Familiarity Promotes People's Cooperation with Volunteers in Waste Sorting and Its Underlying Mechanism: Postprint

Authors: Zhang Xuan, Liu Pingping

Date: 2023-10-09T00:00:00+00:00

Abstract

The rapid growth of waste severely pollutes the environment, urgently necessitating waste classification and reduction. Without volunteer supervision at waste bins, the contamination rate from mixed waste disposal remains persistently high. However, instances of residents' non-cooperation with volunteers occur frequently. How can we promote cooperation between residents and volunteers? Based on reputation concern and social distance theories, this study conducted three scenario experiments and one qualitative interview investigation to address the waste classification dilemma, examining how familiarity with volunteers (high/low/stranger) and volunteer age (elementary school students/young adults/older adults) influence the cooperativeness of residents of different ages (young/middle-aged and older adults), as well as the underlying mechanisms. Results revealed that higher familiarity with volunteers leads to greater cooperativeness; under low-familiarity conditions, cooperativeness is higher toward older adult volunteers (Experiments 1 and 2). Compared with young/middle-aged participants, older adult participants exhibited higher cooperativeness toward older adult volunteers, but lower cooperativeness toward stranger volunteers than young/middle-aged participants (Experiment 2). Social distance and reputation concern can serve as psychological mechanisms through which familiarity promotes cooperation, playing a chain mediating role (Experiment 3). Multiple regression analysis and qualitative research results indicate that supervision and guidance by volunteers familiar to residents in communities, along with residents' own prosociality, play a key role in promoting waste classification. These important findings provide reference value and scientific support for the implementation of waste classification and cost reduction.

Full Text

Preamble

Acta Psychologica Sinica 2023, Vol. 55, No. 8, 1358–1371

https://doi.org/10.3724/SP.J.1041.2023.01358
ChinaXiv Cooperative Journal

Familiarity Promotes Cooperation with Volunteers in Waste Sorting and Its Underlying Mechanisms

ZHANG Xuan, LIU Ping-Ping
(CAS Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, Beijing 100101, China)
(Department of Psychology, University of Chinese Academy of Sciences, Beijing 100049, China)

Abstract

The rapid growth of waste poses severe environmental challenges, making waste sorting and reduction an urgent priority. Without on-site volunteer supervision at waste collection points, contamination rates from mixed waste remain persistently high. However, residents sometimes fail to cooperate with volunteers. Drawing on theories of reputational concern and social distance, this study addresses the waste sorting dilemma through three scenario-based experiments and one qualitative interview investigation. We examined how familiarity (high/low/unfamiliar) and volunteer age (primary school children/young adults/older adults) influence cooperation among residents of different ages (younger and older adults), as well as the underlying psychological mechanisms. Results showed that higher familiarity with volunteers led to greater cooperation. Under low-familiarity conditions, cooperation was higher with older volunteers (Experiments 1 and 2). Compared with younger participants, older participants exhibited higher cooperation with older volunteers but lower cooperation with unfamiliar volunteers (Experiment 2). Social distance and reputational concern served as psychological mechanisms mediating the effect of familiarity on cooperation, forming a serial mediation pathway (Experiment 3). Multiple regression analysis and qualitative findings indicated that familiar volunteer supervision and residents' own prosociality play crucial roles in promoting waste sorting. These important findings provide valuable reference and scientific support for implementing waste sorting programs and reducing management costs.

Keywords: familiarity, age differences, reputational concern, social distance, cooperation
Classification Code: B849: C91

1 Introduction: Research Significance

Global waste generation has created serious environmental problems, making waste sorting and reduction a critical challenge. Social influence—how people are affected by others or groups (Abrahamse & Steg, 2013)—is a key factor in waste sorting interventions (Ling et al., 2021). Social influence promotes waste sorting behavior through mechanisms such as reputational concern, social distance, social norms, and volunteer supervision (Hottle et al., 2015; Leeabai et al., 2019; Lin et al., 2016; Woodard et al., 2000). Among these, volunteer-resident interaction is crucial for enhancing social influence and promoting sorting behavior (Grönlund & Falk, 2019; Xu et al., 2016; Zelenika et al., 2018). Without on-site volunteer supervision, residents' participation rates remain low and contamination rates stay high. Volunteer contributions often exceed actual financial expenditures, generating substantial social benefits (Pillemer et al., 2017). However, some waste sorting practices fail because they cannot sustain residents' long-term behavior. For instance, residents may sort only when required but reduce or stop later. Habit formation takes time; Xu et al. (2016) proposed that three months of volunteer supervision can help establish waste sorting habits. Yet under imperfect legal frameworks, residents sometimes refuse to cooperate with volunteers.

To persuade residents, some communities recruit acquaintances as volunteers (Li, 2020; Wang, 2019) or use older adults for persuasion and supervision (Xu et al., 2016), while others employ primary school children to influence family members (Deng et al., 2022; Maddox et al., 2011). When people learn that familiar individuals engage in environmental behaviors, their own willingness to cooperate strengthens (Xu et al., 2021). Thus, recruiting community members as leaders or role models—particularly influential groups such as older adults or student representatives—to demonstrate and persuade non-compliant neighbors proves more effective than simply providing information (Knickmeyer, 2020). However, which volunteer types best promote resident cooperation remains undetermined, as does the underlying mechanism. This study therefore examines how volunteer familiarity and age affect cooperation in waste sorting and the mediating processes involved.

1.1 The Effect of Familiarity on Cooperation

Familiarity reflects the degree of mutual understanding between people (Goodman & Leyden, 1991) or the frequency of interpersonal interaction (Freeberg, 2020; Gächter & Fehr, 1999). Familiarity can be enhanced through communication and contact (Moore & Geuss, 2020), ranging from high to low: family, close friends, classmates, colleagues, neighbors, etc. (Freeberg, 2020; Gächter & Fehr, 1999). Simple familiarity, achieved through repeated social processes, substantially facilitates interpersonal interaction and behavior (Freeberg, 2020). Previous research demonstrates a significant correlation between familiarity and cooperation. Quervel-Chaumette et al. (2015) found that higher familiarity strengthens altruistic preferences, which form the basis of human cooperation.

Generally, people invest less when encountering new partners, but cooperation increases with familiarity (Keller & Reeve, 1998). The classic mere exposure effect shows that simply repeating a stimulus to increase familiarity reduces uncertainty and promotes positive preferences (Lunn et al., 2020; Zajonc, 1968). Other studies reveal that even minimal familiarity—such as knowing someone's identity—boosts cooperation (Gächter & Fehr, 1999). However, the causal relationship between familiarity and cooperation requires verification.

