with ingroup members because they expect to form more intimate relationships with them compared to outgroup members.

Interacting with a stranger whom you expect to meet again may still evoke a strong fear of exploitation and preference for the certain outcome, but the potential of developing a mutually beneficial relationship with this person is expected to trump these uncertainties. People may be especially motivated to trust others they expect to meet again, even when their self-regulatory resources are depleted. Nonetheless, if there is absolutely no expectation of a future meeting, then self-control may be crucial in promoting trust because self-control is needed to overcome the uncertainty associated with trusting and to consider the joint outcomes of the decision. In Experiment 2, we manipulated depletion and whether participants expected a future meeting with the other person. We expected that depletion would lead to decreased trust, but only among participants who did not expect to meet with the other person. We expected no differences in trust levels between depleted and non-depleted participants who expected a future meeting with the other person.

Similarity

We predicted that trust may be possible in spite of depletion if trusters are sufficiently motivated to trust (e.g., by expecting a future meeting with the trustee). Another factor that may increase motivation to trust is perceived similarity between the truster and trustee. Similarity of attitudes and group membership increases the desire to affiliate (Brewer, 1979; Byrne, 1961; Newcomb, 1956; Tajfel & Turner, 1986). An increased desire to affiliate, in turn, should promote behaviors, such as trust, that allow new relationships to form.

Additionally, perceived similarity may create a sense of shared identity that increases the likelihood of people viewing their own self-interest as aligned with the self-interest of other group members. Indeed, a strongly shared group identity may blur the distinction between selfish interests and the interests of other group members (e.g., Van Vugt & Hart, 2004). Kinship also blurs this distinction because genetic self-interest extends to family members (e.g., Dawkins, 1976; Hamilton, 1964). That is, behaviors that help increase the fitness of kin indirectly enhance the individual's own fitness. When interacting with kin, people may experience selfish impulses but these impulses may actually promote cooperation because providing benefits to kin indirectly provides benefits to the self. Self-control may not be needed to trust kin or group members who share a strong identity because acting selfishly would promote trust. Additionally, interacting with these groups decreases the uncertainty associated with trust because people may assume

that kin or group members with a strongly shared identity would be more likely than strangers to be trustworthy.

In Experiment 3, we manipulated the degree to which participants identified with the trustee by providing false similarity feedback. Some participants were led to believe they shared a high degree of biological similarity with the other person, and other participants were given no information about how similar they were to the other person. We expected that perceiving the other person as very similar would enhance trust because it may increase the motivation to trust, decrease the uncertainty associated with trusting, and activate a default tendency to trust one's relatives. Therefore, we expected that even depleted participants would show high levels of trust toward the other person if they were told they were biologically similar to the other person. We expected to find decreased trust among depleted (versus non-depleted) participants who were given no information about the other person.

Neuroticism

Neuroticism is an individual difference that may be particularly relevant to decisions about whether to trust others. Neuroticism is negatively related to trust ($r = -.57$; Evans & Revelle, 2008). Additionally, correlates of neuroticism, such as attachment anxiety, are also associated with lower levels of trust (see Mikulincer & Shaver, 2007; Nofle & Shaver, 2006). The exact cause of the relationship between neuroticism and decreased trust is unknown, but one speculative explanation is that neurotics are especially sensitive to the potential costs of trusting others (Evans & Revelle, 2008). This explanation is supported by research showing that neurotics tolerate more risk to avoid losses, but tolerate less risk to achieve benefits (Levin, Gaeth, Schreiber, & Lauriola, 2002; Lauriola & Levin, 2001).

Thus, neurotics may be less trusting than other people because they are less willing to take risks to achieve the potential benefits associated with trust. Framed differently, neurotics may have a stronger preference than non-neurotics for certainty when the decision is between an adequate (certain) outcome and a potentially better (uncertain) outcome. Choosing the certain outcome (i.e., not trusting) is safe and prevents potential losses. To overcome their preference for certainty and aversion to loss when deciding about whether to trust others, neurotics may be especially dependent on self-control. We therefore predicted that depletion-related decreases in trust would be larger among neurotics than non-neurotics.

The current experiments

In three experiments, we tested the hypothesis that self-regulatory depletion decreases trust. Experiment 1 tested the basic hypothesis using the investment game. Experiment 2 also manipulated whether participants expected to meet the other person. We predicted that depletion would only lead to decreased trust when participants did not expect to meet with the other person. Experiment 3 manipulated the perceived similarity between the participant and the other person. We predicted that depletion would again lead to decreased trust, but not when depleted participants believed that they were very similar to the other person. We also included a measure of neuroticism in each experiment and predicted that depletion-related decreases in trust would be larger among neurotic (versus non-neurotic) participants.

EXPERIMENT 1

Experiment 1 was designed to test the basic prediction that self-regulatory depletion causes decreased trust. Depletion was manipulated through the use of a brief video clip in which participants received instructions designed either to deplete self-regulatory strength or leave self-regulatory strength unaffected. Participants in the depletion condition were asked to control their attention during the video clip by redirecting their attention away from superfluous words that appeared on the screen, and participants in the non-depletion condition were not given any instructions about how to direct their attention. All participants then completed the investment game with an ostensible other person. We expected participants who were asked to control their attention during the video clip to make lower offer amounts to the other person than participants who were not asked to control their attention.

Method

Participants. Sixty-one participants completed the experiment for course credit. Eight participants who failed instruction checks for the investment game were excluded, leaving a total of 53 participants (31 women).

Procedure. Participants arrived to the lab individually and were randomly assigned to the depletion or non-depletion condition. The depletion manipulation involved watching a silent video of a woman being interviewed by an off-camera interviewer (adapted from Gilbert, Krull, & Pelham, 1988), a task ostensibly designed to measure non-verbal impressions. Throughout the seven-minute interview, neutral words (i.e., hat) appeared at the bottom, right corner of the screen intermittently. Participants in the depletion condition were instructed that it is crucial that they control their attention by ignoring the words and immediately refocusing their attention on the women if they look at the words. Participants in the non-depletion condition were not given specific instructions about the words. This depletion task has been used successfully in past research to deplete self-regulatory resources (e.g., DeWall, Baumeister, Mead, & Vohs, 2011; Masicampo & Baumeister, 2008). Following the depletion manipulation, participants completed the Brief Mood Introspection Scale (*BMIS*; Mayer & Gaschke, 1988) to provide a measure of mood and arousal.

Next, participants completed the investment game with an ostensible other person (Berg, Dickhaut, & McCabe, 1995). The investment game has been used primarily in behavioral economics experiments to measure people's willingness to trust others in economic exchanges.

Instructions for the game were presented on the computer. Participants were told that they would complete an economic decision-making task for real money with another participant who was subject to the same earning possibilities. The identity of the participant and the other person would remain confidential. To decrease suspicion about not meeting the other person, participants were told that they would have the option of meeting this person at the end of the experiment. Next, participants were told that they were randomly assigned to the role of Player A and the other participant to the role of Player B.

The game rules then stated that the participant (Player A) would receive 10 experiment dollars which would be converted to payment for real money at the end of the experiment. The participant could decide whether to send some, none, or all of the experiment dollars to the other player. Any money sent by the participant to the other player would be tripled. Participants were given the example that if they choose to send nothing, the other player receives nothing. If they send 3 experiment dollars, the other player receives 9 experiment dollars. If they send 10 experiment dollars, the other player receives 30 experiment dollars. Participants were then informed that the other player must decide whether to send some, none, or all of the money received back to the participant. An example stated that if the participant sends 3 experiment dollars, the other player receives 9 experiment dollars and can return any amount between 0 and 9 experiment dollars.

