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The Reciprocity of Prosocial Behavior and Positive Affect in Daily Life

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Abstract

Objective: To examine whether prosocial behaviors help sustain a positive mood, we tested the dynamic reciprocal associations between prosocial behavior and positive affect (PA) in daily life. A second aim was to examine whether the personality traits Neuroticism and Extraversion moderate these associations.

Method: The study included a community sample ($N = 553$). Participants completed an electronic diary assessing prosocial behavior and PA three times a day over 30 days. A subsample of 322 participants filled out the NEO Five-Factor Inventory to assess Neuroticism and Extraversion. Multilevel autoregressive models were performed to examine the within-person bidirectional associations between prosocial behavior and PA and possible moderation by Neuroticism and Extraversion.

Results: Within individuals, more PA was followed by more prosocial behavior at the next assessment, and more prosocial behavior was followed by more PA. The effect of prosocial behavior on PA was stronger for individuals high on Neuroticism. Extraversion did not moderate the associations under study.

Conclusions: The findings indicate that prosocial behavior and PA reinforce each other in daily life. Prosocial behavior seems most beneficial for individuals high on Neuroticism.

Keywords: Emotion regulation, social behavior, experience sampling, intensive longitudinal methods, time series

The social instincts lead an animal to take pleasure in the society of its fellows, to feel a certain amount of sympathy with them, and to perform various services for them.
(Darwin, 1871)

Prosocial behaviors are an intriguing category of cooperative acts in which we benefit others, often at a cost to ourselves, such as helping, sharing, donating, comforting, cooperating, and volunteering (Penner, Dovidio, Piliavin, & Schroeder, 2005; Trivers, 1971). Prosocial behaviors lie at the heart of what it means to be human; the Golden Rule to “treat others as you wish to be treated” is part of all major cultures and religions (Nowak, 2011). Prosocial behaviors are typical for mammals, who have brains designed to blur the line between the self and the other, leading to an emotional sensitivity that triggers seemingly altruistic impulses (Nummenmaa et al., 2012). Such helping

behaviors have long puzzled scientists, who asked themselves why and when who helps whom (Trivers, 1971).

There are many explanations for why we help others without expecting an immediate return. One theory is that prosocial behaviors are used instrumentally to sustain an already existing positive mood (Carlson, Charlin, & Miller, 1988; Isen & Simmonds, 1978). Numerous experimental studies (e.g., Isen, Clark, & Schwartz, 1976) and observational studies (e.g., George & Brief,

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1992) have shown that inducing a positive mood increases helping behavior, which is known as “the feel-good, do-good effect” (Rosenhan, Salovey, & Hargis, 1981). Conversely, doing good may also make one feel good, as some longitudinal studies observed that helping behaviors predict future positive feelings (Alden & Trew, 2013; Kahana, Bhatta, Lovegreen, Kahana, & Midlarsky, 2013).

Recent theories suggest that emotions may function as self-perpetuating systems that tend to trigger behaviors that help people maintain or prolong their current state (Garland et al., 2010; Kuppens, Allen, & Sheeber, 2010; Wichers, 2014). This resembles the mood-maintenance theory, which postulates that positive emotions elicit prosocial behavior and that prosocial behaviors subsequently maintain or restore original levels of positive emotions (a positive feedback loop; cf. Carlson et al., 1988; Isen & Simmonds, 1978). However, previous experimental and longitudinal two-wave studies were not designed to test this dynamic interplay taking place *within* individuals in daily life (Molenaar, 2004). Capturing the reciprocity between prosocial behaviors and positive mood states requires a time-series design and repeated assessments over time, such as diary or experience sampling methods.

The few available studies examining the relationship between specific types of prosocial behaviors and positive mood states using repeated assessments have yielded mixed results. Reports of people’s engagement in prosocial behaviors during a day were not associated with their perception of how good or bad that day was (Weinstein & Ryan, 2010), although this study did not directly assess positive mood states. Other studies with a time-series design have shown that helping one’s spouse (Poulin et al., 2010) or colleagues (Glomb, Bhave, Miner, & Wall, 2011) predicted within-person increases in positive affect (PA). The only study that directly tested a bidirectional association, in this case between workplace helping and momentary PA, observed this association only for individuals low in altruism (Conway, Rogelberg, & Pitts, 2009). Thus, no previous studies have yielded evidence of a bidirectional *within*-person association between prosocial behavior and positive affect in daily life in individuals from the general population, despite the fact that the existence of bidirectional effects is central to the mood-maintenance theory and theories suggesting that emotions may function as self-perpetuating systems.