Cooperation involves group members working together toward common goals. In social dilemmas, cooperation means individuals willing to incur costs to benefit the group (Rand, 2016; Sun et al., 2022). Most cooperation research uses costly investment tasks, whereas everyday cooperation requires minimal effort—simply considering others' needs when making decisions (van Doesum et al., 2021). Waste sorting requires universal participation and essentially represents daily cooperative behavior. However, in practice, despite on-site volunteers, cooperation remains suboptimal, with some residents refusing to sort (Wang, 2019). Qualitative studies show that close relationships with neighbors or family increase cooperative participation (Li et al., 2017), yet few quantitative studies have examined whether and how familiarity with volunteers affects cooperation. Therefore, based on quantitative methods, we propose Hypothesis 1: High-familiarity volunteers promote greater cooperative intention and waste sorting behavior than low-familiarity volunteers.

1.2 Age Differences in Cooperation

Beyond familiarity, age may be an important factor influencing waste sorting cooperation. Cooperation levels shift with age. Children lack stable self-identity, values, and mature cooperative strategies, making them more susceptible to influence than adults. Adults develop stable identities and values, leading to more persistent cooperative decisions (Foulkes et al., 2018; Gutiérrez-Roig et al., 2014). In older adulthood, cooperation increases further (Gutiérrez-Roig et al., 2014). Thus, cooperative behavior exhibits age differences.

The age of interaction partners also influences cooperation. Younger people show stronger willingness to cooperate with older than with same-age peers (Romano, Bortolotti et al., 2021). Both younger and older adults reject unfair offers from younger partners more strongly (Bailey et al., 2013). People perceive older adults as more trustworthy and expect greater generosity and cooperation, showing higher willingness to cooperate with them (Romano, Bortolotti et al., 2021).

Additionally, due to family hierarchy and filial piety norms, older adults receive greater respect in intergenerational relationships and even hold power beyond younger people. According to politeness theory, people employ more polite communication strategies to avoid threatening older adults' face (Zhang et al., 2005). We therefore propose Hypothesis 2: In waste sorting practice, regardless of familiarity, people exhibit higher cooperation with older volunteers.

The effect of familiarity on cooperation may also vary by participant age. For instance, Zhang et al. (2017) found that familiarity increased cooperation among university students but not significantly among middle school students. Molina et al. (2019) studied three generations and found that grandchildren and parents showed higher cooperation with relatives than non-relatives, but this difference was absent in older adults. Whether volunteer type effects on cooperation vary by participant age in non-kin, broader interpersonal contexts remains unverified. We therefore propose Hypothesis 3: Familiarity significantly affects younger adults' cooperation but not older adults'.

1.3 Potential Mechanisms of Familiarity's Effect on Cooperation

Why does familiarity affect cooperation? Two social influence mechanisms have been identified: reputational concern and social distance.

1.3.1 Reputational Concern In acquaintance societies, reputation plays a vital role in individual behavior and represents a key factor in human cooperation (Giardini et al., 2021; Wang, 2021). Reputational concern—the degree to which people care about being evaluated by others (Romano, Saral et al., 2021)—influences prosocial behavior and sometimes mediates it (Wu et al., 2016). Indirect reciprocity reflects reputation's importance for cooperation (Wang, 2021), whereby people measure others' altruism through reputation and prefer cooperating with altruistic individuals (Xie et al., 2017). For example, people may contribute to public goods like waste sorting in front of acquaintances to enhance their reputation, potentially receiving future returns through indirect reciprocity (Sylwester & Roberts, 2013).

Reputation also facilitates partner selection. Individuals gain good reputations by helping others, which guides others' partner selection decisions—a pattern known as competitive altruism (Számadó et al., 2021). This explains why people show more prosocial behavior when acquaintances are present. By cultivating a reliable, altruistic image and spreading reputation, individuals attract more cooperation opportunities and receive greater help (Tan et al., 2017). Competitive altruism thus demonstrates reputation's importance for cooperation (Farmer & Farrelly, 2021).

Gossip—evaluative informal communication about past experiences and observations—plays a key role in maintaining reputation systems (Számadó et al., 2021; Yao et al., 2014). Gossip content about others' cooperativeness influences personal reputation and future cooperation intentions. Gossip threats promote cooperation (Romano, Saral et al., 2021; Wu et al., 2016) because when people know they are observed and that this information can be shared, they cooperate more (Számadó et al., 2021). Familiarity increases gossip likelihood; people are more likely to discuss familiar than unfamiliar individuals (Yao et al., 2014), such as familiar people's waste sorting behavior. When familiar people are present, residents are more likely to engage in cooperative behaviors like donations (Tan et al., 2017). Knowing that acquaintances might

see their waste sorting behavior increases reputation transmission likelihood, making people more cooperative.

1.3.2 Social Distance According to social impact theory, social influence is proportional to the strength, immediacy, and number of influence sources (Latané, 1996). Intimacy increases social influence salience; for example, people are more influenced by neighbors than strangers. Social distance represents the abstract degree of emotional or relational closeness between people—a form of psychological distance that measures subjective psychological proximity to others (Lu et al., 2016; Trope et al., 2007; Zhang et al., 2021). Simmel (1955) categorized interpersonal distances as close, medium, and far, which this study maps onto high-familiarity, low-familiarity, and unfamiliar individuals.

Social distance indicates the likelihood that others will provide benefits or that people subjectively infer others' willingness to help. Cooperation intentions differ across social distances. People hold the notion that "the greater the social distance, the less help provided" because distant relationships make long-term interaction harder to maintain and reduce potential long-term benefits (Tan et al., 2017). If people anticipate future encounters, they are less likely to deceive, as deception would be discovered (Bradner & Mark, 2002). Therefore, cooperation intentions—such as complying with waste sorting—may be influenced by social distance: greater familiarity reduces social distance and facilitates cooperation.

Although both reputational concern and social distance may explain the familiarity-cooperation relationship, most previous studies examined them separately. Some found that social distance and reputational concern jointly regulate altruistic motivation (Zhan et al., 2022), while others suggested people use social distance to judge whether reputational investment is worthwhile (Tan et al., 2017). However, whether these variables operate as parallel mediators or in sequence remains unclear and requires verification. We therefore propose Hypothesis 4: In prosocial behaviors like waste sorting, reputational concern and social distance serially mediate the effect of familiarity on cooperation.

1.4 Overall Research Framework

In summary, this study employs three experiments and one field qualitative investigation to examine whether and how volunteer familiarity and age affect residents' cooperative intentions. Experiment 1 investigates the effects of familiarity and volunteer age on cooperation. Experiment 2 validates Experiment 1's findings and tests age-related differences. To examine ecological validity and practical experience, we conducted qualitative interviews with experienced waste sorting practitioners. Experiments 1 and 2 both verified familiarity's effect on cooperation. Experiment 3 introduces reputational concern and social distance to explore the underlying mechanism.