To clarify earning potentials, participants were informed that their payment would be the sum of the amount they kept for themselves out of the original 10 experiment dollars and the amount that the ostensible other player sends back to them. Thus, participants were told that their payment at the end of the experiment could be more than, less than, or equal to \$10. In spite of these stated earning potentials, it was not possible to calculate payment this way because there was no other player in the experiment. Instead, we paid participants \$5 in addition to the partial course credit they received for participating.

After the investment game, participants reported how much money they believed the other person would send back, what amount would be fair for the other person to send back, and what amount they would send back if they switched roles with the other person. Participants then completed the Big Five Aspects Neuroticism Scale ($\alpha = .87$; DeYoung, Quilty, & Peterson, 2007). The Big Five Aspects Neuroticism Scale is composed of two facets, labeled Volatility and Withdrawal. The Volatility facet ($\alpha = .88$) measures irritability, anger, emotional lability, and

difficulty controlling emotional impulses, and the Withdrawal facet ($\alpha = .71$) measures the propensity to experience negative affect. Participants report how characteristic each statement is of them on a 5-point Likert-type scale (1 = not at all characteristic of me; 5 = extremely characteristic of me).

Participants were then asked four questions to check whether they fully understood the instructions of the investment game. The questions asked participants to indicate how many experiment dollars they received at the beginning of the game (10 experiment dollars), whether they had been assigned to be Player A or Player B (Player A), what was the possible amount of experiment dollars they could send to the other person (any amount from 0 to 10), and how many experiment dollars the other person could send back to them (any amount from 0 to three times the amount sent by the participant). Eight participants who failed to answer these questions correctly were excluded from data analyses.

Results

Investment Game. The major dependent variable in this experiment was participants' offers in the investment game. We predicted that participants in the depletion condition would offer less money to the other person than participants in the control condition. To test this hypothesis, we submitted participants' offer amounts to an independent samples *t*-test. This analysis yielded a significant effect of depletion condition on investment game offer amounts, $t(51) = 1.98, p = .05, d = .54$. Consistent with the hypothesis, participants in the depletion condition offered less money to the ostensible other person ($M = \$4.31, SD = \2.35) than participants in the non-depletion condition ($M = \$5.64, SD = \2.53).

As a supplement to the major analysis, we ran independent samples *t*-tests to determine whether assignment to the depletion condition affected how much money participants believed the other person would send back, what amount would be fair, and what amount they would send if the roles were reversed. Because the raw answers to these questions are based on the original amount sent, we first converted all raw answers to proportions of the amount that the other person would have received (i.e., three times the amount sent by the participant). Depleted participants and non-depleted participants did not differ in the proportion of the money they believed the other person would return, $p = .51$, nor the minimum proportion that would be fair to return, $p = .34$. They did, however, differ in the amount that they stated they would return if the roles were reversed. Depleted participants reported that they would send a lower percentage

of the offer amount back ($M = .44$, $SD = .22$) than non-depleted participants ($M = .57$, $SD = .24$), $t(51) = 1.99$, $p = .05$, $d = .55$.

Moderation Analyses. Multiple regression was used to test whether neuroticism scores on the Big Five Aspects Scale moderated the effect of depletion condition on investment game offers. Depletion condition, neuroticism scores, and their centered interaction were entered as predictors of investment game offers. There was no main effect of neuroticism, $\beta = .08$, $p = .57$, $r_{\text{partial}} = .08$, but there was a main effect of depletion condition, $\beta = -.28$, $p = .04$, $r_{\text{partial}} = -.29$. This main effect was qualified by a significant interaction between depletion condition and neuroticism, $\beta = -.30$, $p = .03$, $r_{\text{partial}} = -.31$. We tested the effect of depletion condition at high (1 SD above the mean) and low (1 SD below the mean) levels of neuroticism. Simple slope analyses indicated that depletion condition predicted decreased offer amounts among depleted (versus non-depleted) participants at high levels of neuroticism, $\beta = -.56$, $p < .01$, $r_{\text{partial}} = -.40$, but not at low levels of neuroticism, $\beta = .04$, $p = .85$, $r_{\text{partial}} = .03$.

Because the Neuroticism subscale of the Big Five Aspects scale is composed of the Volatility and Withdrawal facet, additional regression analyses tested for moderation by each subscale. In the first regression, depletion condition, Volatility scores, and their centered interaction were entered to predict offer amounts in the investment game. The main effect of depletion condition remained significant, $\beta = -.28$, $p = .03$, $r_{\text{partial}} = -.30$, and the interaction between depletion condition and Volatility was significant, $\beta = -.34$, $p = .01$, $r_{\text{partial}} = -.36$. Simple slope analyses (at 1 SD above and below the mean of Volatility) indicated an effect of depletion condition on offer amounts at high levels of Volatility, $\beta = -.63$, $p < .01$, $r_{\text{partial}} = -.43$, but not at low levels of Volatility, $\beta = .07$, $p = .7$, $r_{\text{partial}} = .06$. In the second regression, depletion condition, Withdrawal scores, and their centered interaction were entered to predict offer amounts in the investment game. The interaction of depletion condition and Withdrawal failed to reach significance, $\beta = -.17$, $p = .23$, $r_{\text{partial}} = -.17$, indicating that the moderation analyses reported for neuroticism above were driven primarily by the Volatility subscale of the Big Five Aspects scale.

Mood. We also ran additional analyses to address whether differences in mood valence or arousal due to the depletion condition can account for differences in investment game offer amounts. Two independent samples t -tests were conducted with depletion condition predicting each subscale of the Brief Mood Introspection Scale (*BMIS*; Mayer & Gaschke, 1988). There were no differences between the depletion and non-depletion condition in reported mood

valence, $p = .78$, or mood arousal, $p = .51$. As an additional check, we reran the primary investment game analysis controlling for mood valence and arousal. A one-way ANOVA with depletion condition as a predictor of investment game offers controlling for mood valence and arousal remained marginally significant, $F(1, 49) = 3.8, p = .06, \eta^2 = .07$.

Participant gender. Although we made no a priori predictions about the gender differences, we also tested whether offer amounts differed by participant gender. An independent samples t -test revealed a significant effect of participant gender on offer amounts, $t(51) = -2.13, p = .04, d = .59$. Investment game offer amounts were higher among men ($M = \$5.83, SD = \2.64) than among women ($M = \$4.39, SD = \2.27). Due to the unpredicted difference in offer amounts among men and women, we reran the primary analysis to check whether participant gender interacted with depletion condition to predict investment game offers. The interaction between depletion condition and participant gender was non-significant, $p = .89$. Indeed, the effect of depletion condition on investment game offer amounts remained significant when rerunning the analysis controlling for participant gender, $F(1, 50) = 5.25, p = .03, \eta^2 = .10$.

Discussion

The results of Experiment 1 provide initial evidence that ego depletion reduces trust. Participants who controlled their attention during a video clip subsequently sent less money to the other person in the investment game than participants who did not control their attention. When asked how much money they would return to the other person if their roles were reversed, depleted participants reported that they would send back a lower proportion of the money than non-depleted participants. This provides preliminary evidence that depleted participants were not only less trusting than non-depleted participants, but also less trustworthy.