Even if prosocial behaviors precede positive feelings and vice versa, individuals probably differ in the size of these effects. Previous studies showed that behavior that is congruent with one’s personality has stronger effects on one’s mood than behavior that is personality-incongruent (Côté & Moskowitz, 1998; Glomb et al., 2011). Extraversion is characterized by sociability and more frequent, intense, and persistent positive emotions (Verduyn & Brans, 2012). As previously suggested by Côté and Moskowitz (1998), this implies that extraverts may experience more positive emotions than introverts when they engage in prosocial behavior. Conversely, individuals high on Neuroticism have been characterized by more frequent and intense negative emotions (Miller, Vachon, & Lynam, 2009;

Verduyn & Brans, 2012), reduced levels of PA (Jacobs et al., 2011), and a more rapid decay of positive feelings (Hemenover, 2003). Thus, following the congruence principle, high Neuroticism should dampen the PA response to prosocial behavior. Nevertheless, other studies observed that individuals scoring high on Neuroticism have a more favorable course of depression after positive life events than individuals scoring low on Neuroticism (Oldehinkel, Ormel, & Neeleman, 2000; Spinhoven et al., 2011), which suggests that more neurotic individuals may benefit *more* from positive events, rather than less.

To find out whether prosocial behaviors and positive mood states reinforce each other in daily life, the current study examined bidirectional temporal associations between prosocial behaviors and PA using an intensive time-series design in which individuals from the general population assessed themselves three times a day for one month. Second, to investigate whether these dynamic associations are stronger or weaker when prosocial behavior and PA are more personality-congruent, we examined whether the temporal associations between prosocial behavior and PA are moderated by the personality traits Extraversion and Neuroticism.

METHOD

Participants

The sample was composed of 629 individuals from the general Dutch population who took part in the online “HowNutsAreTheDutch” diary study between May 22, 2014 (launching date of the diary study), and December 13, 2014 (end of the first-year wave of the website; see Van der Krieke et al., 2015, in press, for details). As there was no rule by which to stop data collection, the present study concerns a convenience sample. Before starting the study, all participants stated that they were at least 18 years of age, had a smartphone, were not engaged in shift work, did not anticipate a major disruption of daily routines within the study period, were aware that participation would be terminated if too many assessments were missed, and approved of having their anonymous data used for research purposes. The mean age of the participants was 41.0 years ($SD = 13.4$). Most participants were female (82%), in a romantic relationship (71%), and highly educated (high: 83%, middle: 13%, low: 4%). For more details on the participants and study procedure, we refer to Van der Krieke et al. (2015).

Procedure

Participants were recruited by means of a crowdsourcing procedure. Individuals from the general population of the Netherlands were informed about our research (on mental health as a dimensional and dynamic phenomenon) by means of radio and television broadcasts, podium discussions, and articles in newspapers and magazines. Individuals were invited to visit the website www.HoeGekIs.nl and to self-assess their mental health in a cross-sectional study, a longitudinal diary study, or both. In the

longitudinal diary study, participants monitored their feelings, behaviors, cognitions, and activities three times a day over 30 consecutive days (maximum 90 assessments) using an electronic diary. Links to the diary were sent by means of a text message at equidistant time points representing the morning, afternoon, and evening (e.g., 10:30 a.m., 4:30 p.m., and 10:30 p.m., respectively). The exact time points depended on participants' sleep-wake schedule but were always 6 hours apart.

Participants completed on average 45 of the diary assessments ($SD = 32$, range = 0–90). Thus, in total, 50% of the diary assessments were completed, resulting in 28,264 observations out of a possible total of 55,610 (629×90). Of the 629 participants, 553 participants completed at least two consecutive assessments and were included in the analyses (22,460 observations). Of these 553 participants, 322 participants (58%) also completed the questionnaire assessing Neuroticism and Extraversion.