2 Experiment 1: Effects of Volunteer Familiarity and Age on Cooperation

2.1 Participants and Design

Using G*Power 3.1 (Faul et al., 2007) for repeated-measures ANOVA with $\alpha = 0.05$ and medium effect size (f = 0.25), the required sample size for 95% statistical power was at least 22. We recruited 154 university students who voluntarily participated. The questionnaire was distributed online randomly. Seventy-five participants were excluded for providing uniform responses or failing attention checks, leaving 79 valid participants (mean age = 20.16 years, SD = 2.20). The study used a 3 (volunteer familiarity: high/low/unfamiliar) × 3 (volunteer age group: primary children/young adults/older adults) within-subjects design, with the dependent variable being participants' willingness to cooperate with volunteers (i.e., choosing to sort waste).

2.2 Materials

Familiarity Manipulation and Validation. To differentiate familiarity levels with on-site volunteers, high familiarity was defined as a neighbor volunteer known for five years, low familiarity as a volunteer seen and remembered in the community, and unfamiliar as an unknown volunteer (familiarity = 0, requiring no manipulation). To validate the manipulation, 21 participants (who did not participate in the main experiment) rated the familiarity of "a neighbor known for five years" and "someone seen and remembered in the community" on a 7-point scale (1 = completely unfamiliar, 7 = completely familiar). High-familiarity materials (M = 5.76, SD = 1.04) were rated significantly higher than low-familiarity materials (M = 4.43, SD = 1.33), $t(20) = 7.14$, $p < 0.001$, Cohen's d = 1.14, confirming effective manipulation.

Experimental Materials. Mental imagery can evoke emotional and motivational responses similar to actual experiences, producing equivalent effects to real situations (Yu et al., 2013). We adapted previous research paradigms (Fields et al., 2021; Hsee & Weber, 1997) and real-world waste sorting scenarios (Zhao et al., 2021). Materials consisted of 18 three-sentence scenario vignettes. As shown in Table 1 , each vignette included the 3 × 3 conditions (volunteer familiarity × volunteer age), forming nine versions with 162 total items. Each participant responded to 18 items (two per condition). Each vignette presented: (1) a waste sorting scenario using gender-neutral third-person pronouns (e.g., "Xiao Huang"); (2) the independent variable conditions; and (3) a question asking participants to predict whether the protagonist would immediately sort waste, with three response options (yes/no/uncertain) measuring cooperation intention.

A Latin square design balanced presentation order. The questionnaire was distributed online. Participants first read instructions, provided informed consent, answered questions, and finally reported demographic control variables: age, gender, education, whether they had children, volunteer willingness (7-point

scale), whether they had encountered on-site volunteers (yes/no), waste sorting attitudes (7-point scale), and whether their locality had enacted waste sorting regulations (yes/no/unclear). To ensure authenticity and avoid order effects and comprehension bias, we: (1) used Latin square design; (2) randomized item order; (3) emphasized anonymity and absence of correct answers; and (4) requested honest responses. Completion took approximately five minutes, after which participants were thanked.

2.3 Results and Discussion

Chi-square tests examined differences in waste sorting cooperation across volunteer types. Results showed significant differences in cooperation rates, $^{2}(16, N = 1422) = 285.64$, $p < 0.001$. As shown in Figure 1 [Figure 1: see original paper], participants cooperated with high-familiarity volunteers (79.11%) significantly more than low-familiarity volunteers (61.60%), and low-familiarity more than unfamiliar volunteers (27.64%). This indicates that higher volunteer familiarity promotes greater cooperation, supporting Hypothesis 1.

Further odds ratio analyses revealed that under high familiarity, cooperation rates did not differ significantly across volunteer age groups (ps > 0.1), suggesting familiarity outweighs age in promoting cooperation. However, under low familiarity, cooperation with older volunteers (88.98%) was significantly higher than with primary child volunteers (77.12%), $^{2}(1, N = 236) = 5.90$, $p = 0.015$, odds ratio = 2.40, 95% CI [1.17, 4.92]. Under unfamiliar conditions, cooperation with older volunteers (59.09%) was also significantly higher than with young volunteers (40.00%), $^{2}(1, N = 168) = 6.11$, $p = 0.013$, odds ratio = 0.46, 95% CI [0.25, 0.86]. These results preliminarily indicate that high familiarity significantly promotes waste sorting cooperation intention, and under low-familiarity or unfamiliar conditions, people cooperate more with older volunteers.

To examine whether control variables affected cooperation, we conducted hierarchical regression analysis. The first block entered demographics (age, gender, education, having children); the second block entered waste sorting attitudes (Cronbach's $\alpha = 0.836$); the third block entered whether participants had encountered on-site volunteers; the fourth block entered volunteer willingness; and the fifth block entered whether regulations had been enacted. Results showed no significant effects of these variables on cooperation (ps > 0.1), possibly due to the discrete nature of the dependent variable. Experiment 2 will further explore control variables.

Experiment 1 demonstrated that high-familiarity volunteers promote greater cooperation than low-familiarity or unfamiliar volunteers, providing initial support for Hypothesis 1. Using university students, Experiment 1 established baseline effects. To enhance ecological validity, Experiment 2 recruited younger (23–59 years) and older adults (60+ years) to replicate findings and test age-related differences. Since children lack stable values and cooperative strategies (Foulkes et al., 2018; Gutiérrez-Roig et al., 2014) and to ensure comprehension,

Experiments 2 and 3 excluded child participants. Additionally, because waste sorting requires habit formation and long-term mechanisms, Experiments 2 and 3 added both immediate and future sorting scenarios, using 7-point scales to measure habit formation.

3 Experiment 2: Effects of Volunteer Familiarity and Age on Cooperation Across Age Groups

3.1 Participants and Design

Using G*Power 3.1 (Faul et al., 2007) for mixed ANOVA with $\alpha = 0.05$ and medium effect size (f = 0.25), the required sample size for 95% power was at least 22. We recruited 100 younger adults (23–59 years) and 100 older adults (60+ years). Twenty-six participants were excluded for repetitive responses (>90% identical), leaving 174 valid participants: 87 younger adults (M = 40.63 ± 7.60 years, 42.53% male) and 87 older adults (M = 68.90 ± 4.97 years, 47.13% male). As shown in Figure 2 [Figure 2: see original paper], we used a 2 (participant age group: younger/older; between-subjects) × 3 (volunteer familiarity: high/low/unfamiliar; within-subjects) × 3 (volunteer age group: primary children/young adults/older adults; within-subjects) mixed design, with cooperation intention as the dependent variable. All participants completed the nine within-subjects conditions.

3.2 Materials

Materials were similar to Experiment 1 (see Table 1), with two adjustments. First, based on intertemporal choice paradigms (Chen & He, 2014; Zhang et al., 2021), participants predicted protagonists' likelihood of sorting "immediately" and "next time." This adjustment addressed feedback from Experiment 1 and pilot studies: immediate sorting scenarios might involve interference from lack of experience. After prior volunteer reminders, "next time" scenarios better reflect habit formation and volunteer influence. Second, to measure cooperation more precisely, we expanded responses to 7-point likelihood scales (1 = not at all likely, 7 = extremely likely).