Another finding from Experiment 1 was that the decrease in trust observed among depleted participants was moderated by neuroticism. Whereas depletion led to decreased trust among people who scored high on neuroticism, there were no differences in trust among depleted versus non-depleted people who scored low on neuroticism. This finding suggests that neurotic people may depend more on self-control to promote trust than non-neurotic people.

Additional findings suggest that the moderating effect of neuroticism was driven by one particular facet of the Big Five Aspects neuroticism scale, the Volatility facet. The Volatility facet of the Big Five Aspects Neuroticism scale measures irritability, anger, emotional lability,

and difficulty controlling emotional impulses. Thus, people who score high on Volatility may be more likely than others to make decisions based on emotional impulses. Decisions about whether to trust others may evoke certain emotional impulses, such as a fear of exploitation, that lead to heightened distrust. Taken together, neurotics may rely on self-control to override their tendency to let emotional impulses, such as the fear of exploitation, guide their decisions about whether to trust. When self-control is depleted, neurotics may be more likely to distrust than non-neurotics because they view trusting as more inherently risky.

EXPERIMENT 2

Experiment 2 was designed to replicate and extend the results of Experiment 1 in two ways. First, Experiment 2 employed a different depletion manipulation to increase generalizability. This depletion manipulation consisted of a writing task in which participants were asked to either omit two high-frequency letters (depletion condition) or two low-frequency letters (non-depletion condition) from their writing. Writing without high-frequency letters was expected to be more depleting than writing without low-frequency letters because the former task demands more control of attention. Second, Experiment 2 was designed to test for a boundary condition of the effect reported in Experiment 1. Specifically, we predicted that self-control is most needed to facilitate trust in the context of anonymous or one-shot interactions because the uncertainty associated with the outcome and the impulse to behave selfishly would be strongest in this situation. To test this prediction, Experiment 2 manipulated whether participants expected a future meeting with the other person. When the participants expect a future meeting with the other person, then the uncertainty associated with trusting is decreased. Additionally, expecting to meet the other person may evoke concerns about fairness that favor trusting even when self-control is depleted. We therefore predicted that self-regulatory depletion would lead to decreased trust only among participants who do not expect to meet the other person.

Method

Participants. Seventy-nine participants completed the experiment for course credit. Seven participants who failed to correctly answer instruction check questions about the investment game were excluded, leaving a total of 72 participants (51 women).

Procedure. Participants arrived individually to the lab and were randomly assigned to the depletion or non-depletion condition. The depletion manipulation in this experiment was a writing exercise in which participants were given instructions to alter their writing in ways that would either consume or preserve self-regulatory resources. All participants had five minutes to respond to each of three prompts that asked general questions, such as “Describe what you do on a typical weekday. Begin with the moment you wake up and end with the moment you go to sleep.” Participants in the depletion condition were told: “Very important! Please do not use the letters ‘A’ or ‘N’ anywhere in your story.” Participants in the non-depletion condition were given the same instructions but were told not to use the letters ‘X’ or ‘Z’ instead of the letters ‘A’ and ‘N’. Writing without the high frequency letters ‘A’ and ‘N’ requires more self-regulation than

writing without the low frequency letters 'X' and 'Z'. This depletion manipulation has been used successfully in past research to deplete self-regulatory resources (e.g., Mead, Baumeister, Gino, Schweitzer, & Ariely, 2009; Pocheptsova, Amir, Dhar, & Baumeister, 2009; Schmeichel, 2007).

Following the depletion manipulation, participants completed the investment game with an ostensible other person. The instructions received were identical to the instructions used in Experiment 1 with two exceptions. First, participants were explicitly informed that the game would consist of only one round. Second, participants were randomly assigned to a future meeting or no future meeting condition. Participants in the future meeting condition were told that they would be introduced to the other person after the investment game, and participants in the no future meeting condition were told that they would not be introduced to the other person at any time. All participants were told that the experimenter would not have access to their decisions in the game. As in Experiment 1, participants were compensated with \$5 and partial course credit.

After the investment game, participants again reported how much money they believed the other person would send back, what amount would be fair for the other person to send back, and what amount they would send back if they switched roles with the other person. These questions were followed by the Big Five Aspects Neuroticism Scale ($\alpha = .88$; DeYoung, Quilty, & Peterson, 2007; Volatility subscale $\alpha = .86$; Withdrawal subscale $\alpha = .88$) and the investment game instruction check questions reported in the method for Experiment 1.

Results

Manipulation check. Following the writing task, participants were asked to report on a 7-point Likert-type scale how much the task required them to override their typical way of writing, to exert effort, and to exert control ($\alpha = .96$). An independent samples *t*-test was used to predict the mean score on these self-report questions from depletion condition, $t(40.97) = -8.28$, $p < .001$, $d = 2.24$ (Equality of Variances not assumed). Depleted participants ($M = 6.47$, $SD = .75$) found the writing task much more demanding than non-depleted participants ($M = 3.41$, $SD = 2.04$).

Investment Game. This experiment had a 2 (depletion versus non-depletion) X 2 (future meeting X no future meeting) design. The primary prediction was that depleted participants would offer less money in the investment game to the other person than non-depleted

participants, but only when they thought they would never meet the other person. A 2 X 2 ANOVA with depletion condition and meeting condition as independent variables was used to predict investment game offers. The only significant result was the predicted interaction between depletion condition and meeting condition, $F(1, 68) = 4.14, p < .05, \eta^2 = .06$. To interpret this interaction, we performed two contrasts comparing the effect of depletion condition within the no future meeting condition and within the future meeting condition. Consistent with the hypothesis, there was a significant effect of depletion condition among participants who did not expect to meet with the other person, $F(1, 68) = 5.43, p = .02, \eta^2 = .07$. Depleted participants in the no future meeting condition offered less money ($M = \$4.34, SD = \2.39) to the other person than non-depleted participants ($M = \$6.72, SD = \3.18). This effect was eliminated in the future meeting condition. Both depleted participants ($M = \$6.14, SD = \3.05) and non-depleted participants ($M = \$5.72, SD = \2.8) who expected to meet the other person made similar offer amounts.

In this experiment, participants were also asked to report how much money they believed the other person would send back, what amount would be fair, and what amount they would send if the roles were reversed. The raw answers were converted to proportions of the amount the participants' partner would have received based on the participants' original offer. Three 2 X 2 ANOVAs with depletion condition, meeting condition, and their interaction as predictors were run with answers to each of the questions as the outcome variables. These analyses failed to yield any significant results; p 's ranged from .14 to .78.

Moderation Analyses. Experiment one provided preliminary evidence that the effect of depletion on investment game offer amounts was moderated by neuroticism scores as measured by the Big Five Aspects Scale. Regression analyses were run to test for replication of this effect in the current experiment. Depletion condition, neuroticism scores, and their centered interaction were entered as predictors of investment game offer amounts and meeting condition was entered as a covariate. The depletion condition by neuroticism interaction was in the same direction as in Experiment 1, but not significant $p = .4$. Similar results were also found when rerunning the regression equations replacing total neuroticism scores with scores from each of the two facets of the Big Five Aspects neuroticism scale, including Volatility, $p = .59$, and Withdrawal, $p = .98$.