Measures

Positive Affect. Momentary positive affect (PA) was measured with six items from the circumplex model of affect (Feldman Barrett & Russell, 1998). Participants rated the extent to which they felt relaxed, energetic, enthusiastic, content, calm, and cheerful on visual analogue scales (VAS) ranging from 0 (*not at all*) to 100 (*very much*). The composite PA score was calculated by taking the mean of the six mentioned items (range = 0–100). The internal consistency (computed by taking the deviations from the person mean of each item) of the PA scale was good ($\alpha = .86$). The within-person Cronbach's coefficient alpha of PA was also computed separately for individuals who completed at least 75% of the observations. The mean of these within-person Cronbach's coefficient alphas was .84, indicating that the within-person internal consistency of PA was generally good.

To examine whether there was sufficient variability in the diary data, we examined the mean squared successive difference (MSSD) in PA, which is a measure of temporal instability (Jahng, Wood, & Trull, 2008). A high MSSD represents high moment-to-moment variability and low temporal dependency in the time series. The average MSSD of the total PA score was 217.1, which means that the mean difference between two successive observations was 14.7.

Prosocial Behavior. Prosocial behavior during the previous 6-hour time interval was measured with the item "Since the last measurement I was able to make a difference to someone," rated on a VAS ranging from 0 (*not at all*) to 100 (*very much*). In a small validation pilot study of former participants and nonparticipants, we examined what people had in mind when they rated this item positively. Provided types of situations included emotional support (e.g., listening to emotional problems of a friend, sending a supporting text message), practical help (e.g., buying groceries for someone, helping with a work/school assignment),

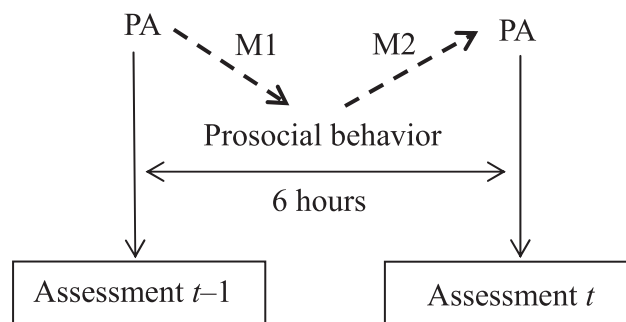


Figure 1 Timing of the assessments. PA = positive affect; M1 = Model 1; M2 = Model 2. The dashed arrows reflect the performed analyses. PA was assessed momentarily and prosocial behavior was assessed retrospectively, covering the previous 6 hours (from $t-1$ to t).

doing something of which you assume it makes the other feel better (e.g., making a compliment to a colleague, calling parents, bringing flowers), and financial help (e.g., giving money to a homeless person). As these examples all reflect cooperative acts that benefit others (i.e., prosocial behavior; cf. Penner et al., 2005), our validation study indicates that our single item was a valid measure of prosocial behavior. The MSSD of this item was 726.9, which means that the mean difference between two successive observations was 27.0. The correlation between the person mean of prosocial behavior during the first 45 assessments with the person and the person mean of prosocial behavior during the last 45 assessments of the measurement period was .84 for the whole sample and .90 in the sample of individuals who completed at least 75% of the observations, indicating good test-retest reliability. All diary items have previously been described (Van der Krieke et al., 2015, in press), and this article is the first to use these specific items for a study of dynamic associations.

Personality. The personality scores were assessed with the updated NEO Five-Factor Inventory (NEO-FFI-3), which has 60 items (De Fruyt & Hoekstra, 2014). The Neuroticism and Extraversion domains were each measured with 12 items scored on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The Cronbach's coefficient alpha was .90 for the Neuroticism items and .83 for the Extraversion items, indicating good internal consistency. This personality measure has previously been used to compare diary study adherers to non-adherers (Van der Krieke et al., in press).

Statistical Analyses

Autoregressive multilevel modeling was performed using STATA XT MIXED to examine the temporal within-person associations between momentary PA and prosocial behavior. In the first model, we tested whether lagged values of momentary PA ($t-1$) predicted prosocial behavior over the next interval of 6 hours (t), controlling for lagged values of prosocial behavior ($t-1$) to remove autocorrelation from the series. In other words,

we examined whether current levels of PA predicted prosocial behavior occurring, on average 3 hours later (see Figure 1). In the second model, we tested whether prosocial behavior over the previous interval of 6 hours (t) predicted current values of PA (t), while controlling for lagged values of PA ($t-1$). In this way, we also predict PA occurring on average 3 hours later than earlier prosocial behavior. We did not take lagged values of prosocial behavior during the previous 6-hour interval ($t-1$) to predict PA at the next point in time (t) because then we would predict PA on average 9 hours later (i.e., the behaviors took place on average 3 hours ago, and the next assessment of PA is 6 hours later). We considered this time period too long to detect the impact of small fluctuations in prosocial behavior on PA.