3.3 Pilot Study and Procedure

Experiment 2 included a pilot study with 38 participants (20–69 years) confirming that "immediate" and "next time" scenarios produced expected differences, validating the imagery manipulation. The main procedure followed Experiment 1 using Latin square design, but included both younger and older adult participants.

3.4 Results and Discussion

3.4.1 Age and Familiarity Effects To examine age-related differences in cooperation with different volunteers, we conducted a 2 (participant age group)

× 3 (volunteer familiarity) × 3 (volunteer age group) mixed ANOVA on cooperation intention.

Results (see Figure 3 [Figure 3: see original paper]) showed significant main effects of volunteer familiarity for both immediate sorting, $F(2, 344) = 128.04$, $p < 0.001$, $^2 = 0.43$, and future sorting, $F(2, 344) = 99.05$, $p < 0.001$, $^2 = 0.37$. Cooperation with high-familiarity volunteers (immediate: $M = 5.47$, $SD = 0.04$; future: $M = 5.72$, $SD = 0.07$) was significantly higher than with low-familiarity volunteers (immediate: $M = 4.86$, $SD = 0.09$; future: $M = 5.24$, $SD = 0.09$), which in turn exceeded cooperation with unfamiliar volunteers (immediate: $M = 4.53$, $SD = 0.02$; future: $M = 4.85$, $SD = 0.11$). This replicates Experiment 1, confirming that higher familiarity promotes cooperation.

For immediate sorting, the participant age group × volunteer familiarity interaction was significant, $F(2, 344) = 14.39$, $p < 0.001$, $^2 = 0.08$. Younger participants cooperated more with unfamiliar volunteers ($M = 4.77$, $SD = 0.13$) than older participants ($M = 4.28$, $SD = 0.13$), $p = 0.008$. No other significant effects emerged.

For future sorting, the three-way interaction was marginally significant, $F(4, 688) = 2.03$, $p = 0.088$, $^2 = 0.01$. The participant age group × volunteer familiarity interaction was marginally significant, $F(2, 344) = 2.61$, $p = 0.075$, $^2 = 0.02$. The volunteer age group main effect was significant, $F(2, 344) = 5.53$, $p = 0.004$, $^2 = 0.03$. The volunteer age group × volunteer familiarity interaction was significant, $F(4, 688) = 3.12$, $p = 0.015$, $^2 = 0.02$. Simple effects analysis showed that under high ($p = 0.001$) and low ($p = 0.021$) familiarity, cooperation with older volunteers was significantly higher than with primary child volunteers, replicating Experiment 1's finding of higher cooperation with older volunteers under low familiarity. The participant age group × volunteer age group interaction was significant, $F(2, 344) = 3.34$, $p = 0.037$, $^2 = 0.02$: older participants cooperated more with older volunteers ($M = 5.54$, $SD = 0.11$) than younger participants ($M = 5.20$, $SD = 0.11$), $p = 0.025$.

In summary, for both immediate and future sorting, high-familiarity volunteers promoted greater cooperation than low-familiarity or unfamiliar volunteers, replicating Experiment 1 and supporting Hypothesis 1. Age interacted with familiarity: older participants showed higher cooperation with older volunteers but lower cooperation with unfamiliar volunteers than younger participants, indicating familiarity has stronger effects on older adults. This supports socioemotional selectivity theory, which posits that older adults prefer familiar, emotionally meaningful social interactions (Carstensen et al., 2003).

T-tests revealed differences between sorting scenarios and prosociality. Future sorting likelihood ($M = 5.27$, $SD = 1.06$) was significantly higher than immediate sorting ($M = 4.95$, $SD = 1.10$), $t(173) = -3.17$, $p = 0.002$, Cohen's $d = 0.30$. Older participants reported higher volunteer willingness ($M = 6.21$, $SD = 1.44$) than younger participants ($M = 4.94$, $SD = 1.84$), $t(172) = -5.05$, $p = 0.002$, Cohen's $d = 0.77$. Women ($M = 5.42$, $SD = 1.01$) showed higher cooperation

than men (M = 5.09, SD = 1.10), t(172) = 2.03, p = 0.044, Cohen's d = 0.32. These results suggest that habit formation is gradual and familiar volunteer supervision plays a key role.

3.4.2 Control Variables and Regression Analysis Hierarchical regression analyses (see Online Supplementary Tables 1 and 2) examined control variables. After controlling for demographics, significant positive predictors of cooperation included: having encountered on-site volunteers (immediate: $\beta = 0.22$, t = 2.66, p = 0.009), waste sorting attitudes (future: $\beta = 0.47$, t = 6.99, p < 0.001; Cronbach's $\alpha = 0.796$), and volunteer willingness (immediate: $\beta = 0.26$, t = 3.05, p = 0.003; future: $\beta = 0.43$, t = 5.98, p < 0.001). Thus, volunteer supervision and residents' prosociality are key to promoting waste sorting.

While Experiments 1 and 2 showed consistent results, they measured behavioral intentions rather than actual behavior, potentially introducing bias. To validate ecological validity, we conducted qualitative interviews.

4 Experiment 3: The Mediating Roles of Social Distance and Reputational Concern

4.1 Participants and Design

Using G*Power 3.1 (Faul et al., 2007) for repeated-measures ANOVA with $\alpha = 0.05$ and medium effect size (f = 0.25), the required sample size for 95% power was at least 36. We recruited 85 participants. Data were collected via online (n = 41) and paper (n = 44) questionnaires. One online participant withdrew, leaving 84 valid participants (mean age = 26.05 years, SD = 11.01; 50% female). Online and offline data showed similar patterns and effect sizes (Paolacci et al., 2010; Tao et al., 2020), so they were combined for analysis.

Experiment 3 examined mediating mechanisms. To ensure response quality, we used a 2 (volunteer familiarity: high/unfamiliar) × 2 (volunteer age group: young adults/older adults) within-subjects design with Latin square counterbalancing. Participants completed one condition per week over four weeks to avoid practice effects. The dependent variable was cooperation intention (likelihood of waste sorting).

4.2 Materials and Procedure

Given that many local governments outsource waste management to third-party companies at high cost, Experiment 3 defined high familiarity as a very familiar volunteer from the community and unfamiliar as an unfamiliar volunteer from a third-party company (see Table 2). Eight participants (19–64 years) completed a pilot test confirming material clarity.

Reputational Concern. Measured using the Reputational Concern Scale (Wu et al., 2016) for each condition on a 5-point scale (1 = completely disagree, 5 = completely agree; Cronbach's $\alpha = 0.792$).