Mood. Additional analyses were conducted to address the possibility that differences in mood valence or arousal can account for the observed effects. Depletion condition, meeting condition, and their interaction were entered in an ANOVA to predict mood valence or arousal. Mood valence did not differ by depletion condition, $p = .77$, meeting condition, $p = .72$, or their interaction, $p = .41$. Arousal also did not differ by depletion condition, $p = .70$, meeting condition, $p = .18$, or their interaction, $p = .58$. Additionally, we reran the primary analysis for investment game offer amounts controlling for mood valence and arousal. The interaction of depletion condition and meeting condition remained significant, $F(1, 66) = 4.415$, $p = .04$, $r^2 = .06$.

Participant Gender. We also examined whether offer amounts differed by participant gender. The results of an independent samples t -test indicate that investment game offer amounts did not differ by participant gender, $p = .93$. Additionally, we examined whether participant gender interacted with depletion condition or meeting condition to predict investment game offer amounts. Participant gender, depletion condition, meeting condition, and all centered two-way and three-way interactions were entered into a regression equation predicting investment game offer amounts. No significant interactions with gender emerged. The depletion condition by participant gender interaction, $p = .59$, the meeting condition by participant gender interaction, $p = .52$, and the three-way interaction between depletion condition, meeting condition, and participant gender, $p = .17$, were all non-significant. Furthermore, we reran the primary analysis of investment game offers while controlling for participant gender, and the interaction of depletion condition and meeting condition remained significant, $F(1, 67) = 4.06$, $p < .05$, $r^2 = .06$.

Discussion

Experiment 2 provided a conceptual replication of Experiment 1 and extended by manipulating whether participants expected a future meeting with the other person. Consistent with the pattern of effects found in Experiment 1, we found lower levels of trust among depleted (versus non-depleted) participants who expected no future meeting with their partner. That is, participants asked to control their writing offered less money in the investment game than participants who were not asked to control their writing when they did not expect to meet their partner. This effect was eliminated, however, among participants who expected a future with the other person. That is, both depleted and non-depleted participants who expected a future meeting

with the other person were equally trusting. We theorized that, although people are generally trusting of strangers, expecting to never meet or interact with the trustee decreases the personal benefits associated with trusting (i.e., the potential to develop a mutually beneficial relationship). Thus, people who do not expect to ever meet with the trustee may focus less on the potential long-term benefits of trusting and more on the immediate uncertainty and the potential of exploitation. When people do not expect future meetings with the trustee, intact self-regulatory resources may be especially important for enabling people to overcome the uncertainty inherent in trusting others.

In Experiment 1, we found that the effect of depletion in reducing trust was specific to people who scored high on neuroticism. We tested for this effect in Experiment 2. Although the predicted interaction was in the same direction, it did not reach significance. This suggests that the results of Experiment 1 should be interpreted with caution. This non-replication of the effect in Experiment 2 does not rule out the possibility that a real effect exists but instead suggests that additional tests of the hypothesis are needed before drawing any conclusions. We therefore included the same measure of neuroticism in Experiment 3.

EXPERIMENT 3

In Experiment 3, participants again completed the investment game with an ostensible other person. In addition to the depletion manipulation, Experiment 3 also included a manipulation of apparent biological similarity between the participant and the other person. Participants underwent a fake EEG and were led to believe that another participant completed the same procedure at the same time. Participants either received no feedback about the results of the EEG reading or were told that the results indicated a high degree of similarity between the participant and the other person (Goldstein & Cialdini, 2007; Maner et al., 2002). We predicted that depleted participants given no information about their partner would show decreased trust compared to non-depleted participants, replicating findings from Experiment 1 and Experiment 2 (no future meeting condition). Furthermore, we predicted that the effect of depletion on trust would be decreased or eliminated among participants who were told the other participant was biologically similar to them. This prediction was based on the idea that the similarity manipulation may activate a default tendency to trust one's relatives.

Method

Participants. One-hundred thirty one participants completed the experiment for partial course credit. Four participants who failed to correctly answer the instruction check questions about the investment game were excluded from analyses, leaving a total of 127 participants (82 women).

Procedure. Participants arrived individually to the laboratory for an apparent social neuroscience experiment on brain activity and personality. First, participants were led to believe that they would complete the experiment with another person. Both the participant and the other person would complete an electroencephalograph (EEG) reading that would supposedly allow researchers to assess their fundamental thinking styles and to meaningfully compare their results. After consenting to the EEG reading, participants were asked to place a black headband around their head and then to insert three electrodes between the headband and their forehead. Although no physiological measures were actually recorded in this experiment, the electrodes used were borrowed from a machine capable of conducting electrocardiography, electromyography, and galvanic skin response measurements. After the electrodes were in place, the experimenter turned out the lights and started a slide show on the computer depicting words and images of objects taken from Google images. The words and images were all neutral in valence, such as the

word banana. Participants were instructed to allow their mind to freely associate while viewing the words and images.

Following the fake EEG measurement period, participants completed the depletion manipulation described in detail in Experiment 2. Participants assigned to the depletion condition were instructed to answer three writing prompts without using the letters 'A' and 'N', and participants assigned to the non-depletion condition were instructed to answer the prompts without using the letters 'X' and 'Z'.

Next, participants were randomly assigned to one of two similarity conditions. In the not similar condition, participants were told that the results of their EEG would be available later that week after they were analyzed by another lab. These participants were shown a copy of a sample individual EEG report, which depicted what looked like the output of an EEG reading. In the similar condition, participants were shown a copy of their individual report and an additional report indicating the degree of similarity between the participant and the other person. This report contained a similarity rating, and the experimenter explained that this rating conveys the similarity between the brainwave patterns of the participant and the other person as a percentage. The similarity rating for all participants in the similar condition was 93%. Participants were further told that a rating of 93% conveys a substantial amount of similarity between two people, to the degree that would be expected to be found among siblings, identical twins, and close friends.

Following the similarity manipulation, participants completed the investment game. The instructions received were identical to the instructions from Experiment 2 with the exception that all participants were told they would not meet the other person at any time during or after the experiment. Decisions in the investment game, therefore, would remain confidential. At the end of the experiment, participants again received a \$5 payment for the investment game in addition to partial course credit for their Introduction to Psychology course.

After the investment game, participants answered the following questions about their decision in the game on 7-point Likert-type scales. How confident are you that the other person will return some of the money to you? How risky do you think it is to send money to the other person? How likely is it that the other person will reciprocate your actions by returning a portion of the money you sent? How much do you trust the other person? Following these questions, participants completed the Neuroticism subscale of the Big Five Aspects Scale ($\alpha = .87$;

Volatility subscale $\alpha = .85$, Withdrawal subscale $\alpha = .77$) and the instruction check questions to confirm that participants understood the instructions of the investment game (see method from Experiment 1). Finally, participants were asked to rate on 7-point Likert-type scales how likable the other person is, how similar they think they are to the other person, and how much they would use the term “WE” to characterize themselves and the other person. They were also asked to complete the Inclusion of Other in Self Scale (Aron, Aron, & Smollan, 1992). This scale depicts a series of circles that become increasingly overlapping, and participants were asked to select the circle that best depicts how connected they felt to the other person.

Results

Manipulation check. Following the depletion manipulation, participants were asked to indicate on a 7-point Likert-type scale how much effort, control, and overriding of typical responses the writing task demanded. Responses to the three questions were averaged ($\alpha = .95$) and then an independent samples *t*-test was conducted to test for differences in perceived effort by depletion condition, $t(125) = -19.82, p < .001, d = 3.53$. Depleted participants ($M = 6.33, SD = .97$) reported that the task was much more demanding than non-depletion participants ($M = 2.69, SD = 1.10$).