To examine within-person deviations from individuals' mean level, the time-varying variables of interest were person-mean centered (i.e., the mean level of each person was subtracted from his or her scores; Curran & Bauer, 2011). Besides the variables of interest, the models included a variable denoting time (1–90), two dummy variables for time of day (afternoon and evening; morning was the reference category), a dummy variable for the occurrence of positive events since the last measurement, and a dummy variable for the occurrence of negative events since the last measurement, to control for the effects of these possible confounders. A random intercept and a random slope for the time-varying predictor variables were included when they did not decrease model fit. Random slopes were included to take individual differences in within-person associations into account. Models with different covariance structures for the random slopes (i.e., independent, exchangeable, identical, unstructured) and residuals (i.e., independent, exchangeable, unstructured, AR1, MA1) were specified, and the model with the best fit according to the Akaike information criterion (AIC) was chosen as the final model. Models with an independent covariance structure for the random slopes and an AR1 residual covariance structure fit best according to the AIC. The size of the effects of the time-varying variables of interest were estimated by computing Cohen's r :

$$r = \beta \times SD(x)/SD(y),$$

where β is the unstandardized regression coefficient for the predictor variable of interest from the multilevel model, $SD(x)$ is the standard deviation of the predictor variable of interest (i.e., the within-person variation in x), and $SD(y)$ is the standard deviation of the dependent variable (i.e., the within-person variation in y).

To examine whether the results would be robust, sensitivity analyses were performed by examining the interaction between the number of completed assessments and the predictors of interest, and the analyses were repeated in the subsample of individuals who completed at least 75% of the assessments, henceforth denoted as "adherers" ($N = 238$).

In the 322 participants who completed the NEO-FFI-3, we tested whether the associations under study were moderated by Neuroticism and Extraversion. We added Neuroticism or

Extraversion (continuous variables) as well as the interaction between these personality traits and the variable of interest to the models.

RESULTS

Descriptives

The average person mean (i.e., the mean level of each person) of PA was 55.8 ($SD = 11.8$, range = 3.5–95.4), and the average person mean of prosocial behavior was 46.9 ($SD = 15.2$, range = 4.4–94.2). Participants who completed the NEO-FFI and those participants who did not differ on these average person means of PA ($t = 0.66, p = .51$) and prosocial behavior ($t = 0.92, p = .36$). The average within-person variation (i.e., the standard deviation of the within-person deviations from each person mean) in prosocial behavior was 20.1, and the average within-person variation in PA was 12.5. The average level of Neuroticism was 34.7 ($SD = 9.2$, range = 12–57), and the average level of Extraversion was 39.1 ($SD = 6.9$, range = 19–60). Higher levels of Neuroticism were associated with lower average levels of PA ($r = -0.58, p < .01$) and with lower average levels of prosocial behavior ($r = -0.19, p < .01$). Higher levels of Extraversion were associated with higher average levels of PA ($r = 0.44, p < .01$) and with higher average levels of prosocial behavior ($r = 0.28, p < .01$).

Temporal Associations Between PA and Prosocial Behavior

Within participants, higher levels of PA were followed by higher levels of prosocial behavior during the next 6-hour interval, while controlling for prosocial behavior during the previous 6-hour interval (see Model 1 in Table 1). The reverse association was also significant; higher levels of prosocial behavior during the previous 6 hours were associated with higher current values of PA, while controlling for values of PA at the previous assessment (see Model 2 in Table 1). The sizes of the average effects of PA on prosocial behavior (Cohen's $r = .05$) and of prosocial behavior on PA (Cohen's $r = .17$) were small. The random effects indicated considerable variability between individuals in the strength of the effect of PA on prosocial behavior and in the strength of the effect of prosocial behavior on PA.