Social Distance. Measured using the Inclusion of Other in the Self Scale (Aron et al., 1992; Chen & He, 2014; Niu et al., 2010), where participants rated overlap between self and volunteer circles (1 = almost completely overlapping, 7 = not overlapping at all). Higher scores indicated greater perceived distance and lower intimacy.

To ensure authenticity and avoid comprehension bias, we emphasized anonymity and absence of correct answers before questionnaire completion. Each session took approximately five minutes. Participants received gifts after completing all four sessions.

4.3 Results and Discussion

4.3.1 Main Effects of Familiarity and Age A 2 (volunteer familiarity) × 2 (volunteer age group) ANOVA on cooperation intention revealed that, for both immediate and future sorting, age main effects were non-significant (ps > 0.1), but familiarity main effects were significant (ps < 0.001). Cooperation with high-familiarity volunteers (M = 5.81, SD = 0.89) exceeded that with unfamiliar volunteers (M = 5.39, SD = 1.04), replicating Experiments 1 and 2.

For future sorting, the familiarity × age interaction was significant, F(1, 83) = 4.41, p = 0.039, ^{2} = 0.05. Under high familiarity, cooperation did not differ by volunteer age (p = 0.383). However, under unfamiliar conditions, cooperation with young volunteers (M = 5.39, SD = 1.16) was slightly higher than with older volunteers (M = 5.18, SD = 1.35), p = 0.041, differing from Experiments 1 and 2. This may reflect the third-party company context for unfamiliar volunteers in Experiment 3.

4.3.2 Mediation Analysis of Reputational Concern and Social Distance Three experiments consistently showed that high-familiarity volunteers promote cooperation, but what is the mechanism? We tested whether reputational concern and social distance mediate the familiarity-cooperation relationship. In a model containing both mediators, if familiarity significantly predicts social distance, social distance significantly predicts reputational concern, and reputational concern significantly predicts cooperation, this supports serial mediation. If social distance does not predict reputational concern but both mediators have independent effects, this supports parallel mediation.

Using Hayes's (2018) PROCESS model 6 in SPSS, we tested the serial mediation with familiarity as the independent variable, cooperation as the dependent variable, social distance and reputational concern as mediators, and age, gender, education, and having children as control variables. Bootstrap sampling tested indirect effects. Path coefficients are shown in Figure 5 [Figure 5: see original paper].

The overall regression model was significant, R^2 = 0.14, F(5, 1338) = 43.58, p < 0.001. The indirect effect through the serial pathway (familiarity → social distance → reputational concern → cooperation) was 0.034, 95% CI [0.019,

0.053]. The total indirect effect was 0.070, 95% CI [0.007, 0.133]. All three path coefficients were significant: familiarity to social distance (b = -0.31, p $<$ 0.001), social distance to reputational concern (b = -0.12, p $<$ 0.001), and reputational concern to cooperation (b = 0.89, p $<$ 0.001). However, separate indirect effects through social distance alone (b = 0.031, 95% CI [-0.027, 0.090]) and reputational concern alone (b = 0.004, 95% CI [-0.020, 0.030]) were non-significant. Thus, social distance and reputational concern serially mediate the effect of familiarity on cooperation, supporting Hypothesis 4.

4.3.3 Control Variables and Regression Analysis Hierarchical regression (see Online Supplementary Table 3) showed that, after controlling for demographics, reputational concern (β = 0.26, t = 2.40, p = 0.019), waste sorting attitudes (β = 0.24, t = 2.26, p = 0.026; Cronbach's α = 0.874), and having encountered on-site volunteers (β = 0.20, t = 2.00, p = 0.049) significantly predicted cooperation.

Like Experiments 1 and 2, Experiment 3 found that high familiarity significantly promotes cooperation, with age interacting with familiarity only in future sorting scenarios. Importantly, social distance and reputational concern serially mediate this relationship.

5 General Discussion

This study systematically examined causal relationships among volunteer familiarity, volunteer age, and resident cooperation, along with underlying mechanisms. Three experiments and qualitative interviews revealed that familiarity significantly affects cooperation: high-familiarity volunteers promote greater cooperative intention than low-familiarity volunteers. Age interacts with familiarity: under low-familiarity conditions, cooperation is higher with older volunteers (Experiments 1 and 2). Familiarity significantly affects both younger and older participants, but older adults show higher cooperation with older volunteers and lower cooperation with unfamiliar volunteers than younger adults (Experiment 2). Social distance and reputational concern serially mediate familiarity's effect on cooperation (Experiment 3). Multiple regression and qualitative findings indicate that familiar volunteer supervision and residents' prosociality are crucial for waste sorting promotion. These findings provide empirical support for policymakers and scientific backing for cost-effective waste sorting implementation.

5.1 Familiarity's Effect on Cooperation and Its Psychological Mechanisms

Three experiments consistently demonstrated that higher familiarity with on-site volunteers promotes cooperation. People associate unfamiliarity with uncertainty or negative outcomes, reducing willingness to cooperate with strangers (Molina et al., 2019; Zajonc, 1968). Uncertainty about others' reactions, especially strangers', may cause anxiety and negative expectations. Greater famil-

iarity increases positive expectations (Epley et al., 2022). Thus, even minimal familiarity boosts generosity and cooperation (Gächter & Fehr, 1999).

China is fundamentally an acquaintance society where relationships, face, and sentiment hold special significance (Zhang & Deng, 2020). Using familiar relationships to encourage waste sorting leverages traditional Chinese values of connection and face, with peer pressure capitalizing on face-consciousness in acquaintance societies (Wang, 2019). Therefore, familiarity significantly impacts cooperation. While many local governments outsource waste management to third-party companies at high cost, recruiting community members familiar to residents or increasing familiarity beforehand could be more effective and cost-efficient.

Social distance and reputational concern serially mediate familiarity's effect. Reputation helps predict others' behavior, motivating people to sacrifice personal interests for cooperative, prosocial actions to build good reputations and secure future benefits (Giardini et al., 2021). Simultaneously, people use social distance to gauge whether reputational investment is worthwhile. With greater social distance, interaction opportunities decrease, reducing the value of reputation and increasing self-interest orientation (Tan et al., 2017). When familiar people are present, closer social distance increases perceived likelihood of reciprocity, making reputational investment more valuable and encouraging cooperation. Thus, greater familiarity reduces social distance, enhances reputational concern, and increases cooperation, such as waste sorting behavior.

5.2 Age Differences in Cooperation

Unlike previous research (Bailey et al., 2013; Romano, Bortolotti et al., 2021), age did not independently affect cooperation but interacted with familiarity. Under high familiarity, age did not significantly affect cooperation. However, under low familiarity, cooperation was higher with older volunteers, possibly because older adults are perceived as more trustworthy (Romano, Bortolotti et al., 2021).