To check the effectiveness of the similarity manipulation, participants were also asked to answer how likable the other person was, how similar they believe they were to the other person, to what extent they would use the term “WE” to characterize themselves and the other person, and to indicate how connected they felt to the other person using the Inclusion of Other in Self Scale (IOS; Aron, Aron, & Smollan, 1992). Responses to these four questions were averaged ($\alpha = .76$). A 2 X 2 ANOVA was run to test for differences in perceived similarity by depletion condition, similarity condition, and their interaction. There was a main effect of similarity condition, $F(1, 123) = 69.75, p < .001, \eta^2 = .36$. Participants in the similar condition ($M = 6.07, SD = 1.51$) reported they perceived more similarity between themselves and the other person than participants in the not similar condition ($M = 4.30, SD = 1.06$). This main effect was qualified by a significant interaction between depletion condition and similarity condition, $F(1, 123) = 5.12, p = .05, \eta^2 = .04$. To interpret this interaction, contrasts of the depletion versus non-depletion condition within the similar condition and within the not similar condition were tested.

Depleted participants in the similar condition ($M = 6.34$, $SD = 1.22$) reported feeling even more similar to the other person than non-depleted participants in the similar condition ($M = 5.77$, $SD = 1.36$), $F(1, 123) = -3.83$, $p = .05$, $r^2 = .04$. Depleted ($M = 4.12$, $SD = 1.16$) and non-depleted participants ($M = 4.49$, $SD = .92$) in the not similar condition did not differ in their perception of partner similarity, $p = .21$. These analyses indicate that the similarity manipulation effectively manipulated perceived similarity between the participant and the other person.

Investment Game. This experiment had a 2 (depletion versus non-depletion) X 2 (similar versus not similar) design. The major prediction was that depleted participants would offer less money than non-depleted participants to the other person in the investment game, but that this effect would be attenuated for depleted participants in the similar condition. A 2 X 2 ANOVA was conducted with depletion condition, similar condition, and their interaction entered as predictors of investment game offer amounts. Results indicated a marginally significant effect of depletion condition, $F(1, 123) = -2.97$, $p = .09$, $r^2 = .02$. Depleted participants ($M = \$4.72$, $SD = \$2.79$) offered marginally less money to the trustee than non-depleted participants ($M = \$5.55$, $SD = \$2.80$). No main effect of similarity condition was observed, $F(1, 123) = .60$, $p = .44$, $r^2 < .01$. The main effect of depletion condition was qualified by a significant interaction between depletion condition and similarity condition, $F(1, 123) = 3.97$, $p < .05$, $r^2 = .03$. To interpret this interaction, we performed two contrasts comparing the effect of depletion condition within participants in the not similar condition and within participants in the similar condition. The effect of depletion condition among participants in the not similar condition was significant, $F(1, 123) = -6.75$, $p = .01$, $r^2 = .05$. Depleted participants who were given no information about how similar they were to the other person ($M = \$4.02$, $SD = \$2.41$) offered less money to the other person in the investment game than non-depleted participants given no information about the other person ($M = \$5.85$, $SD = \$2.57$), thereby replicating the findings of Experiment 1. There was no difference in offer amounts among depleted ($M = \$5.38$, $SD = \$2.99$) and non-depleted ($M = \5.25, $SD = \$3.02$) participants who were led to believe their brainwave patterns were similar to the other person's brainwave patterns, $p = .85$.

After the investment game, we asked participants to answer four questions about their perception of their game play on 7-point Likert-type scales. We subjected the answers to each

question to a 2 X 2 ANOVA with depletion condition, similarity condition, and their interaction as predictors. The first question asked participants how confident they were that the other person would return some of the money to them. Results indicated a significant effect of similarity condition, $F(1, 123) = 4.41, p = .05, \eta^2 = .04$. Participants in the similar condition ($M = 4.17, SD = 1.52$) reported more confidence that the other person will return money than participants in the not similar condition, ($M = 3.6, SD = 1.45$). This main effect was qualified by a significant interaction between depletion condition and similarity condition, $F(1, 123) = 3.84, p = .05, \eta^2 = .03$. To follow-up this interaction, two simple contrasts compared the effect of depletion condition within the similar condition and within the not similar condition. For both analyses, the contrasts were not significant, $p = .17$. A contrast testing the effect of similarity within the depletion condition, however, showed a significant effect, $F(1, 123) = 8.58, p < .01, \eta^2 = .07$. Whereas non-depleted participants in the similar condition ($M = 3.9, SD = 1.51$) and the not similar condition ($M = 3.87, SD = 1.33$) did not differ, depleted participants in the similar condition ($M = 4.41, SD = 1.52$) were more confident that the other person would return money to them than were depleted participants in the not similar condition ($M = 3.34, SD = 1.52$).

The outcome variable of the second ANOVA was participants' responses to the question: "How risky do you think it is to send money to the other person?" Assessments of risk did not differ by depletion condition, $p = .25$, similarity condition, $p = .24$, or their interaction $p = .5$.

The next question asked how likely participants thought it was that the other person would reciprocate their actions by returning a portion of the money sent. The results of a 2 X 2 ANOVA indicate a main effect of similarity condition, $F(1, 123) = 4.38, p = .05, \eta^2 = .03$. Participants in the similar condition ($M = 4.31, SD = 1.42$) reported that it was more likely that the other person would reciprocate their actions than participants in the not similar condition ($M = 3.84, SD = 1.18$). This main effect was qualified by a significant depletion condition by similarity condition interaction, $F(1, 123) = 4.38, p = .04, \eta^2 = .03$. Depleted participants in the similar condition ($M = 4.62, SD = 1.37$) were more likely than non-depleted participants in the similar condition ($M = 3.97, SD = 1.43$) to think that the other person would reciprocate their actions, but there was no difference between depleted ($M = 3.69, SD = 1.06$) and non-depleted participants ($M = 4.00, SD = 1.29$) in the not similar condition. In all, depleted participants in the

similarity condition were most likely to believe that the other person would reciprocate their actions by returning some portion of the money.

The final question asked participants how much they trusted the other person. The only significant result to emerge was a main effect of similarity condition, $F(1, 123) = -8.16, p < .01, r^2 = .06$. Participants in the similar condition ($M = 3.71, SD = 1.63$) reported more trust in the other person than participants in the not similar condition ($M = 2.97, SD = 1.23$).

In this experiment, participants were also asked to report how much money they believed the other person would send back, what amount would be fair, and what amount they would send if the roles were reversed. The raw answers were converted to proportions of the amount the other person would have received based on the participants' original offer. Three 2 X 2 ANOVAs with depletion condition, similarity condition, and their interaction as predictors were run with answers to each of the questions as the outcome variables. These analyses failed to yield any significant results; p 's ranged from .15 to .86.

Moderation Analyses. The moderation analyses conducted in Experiment 1 and 2 with neuroticism yielded inconsistent results. In Experiment 3, we again tested whether neuroticism scores moderated the relationship between depletion condition and investment game offers. Regression analyses were conducted with depletion condition, neuroticism, and their interactions as predictors of investment game offers with similarity condition as a covariate. The interaction between depletion condition and neuroticism was marginally significant, $\beta = -.16, p = .08, r_{\text{partial}} = -.16$. Simple slopes analysis was conducted to interpret this interaction. We tested the effect of depletion condition at high (1 SD above the mean) and low (1 SD below the mean) levels of neuroticism. The effect of depletion condition was significant at high levels of neuroticism, $\beta = -.31, p = .02, r_{\text{partial}} = -.22$, but not at low levels of neuroticism, $\beta = .01, p = .92, r_{\text{partial}} = .01$. This indicates that depletion only decreased trust among participants who scored high on neuroticism.