Repeating the analyses in the adherers yielded similar results; higher PA predicted prosocial behavior during the next 6-hour time interval ($B = 0.06, SE = 0.01, Z = 4.30, p < .01$), and previous prosocial behavior also predicted current levels of PA ($B = 0.11, SE = 0.01, Z = 14.00, p < .01$). Also, there was no significant interaction between the number of assessments and PA in the prediction of prosocial behavior during the next 6-hour time interval ($B < -0.01, SE < 0.01, Z = 0.52, p = .61$). Similarly, the interaction between the number of assessments and prosocial behavior in the prediction of PA was not significant ($B < -0.01, SE < 0.01, Z = -0.23, p = .62$).

Table 1 Associations Between Prosocial Behavior and Positive Affect

	Prosocial Behavior (Model 1)			Positive Affect (Model 2)		
	B (SE)	Z	p	B (SE)	Z	p
Fixed effects						
Prosocial behavior $t-1$	0.04 (.01)	4.91	<.01			
Prosocial behavior t				0.10 (<.01)	17.14	<.01
PA $t-1$	0.07 (.01)	5.80	<.01	0.30 (.01)	32.86	<.01
Time	<0.01 (.01)	0.29	.77	0.01 (<.01)	2.68	.01
Afternoon	9.90 (.38)	26.21	<.01	-0.95 (.20)	-4.83	<.01
Evening	8.54 (.38)	22.25	<.01	-2.00 (.21)	-9.34	<.01
Positive event	9.32 (0.48)	19.47	<.01	4.55 (0.27)	17.03	<.01
Negative event	-2.51 (0.58)	-4.31	<.01	-11.74 (0.43)	-27.41	<.01
Random effects (in SD)						
	B (SE)	95% CI		B (SE)	95% CI	
Prosocial behavior $t-1$	0.11 (.01)	[0.09, 0.13]		0.09 (.01)	[0.08, 0.10]	
PA $t-1$	0.12 (.02)	[0.09, 0.16]		0.14 (.01)	[0.12, 0.16]	
Time	0.03 (.01)	[0.02, 0.04]		Omitted	Omitted	
Afternoon	4.54 (.35)	[3.90, 5.28]		1.05 (.26)	[0.65, 1.71]	
Evening	5.11 (.33)	[4.50, 5.80]		2.16 (0.18)	[1.83, 2.55]	
Positive event	3.89 (.65)	[2.80, 5.41]		1.99 (.37)	[1.38, 2.87]	
Negative event	3.82 (.99)	[2.30, 6.33]		5.04 (.48)	[4.18, 6.06]	
N/observations		553/22,460			553/22,460	

Note. Prosocial behavior = deviation from the person mean of prosocial behavior; PA = deviation from the person mean of positive affect; $t-1$ = previous assessment; time = time in days; Afternoon and evening represent dummy variables in which 0 = morning and 1 = afternoon or evening. The random effect of time was omitted because it decreased model fit.

Interaction With Extraversion and Neuroticism

The effect of previous prosocial behavior on current levels of PA was moderated by Neuroticism ($B = 0.004$, $SE = 0.001$, $Z = 4.67$, $p < .01$), whereas the effect was not significantly moderated by Extraversion ($B = -0.001$, $SE = 0.001$, $Z = -0.81$, $p = .42$). The effect of current levels of PA on prosocial behavior during the next 6 hours was not significantly moderated by Neuroticism ($B = -0.01$, $SE = 0.002$, $Z = -0.66$, $p = .51$) or Extraversion ($B = -0.001$, $SE = 0.002$, $Z = -0.51$, $p = .61$).

DISCUSSION

This study yielded two key observations that merit discussion. First, we found evidence for bidirectional dynamic within-person associations between prosocial behaviors and positive affect (PA) in daily life. Second, individuals who scored higher on Neuroticism reported more PA after prosocial behaviors than individuals scoring lower on Neuroticism, whereas Extraversion did not moderate the dynamic associations. Below, these results are interpreted in light of the existing literature.

The present study indicates that positive mood states and prosocial behaviors tend to reinforce one another *within* individuals in daily life. This observation corresponds with the theory that people engage in prosocial behavior to maintain a positive mood (Carlson et al., 1988) and the scenario that emotions function as self-perpetuating systems, since reciprocal links between affective states and behaviors can serve to restore or prolong

positive emotions (Garland et al., 2010; Kuppens et al., 2010; Wichers, 2014). To the best of our knowledge, given its design, the present study yields the strongest available evidence for the mood-maintenance hypothesis concerning prosocial behavior (Carlson et al., 1988) to date.