Contrary to Hypothesis 3, familiarity significantly affected older adults' cooperation. This may be because previous studies examined kinship groups (Molina et al., 2019), whereas this study focused on non-kin relationships. Additionally, most cooperation research uses costly economic games, whereas daily cooperation like waste sorting occurs at the interpersonal level and is influenced by familiarity and trustworthiness (van Doesum et al., 2021). Socioemotional selectivity theory suggests that older adults, perceiving limited future time, focus on emotionally meaningful relationships (Carstensen et al., 2003). Thus, high familiarity particularly promotes cooperation among older adults.

Multiple regression and qualitative interviews showed that familiar volunteer supervision and residents' prosociality are key to waste sorting promotion. Older adults show higher volunteer willingness than younger adults, consistent with the prosocial growth hypothesis that prosociality increases with age (van Lange

et al., 1997). Helping others can buffer older adults' loss of meaningful social roles after retirement, enhancing self-esteem, positive affect, and life satisfaction (Caprara & Steca, 2005). Older adults may view environmental volunteering as valuable work benefiting future generations (Pillemer et al., 2017).

5.3 Limitations and Future Directions

This study examined cooperation in the everyday dilemma of waste sorting, proposing a low-cost, effective strategy based on familiarity. Using experimental and interview methods grounded in competitive altruism and social influence theories, we validated the causal relationship between familiarity and cooperation and identified the serial mediation of social distance and reputational concern. Our sample spanned younger and older adults, providing scientific evidence for promoting cooperation across age groups. However, several limitations warrant future research.

First, we measured behavioral intentions rather than actual behavior, which may introduce bias. Future research should validate findings through field experiments. Second, the younger adult group spanned a wide age range (23–59 years); future studies could use finer age categories. The scenario materials used gender-neutral third-person pronouns (e.g., "Xiao Huang") without distinguishing specific roles like primary child volunteers or waste disposers' ages, which could be explored further. Third, we focused only on familiarity and age; future research could examine how volunteers' facial expressions, verbal communication, and persuasion skills affect cooperation. Fourth, other potential mediators in the familiarity-cooperation relationship merit investigation.

6 Conclusion

This study demonstrates that recruiting community members familiar to residents as volunteers, or increasing residents' familiarity with volunteers beforehand, promotes cooperation and habit formation in waste sorting. Social distance and reputational concern serially mediate this relationship. These findings provide empirical support for policymakers and scientific backing for cost-effective waste sorting implementation.

References

Abrahamse, W., & Steg, L. (2013). Social influence approaches to encourage resource conservation: A meta-analysis. *Global Environmental Change*, 23(6), 1773–1785.

Aron, A., Aron, E. N., & Smollan, D. (1992). Inclusion of other in the self scale and the structure of interpersonal closeness. *Journal of Personality and Social Psychology*, 63(4), 596–612.

Bailey, P. E., Ruffman, T., & Rendell, P. G. (2013). Age-related differences in social economic decision making: The ultimatum game. *Journals of Gerontology*

Series B: Psychological Sciences and Social Sciences, 68(3), 356–363.

Bradner, E., & Mark, G. (2002). Why distance matters: Effects on cooperation, persuasion and deception. In *Proceedings of the 2002 ACM Conference on Computer Supported Cooperative Work* (pp. 226–235). New Orleans, Louisiana.

Caprara, G. V., & Steca, P. (2005). Self-efficacy beliefs as determinants of prosocial behavior conducive to life satisfaction across ages. *Journal of Social and Clinical Psychology*, 24(2), 191–217.

Carstensen, L. L., Fung, H. H., & Charles, S. T. (2003). Socioemotional selectivity theory and the regulation of emotion in the second half of life. *Motivation and Emotion*, 27(2), 103–123.

Chen, H., & He, G. (2014). The effect of psychological distance on intertemporal choice and risky choice. *Acta Psychologica Sinica*, 46(5), 677–690.

Deng, J., Tang, J., Lu, C., Han, B., & Liu, P. (2022). Commitment and intergenerational influence: A field study on the role of children in promoting recycling in the family. *Resources, Conservation & Recycling*, 185, 106403. https://doi.org/10.1016/j.resconrec.2022.106403

Epley, N., Kardas, M., Zhao, X., Atir, S., & Schroeder, J. (2022). Undersociality: Miscalibrated social cognition can inhibit social connection. *Trends in Cognitive Sciences*, 26(5), 406–418.

Farmer, S., & Farrelly, D. (2021). Men increase time spent on a charitable task when in the presence of women and other men: Evidence of competitive altruism in online mating scenarios. *Current Psychology*. https://doi.org/10.1007/s12144-021-02173-w

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences.* Behavior Research Methods*, 39(2), 175–191.

Fields, E. C., Bowen, H. J., Daley, R. T., Parisi, K. R., Gutchess, A., & Kensinger, E. A. (2021). An ERP investigation of age differences in the negativity bias for self-relevant and non-self-relevant stimuli. *Neurobiology of Aging*, 103, 1–11.

Foulkes, L., Leung, J. T., Fuhrmann, D., Knoll, L. J., & Blakemore, S. J. (2018). Age differences in the prosocial influence effect. *Developmental Science*, 21(6), e12666. https://doi.org/10.1111/desc.12666

Freeberg, T. M. (2020). Familiarity—The bridge from social interactions to relationships? *Journal of Comparative Psychology*, 134(2), 133–134.

Gächter, S., & Fehr, E. (1999). Collective action as a social exchange. *Journal of Economic Behavior & Organization*, 39(4), 341–369.

Giardini, F., Vilone, D., Sánchez, A., & Antonioni, A. (2021). Gossip and competitive altruism support cooperation in a Public Good game.

Philosophical Transactions of the Royal Society B, 376(1838), 20200303. https://doi.org/10.1098/rstb.2020.0303

Goodman, P. S., & Leyden, D. P. (1991). Familiarity and group productivity. *Journal of Applied Psychology*, 76(4), 578–586.

Grönlund, H., & Falk, H. (2019). Does it make a difference? The effects of volunteering from recipients' viewpoint—A literature review. *Diaconia*, 10(1), 7–26.

Gutiérrez-Roig, M., Gracia-Lázaro, C., Perelló, J., Moreno, Y., & Sánchez, A. (2014). Transition from reciprocal cooperation to persistent behaviour in social dilemmas at the end of adolescence. *Nature Communications*, 5(1), 1–7.

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Publications.

Hottle, T. A., Bilec, M. M., Brown, N. R., & Landis, A. E. (2015). Toward zero waste: Composting and recycling for sustainable venue based events. *Waste Management*, 38, 86–94.

Hsee, C. K., & Weber, E. U. (1997). A fundamental prediction error: Self-others discrepancies in risk preference. *Journal of Experimental Psychology: General*, 126(1), 45–53.

Keller, L., & Reeve, H. K. (1998). Familiarity breeds cooperation. *Nature*, 394(6689), 121–122.