Two additional regression analyses were run replacing the total neuroticism score with scores from each of the two facets of the Big Five Aspects Neuroticism Scale. Results indicate that the Neuroticism interaction reported above was primarily driven by scores on the Volatility facet. Whereas the interaction between depletion condition and the Withdrawal facet was non-significant, $\beta = -.12, p = .21, r_{\text{partial}} = -.11$, the interaction between depletion condition and the Volatility facet was significant, $\beta = -.16, p = .08, r_{\text{partial}} = -.16$. Simple slopes analyses indicate the effect of depletion condition was significant at high levels of Volatility, $\beta = -.31, p = .02, r_{\text{partial}} =$

-.22, but not at low levels of Volatility, $\beta = .01$, $p = .94$, $r_{\text{partial}} = .01$. Depletion decreased trust among participants who scored high on Volatility but not among participants who scored low on Volatility. This pattern of results replicates the findings from Experiment 1.

Our theory suggests that self-control is more relevant to neurotics (versus non-neurotics) decisions' to trust because neurotics view decisions to trust as more risky than non-neurotics. Neurotics, therefore, must rely on self-control to a greater extent than non-neurotics to overcome their fear of exploitation. We were able to provide one test of this theorizing by analyzing participants' self-report perception of how risky they viewed the decision to trust the other person. We regressed risk perceptions on depletion condition, neuroticism scores, and their centered interaction, controlling for assignment to similarity condition. The depletion condition X neuroticism interaction was significant, $\beta = -.19$, $p = .04$, $r_{\text{partial}} = -.19$. Simple slopes analyses indicated a significant effect of depletion condition at high levels of neuroticism, $\beta = -.29$, $p = .02$, $r_{\text{partial}} = -.20$, but not at low levels of neuroticism, $\beta = .09$, $p = .49$, $r_{\text{partial}} = .06$. Depleted neurotic participants viewed the decision to trust as more risky than non-depleted neurotic participants, suggesting that non-depleted neurotics rely on self-control to override the perception that trusting others is risky.

Mood. We conducted additional analyses to address the possibility that the results for the primary analysis of investment game offers were due to mood valence or arousal. Two 2 X 2 ANOVAs were run with depletion condition, similarity condition, and their interaction predicting mood valence and mood arousal. Mood valence did not differ significantly by depletion condition, $p = .37$, similarity condition, $p = .93$, or their interaction, $p = .41$. Mood arousal did not differ by depletion condition, $p = .94$ or the interaction of depletion condition and similarity condition, $p = .88$, but there was a marginally significant difference in mood arousal between participants in the similar condition and in the not similar condition, $F(1, 123) = 2.95$, $p = .09$, $\eta^2 = .02$. Participants in the similar condition reported marginally higher mood arousal ($M = 14.4$, $SD = 3.78$) than participants in the not similar condition ($M = 13.24$, $SD = 3.73$). To ensure that this marginally significant effect cannot account for the results, we reran the primary analysis of investment game offer amounts controlling for mood valence and mood arousal. The depletion condition by similarity condition interaction remained significant, $F(1, 121) = 4.09$, $p < .05$, $\eta^2 = .03$.

Participant Gender. Additional analyses were conducted to test for differences in offer amounts by participant gender and for any interaction between participant gender, depletion condition, and similarity condition in predicting investment game offer amounts. An independent samples *t*-test confirmed that investment game offers did not differ by participant gender, $p = .16$, unlike in Experiment 1. Additionally, a regression was run with participant gender, depletion condition, similarity condition, and all two-way and three-way interactions. Participant gender did not interact with depletion condition, $p = .15$, or similarity condition, $p = .15$, and the three-way interaction between participant gender, depletion condition, and similarity condition was also non-significant, $p = .41$. Finally, the primary analysis of the investment game offer amounts was rerun controlling for participant gender. The depletion condition by similarity condition interaction remained significant even when controlling for participant gender, $F(1, 122) = 3.78$, $p = .05$, $r^2 = .03$.

Discussion

Experiment 3 provided a replication of Experiments 1 and 2 and extended it by including a manipulation of the other person's similarity. Results indicated that depletion led to decreased trust, but only among participants who were given no information about the other person. There were no differences in trust observed among depleted and non-depleted participants who were told that they had similar brainwave patterns to the other person. We reasoned that leading participants to believe they could be genetically related to the other person may activate a default tendency to trust one's relatives. Additionally, we theorized that interacting with a highly similar person may strengthen the expectation that it would be possible to develop a mutually beneficial, ongoing relationship with that person. Thus, depleted people paired with a very similar other person may have had more motivation to overcome the selfish response of simply keeping all the money for themselves.

Additionally, the self-report data we collected suggests that participants who believed the other person was similar to them reported more confidence that the other person would return some money to them. Thus, believing that another person is similar to the self may eliminate some of the uncertainties associated with how the trustee will behave.

The self-report data also asked participants to indicate the degree to which they trusted their partner. One noteworthy finding was that both depleted and non-depleted participants in the not similar condition reported similar levels of trust in their partner. In the investment game,

depleted participants in the not similar condition were less trusting than non-depleted participants. Thus, the self-report measure of trust did not mirror participants' actual decisions in the investment game (a behavioral measure of trust). The discrepancy between self-reported trust and trust behavior suggests that it may be possible to show decreased trust without conscious awareness.

Experiment 3 also included a measure of neuroticism that was intended to shed light on the inconsistent results from Experiments 1 and 2. In Experiment 1, depletion led to decreased trust among neurotic participants, but not among non-neurotic participants. In Experiment 2, the interaction between depletion condition and neuroticism was in the same direction but not significant. Experiment 3, however, again found that neuroticism scores moderated the effect of depletion on trust. Additionally, in Experiment 3, we found that depleted neurotics perceived the decision to trust as more risky than other participants. This suggests that neurotics depend on self-control to overcome the perception that trusting others is risky. When self-control is depleted, neurotics view the decision to trust as somewhat risky and are therefore less likely than other people to trust.

META-ANALYSIS OF MODERATION ANALYSES

Three experiments tested whether neuroticism moderated the relationship between depletion and trust. Experiments 1 and 3 found a statistically significant moderation effect of neuroticism. In Experiment 2, the direction of the effect was consistent with the other experiments but was not statistically significant. We conducted a meta-analysis to test the overall significance of the moderation finding. This meta-analysis includes the depletion condition by neuroticism interaction from each experiment, controlling for meeting condition for Experiment 2 and controlling for similarity condition for Experiment 3. The p -values obtained in each experiment were converted to one-tailed p -values in order to obtain a Z score for each significance test. Z scores were then weighted by the degrees of freedom in each experiment. The weighted Z scores were summed and divided by the square root of the total value of the squared degrees of freedom for each experiment. The Z score obtained was then converted to a one-tailed p -value, which was doubled to obtain the two-tailed p -value. The Z score obtained for the meta-analysis of the neuroticism moderation effects was $Z = 2.59$, which corresponds to an overall two-tailed significance level of $p = .01$. Similar analyses were conducted for the results of the Volatility facet. In this analysis an overall Z score of 2.55 was obtained, and this corresponds to an overall significance level of $p = .01$. Thus, the results of the meta-analysis indicate that Neuroticism levels moderated the effect of depletion on offer amounts in the investment game, such that depletion mainly decreased trust among highly neurotic participants.