The findings contribute to the existing literature on prosocial behavior and positive mood states in several ways. Previous studies have suggested that prosocial behaviors can boost general levels of PA, as deliberately engaging in three prosocial acts a day has been shown to increase PA in socially anxious individuals (Alden & Trew, 2013). Studies using time-series designs have shown that helping colleagues (Glomb et al., 2011) or one's spouse (Poulin et al., 2010) in daily life is associated with within-person increases in PA. However, the only study that focused on the bidirectional association between helping behaviors (at work) and PA showed that this association was only present in people low on altruism (Conway et al., 2009). Our results extend these findings by showing a dynamic reciprocal association between PA and prosocial behavior in daily life in individuals sampled from the general population. This suggests that emotional well-being may not only be sustained by engaging in more cooperative acts, but that generated PA may also trigger more prosocial behaviors.

The second key finding of our study is that the effect of prosocial behavior on PA was stronger in people scoring higher on Neuroticism, for whom such a boost may be most welcome (Jeronimus, Ormel, Aleman, Penninx, & Riese, 2013). This result aligns with previous studies in which individuals high on

Neuroticism were more responsive to positive life events (Jeronimus et al., 2013) and benefited more from positive experiences during a depression event (Oldehinkel et al., 2000). The stronger increase in PA after prosocial behaviors in people high on Neuroticism may reflect the notion that emotional instability forms the core of Neuroticism (Garcia & Erlandsson, 2011; Schimmack, 2003). However, high Neuroticism has also been associated with a more rapid decay of positive mood states (Hemenover, 2003). This latter effect suggests a smaller time window for the feedback loop between prosocial behaviors and PA in people high on Neuroticism. Future studies might explore this possibility.

As the effect of prosocial behavior on PA increased in individuals scoring higher rather than lower on Neuroticism, and as the associations under study were not moderated by Extraversion, our results do not support the hypothesis that trait-congruent behaviors are more rewarding (Côté & Moskowitz, 1998). Yet, the fact that Extraversion did not moderate the associations between prosocial behavior and PA may also reflect a ceiling effect in the extent to which there was room for PA improvement. Thus, to show the robustness of our results, replication of the findings is warranted.

The effect sizes shown in the current study are similar to those found in previous studies on momentary daily life experiences showing, for example, small increases in negative affect in response to minor daily unpleasant events (Wichers et al., 2010). Such effects, while small, have been shown to be clinically relevant, as they predicted current and future symptoms of psychopathology (Kramer et al., 2014; Wichers et al., 2010). Similarly, the small bidirectional effects between PA and prosocial behavior may become very relevant to one's mental well-being because they occur repeatedly over time. Previous work has suggested that affective reactions can spill over into personality changes that persist for years (Jeronimus, Riese, Sanderman, & Ormel, 2014). An important avenue for future research may therefore be to examine whether people with higher reciprocity between prosocial behavior and PA increase in well-being over longer time periods.

The present study has notable strengths, such as the inclusion of a large community sample, an ecologically valid design, intensive longitudinal assessments over 30 days, and an investigation of within-person associations while controlling for plausible confounders (i.e., time in days, time of the day, positive events, and negative events). A limitation of the study is that prosocial behavior was assessed with one item. Preferably, constructs are rated with more items, but short diary questionnaires are recommended to increase completion rates and to ensure reliability of the responses (Thiele, Laireiter, & Baumann, 2002). Also, the test-retest reliability of the item measuring prosocial behavior was adequate, and our pilot validation study indicated that the item was a valid measure of prosocial behavior. Another limitation is that the results of the study may not be directly generalizable to the Dutch population as a whole, since the sample included predominantly highly educated women in a romantic relationship. Furthermore, we used concurrent

assessments to examine the effect of prosocial behavior in the previous 6 hours on current levels of PA. As prosocial behavior and PA were assessed at the same moment in time, we cannot rule out that part of their association is due to shared method variance. Finally, although the person-mean centering eliminated confounding by between-subjects differences, confounding by within-subject time-varying factors cannot be ruled out.

The findings of our study suggest that prosocial behavior and PA may enhance one another in daily life, and may thereby help maintain positive mental states. Moreover, individuals higher on Neuroticism may benefit most from performing more prosocial acts. The reciprocal association between prosocial behavior and PA indicates that helping others makes people happy and that these positive feelings, in turn, appear to amplify willingness to help others.

Declaration of Conflicting Interests

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