Knickmeyer, D. (2020). Social factors influencing household waste separation: A literature review on good practices to improve the recycling performance of urban areas. *Journal of Cleaner Production*, 245, 118605. https://doi.org/10.1016/j.jclepro.2019.118605

Latané, B. (1996). Dynamic social impact: The creation of culture by communication. *Journal of Communication*, 46(4), 13–25.

Leeabai, N., Suzuki, S., Jiang, Q., Dilixiati, D., & Takahashi, F. (2019). The effects of setting conditions of trash bins on waste collection performance and waste separation behaviors: From walking path, separated setting, and distance arrangements. *Waste Management*, 94, 58–67.

Li, A. (2020). Social work advocacy in the study of community garbage sorting (Unpublished master's thesis). Jilin University, China.

Li, C. J., Bian, S. Q., Xue, Y. S., Ma, Z. L., & Ha, M. (2022). Key measure indicators affecting residents' waste sorting performance in Shanghai communities. *Chinese Journal of Environmental Management*, 14(2), 27–33.

Li, C. J., Huang, Y. Y., & Harder, M. K. (2017). Incentives for food waste diversion: Exploration of a long term successful Chinese city residential scheme. *Journal of Cleaner Production*, 156, 491–499.

Lin, Z. Y., Wang, X., Li, C. J., Gordon, M. P., & Harder, M. K. (2016). Visual prompts or volunteer models: An experiment in recycling. *Sustainability*, 8(5), 458–473.

Ling, M., Xu, L., & Xiang, L. (2021). Social-contextual influences on public participation in incentive programs of household waste separation. *Journal of Environmental Management*, 281, 111914. https://doi.org/10.1016/j.jenvman.2021.111914

Lu, Y., Zhang, L., & Xu, B. (2016). The effect on cooperative behaviors by cooperation index and social distance. *Journal of Psychological Science*, 39(2), 435–440.

Lunn, P., Belton, C., Lavin, C., McGowan, F., Timmons, S., & Robertson, D. (2020). Using behavioural science to help fight the coronavirus. ESRI Working Paper, 656. http://hdl.handle.net/10419/237928

Maddox, P., Doran, C., Williams, I. D., & Kus, M. (2011). The role of intergenerational influence in waste education programmes: The THAW project. *Waste Management*, 31(12), 2590–2600.

Minelgaitė, A., & Liobikienė, G. (2019). The problem of not waste sorting behaviour, comparison of waste sorters and non-sorters in European Union: Cross-cultural analysis. *Science of the Total Environment*, 672, 174–182.

Molina, J. A., Ferrer, A., Giménez-Nadal, J. I., Gracia-Lázaro, C., Moreno, Y., & Sanchez, A. (2019). Intergenerational cooperation within the household: A public good game with three generations. *Review of Economics of the Household*, 17(2), 535–552.

Moore, S. M., & Geuss, M. N. (2020). Familiarity with teammate's attitudes improves team performance in virtual reality. *PLOS ONE*, 15(10), e0241011. https://doi.org/10.1371/journal.pone.0241011

Niu, Z. H., Jiang, S., Qiu, J. J., Shen, Z. M., & Zhang, F. (2010). The effect of social distance on representation of other's behavior: The role of valence of the content of evaluation. *Chinese Journal of Applied Psychology*, 16(4), 291–300.

Paolacci, G., Chandler, J., & Ipeirotis, P. G. (2010). Running experiments on Amazon Mechanical Turk. *Judgment and Decision Making*, 5(5), 411–419.

Pillemer, K., Wells, N. M., Meador, R. H., Schultz, L., Henderson, C. R., & Cope, M. T. (2017). Engaging older adults in environmental volunteerism: The retirees in service to the environment program. *The Gerontologist*, 57(2), 367–375.

Quervel-Chaumette, M., Dale, R., Marshall-Pescini, S., & Range, F. (2015). Familiarity affects other-regarding preferences in pet dogs. *Scientific Reports*, 5(1), 1–7.

Rand, D. G. (2016). Cooperation, fast and slow: Meta-analytic evidence for a theory of social heuristics and self-interested deliberation. *Psychological Science*, 27(9), 1192–1206.

Romano, A., Bortolotti, S., Hofmann, W., Praxmarer, M., & Sutter, M. (2021). Generosity and cooperation across the life span: A lab-in-the-field study. *Psychology and Aging*, 36(1), 108–118.

Romano, A., Saral, A. S., & Wu, J. (2021). Direct and indirect reciprocity among individuals and groups. *Current Opinion in Psychology*, 43, 254–259.

Simmel, G. (1955). *Conflict and the web of group affiliations*. Glencoe, IL: Free Press.

Sun, Q., Cheng, H., & Liu, Y. (2022). Exposure to positive and negative nature affects cooperative behavior: The mediating role of cooperative expectations. *Chinese Journal of Applied Psychology*, 29(1), 12–19.

Sylwester, K., & Roberts, G. (2013). Reputation-based partner choice is an effective alternative to indirect reciprocity in solving social dilemmas. *Evolution and Human Behavior*, 34(3), 201–206.

Számadó, S., Balliet, D., Giardini, F., Power, E. A., & Takács, K. (2021). The language of cooperation: Reputation and honest signalling. *Philosophical Transactions of the Royal Society B*, 376(1838), 20200286. https://doi.org/10.1098/rstb.2020.0286

Tan, C., Wang, P., & Cui, Y. (2017). Should I sacrifice my profit before his eyes? Partner's ability and social distance affecting the tendency of reputation-profit game. *Acta Psychologica Sinica*, 49(9), 1206–1218.

Tao, L., Fu, L., Zhang, X., Feng, X., & Fu, M. R. (2020). The perceived self-efficacy on early functional exercise adherence among postoperative breast cancer patients. *Chinese Journal of Surgical Oncology*, 12(1), 84–88.

Trope, Y., Liberman, N., & Wakslak, C. (2007). Construal levels and psychological distance: Effects on representation, prediction, evaluation, and behavior. *Journal of Consumer Psychology*, 17(2), 83–95.

van Doesum, N. J., Murphy, R. O., Gallucci, M., Aharonov-Majar, E., Athenstaedt, U., Au, W. T., … van Lange, P. A. (2021). Social mindfulness and prosociality vary across the globe. *Proceedings of the National Academy of Sciences*, 118(35), e2023846118. https://doi.org/10.1073/pnas.2023846118

van Lange, P. A., de Bruin, E., Otten, W., & Joireman, J. A. (1997). Development of prosocial, individualistic, and competitive orientations: Theory and preliminary evidence. *Journal of Personality and Social Psychology*, 73(4), 733–746.

Wang, S. (2019). Community experience and its optimization in solving the dilemma of garbage classification. *Journal of Zhejiang Gongshang University*, 33(3), 121–128.