GENERAL DISCUSSION

Three experiments found that self-regulatory depletion led to decreased trust in the investment game. Across three experiments, depletion led to decreased trust toward an anonymous other person.

Additionally, Experiment 2 manipulated whether participants expected a future meeting with the trustee. The results for participants who did not expect to meet the trustee replicated Experiment 1. That is, depleted participants who did not expect to meet the other person offered less money in the investment game than non-depleted participants. In contrast, depletion did not affect trust among participants who expected a future meeting with the other person. Both depleted and non-depleted participants who believed they would meet the other person were equally trusting. These findings suggest that self-control is needed to trust strangers when there is no expectation of meeting them or interacting with them in the future.

Experiment 3 manipulated depletion and perceived similarity of the other person. Participants underwent a fake EEG procedure and received either no information about the EEG test results or were told that their brainwave patterns were very similar to their other person's brainwave patterns. The results for participants given no information about the EEG test results replicated the basic effects reported in Experiments 1 and 2. That is, depleted participants showed less trust in the other person in the investment game than non-depleted participants. On the other hand, depletion did not affect trust among participants who believed they were interacting with a biologically similar other person. Both depleted and non-depleted participants who believed the other person had similar brainwave patterns were equally trusting. Taken together, these findings indicate that depletion does not lead to lower trust among people who believe the trustee is very similar to themselves, perhaps because similarity indicates a higher likelihood that a mutually beneficial relationship could develop between the truster and trustee.

The current experiments also provided evidence that the effect of depletion on trust was driven primarily by participants who scored high in neuroticism. In Experiment 3, participants were asked to report how risky they thought it was to trust the other person. Depleted neurotics reported higher perceptions of risk than all other participants. When self-control was intact, neurotic and non-neurotics did not differ in their risk assessments. The difference in perceived risk only emerged among neurotics and non-neurotics who were depleted. This suggests that

neurotics use self-control to overcome the perception that trusting others is risky. When self-control is depleted, perceptions of risk may persist and this may lead to lower levels of trust.

Implications of the Current Research

The current research contributes to a large body of evidence showing that self-control is used to override impulses that would otherwise lead to undesirable behavior (Vohs & Baumeister, 2004). When self-control is depleted, people behave more dishonestly, provide less help to others, and become worse at restraining aggressive and the other personal urges (e.g., DeWall, Baumeister, Gailliot, & Maner, 2008; DeWall, Baumeister, Stillman, & Gailliot, 2007; Gailliot & Baumeister, 2007; Mead, Baumeister, Gino, Schweitzer, & Ariely, 2009). We theorized that self-control affects decisions about whether to trust others by providing people with the strength to override impulses (e.g., fear of exploitation, loss aversion, and selfishness) that would otherwise lead people to distrust.

The current research also has implications not for relationships among strangers. Rational economic models predict minimal trust between strangers in the investment game because the truster must assume that the trustee will keep all the money for himself or herself. Nonetheless, there is a robust literature showing that trusters often do choose to trust strangers (Berg, Dickhaut, & McCabe, 1995; Lount, Zhong, Sivanathan, & Murnighan, 2008; Meyerson, Weick, & Kramer, 1996; Yamagishi & Yamagishi, 1994).

In Experiment 2, we found that depletion decreased trust only among participants who expected to never meet the other person. Depletion did not decrease trust among participants who expected to meet the other person. This finding is consistent with evidence showing that people have evolved to treat strangers as potential cooperative partners (see Delton, Krasnow, Cosmides, & Tooby, 2011). The evolved motivation to cooperate with strangers, however, may be undermined if the truster is made explicitly aware that there is no chance of ever meeting the trustee. Our results suggest that self-control is needed to forge trust when there are no cues, such as an anticipated future meeting or live interaction, that signal the potential to develop a cooperative relationship. Thus, self-control may be especially important for fostering trust in anonymous contexts (e.g., online).

Experiment 3 offered additional evidence that self-control may be needed to promote trust among people who do not expect to develop an ongoing relationship. Depletion led to decreased trust generally, but not when participants were led to believe they were interacting

with a very similar other person. One interpretation is that interacting with a highly similar person strengthens the expectation that it would be possible to develop a mutually beneficial, ongoing relationship with that person. A highly similar person may share similar attitudes and belong to a similar group, which are both attributes that increase the desire to affiliate (Brewer, 1979; Byrne, 1961; Newcomb, 1956; Tajfel & Turner, 1986). Increased desire to affiliate should lead to behaviors, such as trust, that are crucial to developing new relationships.

Trusters who do not expect to develop an ongoing relationship with the trustee may be less motivated to consider joint outcomes when deciding about whether to trust. We did not manipulate dissimilarity in the current research, but self-control may be especially needed to enable trust between people who differ in salient personal characteristics (e.g., by age, race, or religion) because such differences may signal that there is a lower probability of forming an ongoing relationship.

The finding that depletion led to decreased trust may also have implications for the literature on relationships. We expect that self-control is most relevant to forging trust in developing relationships partially because there is less motivation to act in the best interest of the other person. Based on that reasoning, self-control may also be necessary to maintain trust in established relationships when there is a period of low relationship commitment. Because lower trust is associated with decreases in relationship satisfaction (Holmes & Rempel, 1989), self-regulatory depletion may undermine relationship functioning by decreasing trust. This implies that trust is not entirely a function of relationship status, but instead may also fluctuate as a function of external factors that deplete self-regulatory resources. State fluctuations in self-control in either partner may lead to decreased trust. One implication is that couples would be well advised to discuss relationship issues that require trust after rather than before dinner, as replenishing glucose may be one of the most efficient ways to bolster self-regulatory strength (e.g., Gailliot et al., 2007; Masicampo & Baumeister, 2008).

The current research also contributes to the literature on personality and individual differences. A meta-analysis of the three experiments showed that neuroticism scores moderated the effect of depletion on trust, such depletion lowered trust mainly among neurotic participants. This effect was driven by scores on the Volatility facet of the Big Five Aspects Neuroticism Scale, which measures irritability, anger, emotional lability, and difficulty controlling emotional

impulses. This finding can be interpreted by considering the risk-as-feelings hypothesis of decision making under uncertainty (Loewenstein, Weber, Hsee, & Welch, 2001).

The risk-as-feelings hypothesis suggests that cognitive and affective evaluations of risk may diverge. When this happens, people base decisions about whether to take risks not on the probability of achieving a desirable versus undesirable outcome, but rather on their own anticipated emotional reactions to potential outcomes. Due to their emotional impulsivity, the potential for exploitation inherent in trusting may lead neurotic participants to anticipate more negative emotional reactions than other people. Consistent with this idea, neurotic participants who were depleted, compared to all other participants, reported that trusting the other person was particularly risky. When self-control was intact, neurotic participants did not report heightened perceptions of risk. This suggests that neurotics may see trusting as inherently more risky than non-neurotics. Neurotics may depend on self-control more than non-neurotics to trust other because self-control may be used to overcome the perception that trusting others is risky and may lead to exploitation. This finding suggests another way that self-control can be used to modulate the effects of personality on behavior.

Limitations and Future Directions

Some limitations of the current research suggest directions for future research. The current research provided evidence that depletion decreases trust in economic decision making. We theorized that self-control facilitates trust because it enables people to overcome the uncertainty associated with trusting and to consider how the trustee may benefit from a decision to trust. Although we find support for these assertions, we discuss the plausibility of several alternative explanations for the current research below.