Wang, X. (2021). Analysis of influencing mechanism on waste separation behavior in Shanghai. *Sustainable Energy Technologies and Assessments*, 47, 101479. https://doi.org/10.1016/j.seta.2021.101479

Woodard, R., Firoozmand, F., & Harder, M. K. (2000). The use of cash vouchers to incentive householders to recycle. *Population*, 97(143, 100), 89–667.

Wu, J., Balliet, D., & van Lange, P. A. (2016). Reputation management: Why and how gossip enhances generosity. *Evolution and Human Behavior*, 37(3), 193–201.

Xie, X., Wang, Y., Gu, S., & Li, W. (2017). Is altruism just other-benefiting? A dual pathway model from an evolutionary perspective. *Advances in Psychological Science*, 25(9), 1441–1455.

Xu, D. Y., Lin, Z. Y., Gordon, M. P. R., Robinson, N. K. L., & Harder, M. K. (2016). Perceived key elements of a successful residential food waste sorting program in urban apartments: Stakeholder views. *Journal of Cleaner Production*, 134, 362–370.

Xu, L., Chu, X., & Ling, M. (2021). Influence of role models on public participation in household waste separation: An examination of local contextual moderators. *Sustainable Production and Consumption*, 27, 1934–1943.

Yao, B., Scott, G. G., McAleer, P., O'Donnell, P. J., & Sereno, S. C. (2014). Familiarity with interest breeds gossip: Contributions of emotion, expectation, and reputation. *PLOS ONE*, 9(8), e104916. https://doi.org/10.1371/journal.pone.0104916

Yu, H., Yang, J., Zhang, Y., & Jin, S. (2013). Imagining contact reduce intergroup bias: Theoretical basis, practical demand, underlying mechanisms. *Advances in Psychological Science*, 21(10), 1824–1832.

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, 9(2p2), 1–27.

Zelenika, I., Moreau, T., & Zhao, J. (2018). Toward zero waste events: Reducing contamination in waste streams with volunteer assistance. *Waste Management*, 76, 39–45.

Zhan, Y., Xiao, X., Tan, Q., Li, J., & Zhong, Y. (2022). Influence of reputational concern and social distance on moral decision-making under the harmful dilemma: Evidence from behavioral and ERPs study. *Acta Psychologica Sinica*, 54(6), 613–627.

Zhang, J., Zhao, L., & Hu, S. (2021). Visualizing recycling: Promoting recycling through mental simulation. *Resources, Conservation and Recycling*, 174, 105783. https://doi.org/10.1016/j.resconrec.2021.105783

Zhang, L., Xu, B., & Ding, L. (2017). The different effects on cooperative behavior among teenagers by social distance and the cooperation index. *Psychological Development and Education*, 33(4), 410–416.

Zhang, Q., & Deng, Z. (2020). Closeness difference: The influence of social distance on implicit cooperative attitude. *Psychology: Techniques and Applications*, 8(9), 521–526.

Zhang, Y. B., Harwood, J., & Hummert, M. L. (2005). Perceptions of conflict management styles in Chinese intergenerational dyads. *Communication Monographs*, 72(1), 71–91.

Zhao, Y., Chen, R., Yabe, M., Han, B., & Liu, P. (2021). I am better than others: Waste management policies and self-enhancement bias. *Sustainability*, 13, 13257. https://doi.org/10.3390/su132313257

Supplementary Tables

Supplementary Table 1. Hierarchical regression analysis for immediate sorting in Experiment 2 (N = 174)

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5
Age (years)	-0.12	-0.11	-0.07	2.62**	2.66**
	(-1.67)	(-1.50)	(-0.92)	(2.58)	(3.14)
Gender	-0.00	-0.04	3.12**	3.72**	
	(-0.06)	(-0.75)	(2.94)	(7.07)	
Education	-0.06				
	(-0.92)				
Having children[1]	-0.11				
	(-1.50)				
Waste sorting attitude		2.58*			
		(2.66)			
Encountered on-site volunteers[2]			3.05**		
			(2.94)		
Volunteer willingness[3]				4.68***	
				(9.31)	
Regulations enacted					2.00*
					(4.85)

Note: Gender coded: male = 1, female = 0. [1]Having children: yes = 1, no = 0. [2]Encountered on-site volunteers: yes = 1, no = 0. [3]Volunteer willingness (7-point scale, higher = greater willingness). $p < 0.05$, **p* < 0.01,** $p < 0.001$.

Supplementary Table 2. Hierarchical regression analysis for future sorting in Experiment 2 (N = 174)

Predictor	Model 1	Model 2	Model 3	Model 4	M
Age (years)	-0.17 (-2.27*)	-0.12 (-1.78)	6.99***	-0.10 (-1.42)	-
Gender	-0.01 (-0.10)	7.01***	-0.05 (-0.46)	-0.08 (-0.79)	
Education	-0.12 (-1.78)				

Predictor	Model 1	Model 2	Model 3	Model 4	M
Having children[1]	4.95*** (2.43*)				
Waste sorting attitude		5.98*** (3.36*)			
Encountered on-site volunteers[2]			13.21*** (48.80)		
Volunteer willingness[3]				11.45*** (16.97)	
Regulations enacted					3

Note: Gender coded: male = 1, female = 0. [1]Having children: yes = 1, no = 0. [2]Encountered on-site volunteers: yes = 1, no = 0. [3]Volunteer willingness (7-point scale, higher = greater willingness). $p < 0.05$, **p* < 0.01,** $p < 0.001$.

Supplementary Table 3. Hierarchical regression analysis for Experiment 3 (N = 84)

Predictor	M	SD	Model 1	Model 2	Model 3	Model 4	Model 5
Age (years)	26.05	11.01	-0.06 (-0.28)	-0.06 (-0.28)	-0.08 (-0.35)	-0.15 (-0.71)	-0.22 (-1.05)
Gender	0.50	-0.45 (-3.97)	-0.45 (-3.97***)	-0.38 (-3.35***)	-0.33 (-2.87**)	-0.31 (-2.73**)	
Education	1.70	-0.11 (-1.05)	-0.12 (-1.11)	-0.10 (-0.94)	-0.05 (-0.46)	-0.08 (-0.79)	
Having children[1]	2.40	*	2.24*	2.26*	2.00*	1.99*	
Waste sorting attitude				2.48*	2.00*	5.09***	
Encountered on-site volunteers[2]					4.07**	4.56***	
Volunteer willingness[3]						5.76*	
Regulations enacted							4.85***

Note: Gender coded: male = 1, female = 0. [1]Having children: yes = 1, no = 0. [2]Encountered on-site volunteers: yes = 1, no = 0. [3]Volunteer willingness (7-point scale, higher = greater willingness). $p < 0.05$, **p* < 0.01,** $p < 0.001$.

Note: Figure translations are in progress. See original paper for figures.