Righetti and Finkenauer (2011) found that depleted participants were perceived as less trustworthy than non-depleted participants. Results of the current Experiment 1 suggest that depleted participants may indeed be less trustworthy than non-depleted participants. In Experiment 1, participants were asked to indicate what proportion of their original offer amount they would return to the other person if the roles were reversed. Depleted participants reported that they would return a lower percentage of the offer amount than non-depleted participants. This result suggests that depletion leads not only to decreased trust, but also decreased trustworthiness. This interpretation should be treated with appropriate skepticism because Experiments 2 and 3 did not replicate the finding that depleted participants would return a lower

percentage of the offer amount than non-depleted participant if the roles were reversed. Future research could benefit by directly testing the hypothesis that depletion lowers trustworthiness.

Experiment 3 provided additional indirect evidence pointing to possible reasons for why depletion decreased trust. Participants who were depleted and told that the other person had similar brainwaves were more confident than any other group of participants that the other person would return some portion of the money. One reason that these participants (depleted participants who believe the other person was similar to them) were able to trust in spite of depleted self-control may be that they viewed the other person's behavior as relatively predictable. Viewing the other person's behavior as predictable would lower the uncertainty associated with trusting and possibly the fear of exploitation, thus decreasing the need for self-control to facilitate trust. Participants who were less confident than others about the other person's behavior showed decreases in trust, but only when their self-control was depleted. This finding suggests that non-depleted participants used self-control to overcome the uncertainty associated with trusting the other person.

Future research could directly explore the mechanisms underlying depletion-related decreases in trust by varying the certainty or uncertainty associated with the decision to trust. This may be achieved, for example, by providing participants with false information regarding how frequently past participants chose to return some portion of the money to the truster (e.g., 25% of participants versus 75% of participants).

In Experiment 3, participants who were told they were interacting with a similar other person reported higher levels of trust in the other person than participants told nothing about the other person. These self-reports of trust differed somewhat from the pattern of data observed from the investment game. Depleted and non-depleted participants who received no information about the other person reported equally low levels of trust, but only depleted participants showed decreased trust in the investment game. The discrepancy between self-reported trust and trust behavior suggests that it may be possible to show decreased trust without conscious awareness. Alternatively, non-depleted participants in the not similar condition may have offered more money to their partner than depleted participants out of a sense of altruism. Future research on depletion and trust may benefit by using a measure of trust that is not confounded with altruistic generosity.

The current research used a popular and valid measure of trust, but future research may benefit from using a different measure. We chose the investment game because this measure provides a tightly controlled laboratory measure of trust behavior. The one-round version of the investment game is also advantageous because it eliminates other possible explanations for trusting behavior, such as reciprocity norms. Indeed, in multiple round investment games, people may offer the other person money due to strategic self-interest rather than trust if they are pursuing a tit-for-tat strategy (Kuhlman & Marshello, 1975). Future research could profitably explore whether depletion decreases trust using other measures of trust and whether depletion decreases trust in non-economic domains.

In the current research, we also focused specifically on trust between strangers. Self-control may play a less central role in facilitating trust among established relationship partners because (a) the behavior of the trustee should be more predictable, and (b) people may have stronger motivation to value the outcome of the trustee when that person is an established friend, colleague, or romantic partner. Indeed, results of Experiments 2 and 3 suggest that trust does not depend as heavily on self-control when there are situation or dispositional cues indicating that a relationship could develop (e.g., expecting a future meeting or viewing the trustee as similar to the self).

Conclusion

Three experiments demonstrated the role of self-control in facilitating trusting behavior. Whereas past research has shown that the self-control of the trustee affects perceptions of that person's trustworthiness (Righetti & Finkenauer, 2011), the current research focused on the self-control of the truster. State fluctuations in the self-control of the truster impacted decisions about whether to trust the partner, especially among highly neurotic people. The current experiments also provided evidence that self-control is most relevant in facilitating trust among relative strangers with whom no connection exists or is anticipated. Thus, self-control is relevant to interactions in the broader society that require trust.

APPENDIX A

HUMAN SUBJECTS APPROVAL LETTER

/w EPDw UKLTY0

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673, FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 9/21/2011

To: Sarah Ainsworth [ainsworth@psy.fsu.edu]

Address: 4301

Dept.: PSYCHOLOGY DEPARTMENT

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research

Ego Depletion and Economic Decision-Making

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 8/8/2012, you are must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the

proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: []

HSC No. 2011.6325

APPENDIX B

SAMPLE INFORMED CONSENT

INFORMED CONSENT FORM

I freely and voluntarily and without element of force or coercion, consent to be a participant in the research project "Physiology and Decision-Making" This research is being conducted by Sarah Ainsworth, a graduate student at Florida State University. I understand the purpose of this research project is to examine physiology and the kind of decisions people make in regards to money. I understand that if I participate in the project, my brainwaves will be measured and I will play an economic decision-making game with another participant, will complete two pilot tasks consisting of three short-answer essays and word classifications, and will complete several short questionnaires about my personality.

I understand my participation is totally voluntary and I may stop participation at anytime. The total time commitment would be about 35 minutes for the entire project. I will be compensated by receiving one half (0.5) credit towards my General Psychology class. If I decide to stop participation, I will still be entitled to the one half (0.5) credit. All my answers to the questions will be kept confidential and identified by a participant code number. My name will not appear on any of the results. No individual responses will be reported. Only group findings will be reported. Consent forms will be stored in a location separate from the experimental materials and destroyed on or before July 1, 2022. All information will remain confidential to the fullest extent allowed by law. Data will be stored in a locked file in the Psychology Building.

I understand that I must be at least 18 years of age in order to participate. I understand there is a possibility of a minimal level of risk involved if I agree to participate in this study. The research assistant will be available to talk with me about any emotional discomfort I any experience while participating. I am also able to stop my participation at any time I wish.

I understand there are benefits for participating in this research project. Specifically, I could receive a cash payment at the end of the study depending on my decisions and the decisions of another participant during the economic decision-making task. I will also develop a better understanding of research methodology and will be providing researchers with valuable insights into human behavior.

I understand that this consent may be withdrawn at any time without prejudice, penalty or loss of benefits to which I am otherwise entitled, to include any cash that I might receive as part of the game. I have been given the right to ask and have answered any inquiry concerning the study. Questions, if any, have been answered to my satisfaction.

I understand that I may contact Sarah Ainsworth, [REDACTED] Florida State University, Department of Psychology, Psychology Bldg. Rm. [REDACTED] or Dr. Roy Baumeister [REDACTED] for answers to questions about this research or my rights. Group results will be sent to me upon my request. If I have questions about my rights as a subject/participant in this research, or if I feel I have been placed at risk, I can contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Office of the Vice President for Research, at (850) 644-8633.

I have read and understand this consent form in its entirety.

(Subject Signature)

(Today's Date)

FSU Human Subjects Committee Approved on 9/20/2011. Void after 8/8/2012. HSC# 2011.6325

APPENDIX C

FIGURES

Figure 1. Depleted participants offered less money than non-depleted participants in the investment game.

Figure 2. Depleted participants offered less money than non-depleted participants in the investment game, but only when they did not expect to meet the other person.

Figure 3. Depleted participants offered less money than non-depleted participants in the investment game, but only when they received feedback indicating they share a high degree of similarity with the other person.

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