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# Economic incentive and social influence to overcome household waste separation dilemma: A field intervention study

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## ABSTRACT

China has experienced a rapid growth of solid waste over the years, household waste source-separation is becoming a nationwide strategy for promoting recycling economy and improving urban environmental sustainability. Waste separation, however, may end in failure due to the free-rider problem similarly existing in other pro-environmental collective actions. Along with the economic and sociological/social psychological logic respectively, this study tested the effects of economic incentive and social influence, which are theoretically considered as two general solutions to domestic waste separation dilemma. One hundred and eighty-eight residents in the three communities of Hangzhou, Zhejiang Province were assigned to a control group or one of two experimental scenarios, where they were encouraged to participate in waste separation activities through either the economic rewards given on their performance, or door-stepping campaigns aimed at constructing a supportive social environment. Six-month intervention effects were analyzed and showed that economic inducement was more effective than social mobilization in promoting waste separation. Further mediation tests indicated that self-efficacy partially mediated the effects of both strategies, while personal norms were positively associated with two treatments instead of behavior demonstration. In addition, the moderating effects of several socio-demographic factors on psychological mechanisms were also explored. The findings, limitations and implications for future research and policy are discussed in the concluding section.

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## 1. Introduction

Household solid waste management is widely accepted as a key indicator in measuring both the quality of life of dwellers and urban sustainability. China has recently experienced a dramatic increase in domestic waste production at the rate of 8%–10% per year<sup>1</sup> – approaching an alarming level that poses a severe threat to the environment and citizens' living standards. As one of the major strategies adopted in many countries, promoting source-separation of household waste to increase recycling and lighten the load of landfill and incineration (Stoeva and Alriksson, 2017), has become one of the most pressing issues on Chinese government agenda. In particular, the State Council has issued its Implementation Program of Household Garbage System in March 2017, highlighting the urgency and importance of this work.

Undoubtedly, the widespread participation of general public is the key to the success of waste separation in a society, since it requires a concerted effort of social members. Like other pro-social behaviors, however, such collective action is vulnerable to the free-rider problem (Olson, 1965) and easily ends in failure. By its nature, waste separation is a voluntary provision of such public goods as a cleaner environment and more efficient utilization of energy resources (Yau, 2010), yet these longer-term and collective benefits may not cover the time, energy and/or other costs paid by individuals for accurately separating (Garcés et al., 2002). Moreover, they need to be supplied jointly but not excludable to anyone (Yau, 2010). Driven by rationality, hence, residents seeking utility maximization tend to free ride on others' efforts and choose not to engage in waste separation.

While collective-action problem, or “tragedy of commons” (Hardin, 1968), seems inevitable under this rational egoist assumption, it can be solved through several well-designed institutions or behavioral interventions that increase individuals' objective payoff or motivation and hence facilitate altruistic behaviors (Ostrom, 2000). From the perspective of environmental collectivism that is seldom discussed by domestic waste separation or recycling literature (Yau, 2010), the aim of this intervention study was to

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<sup>1</sup> Retrieved on 11 September 2017, from <http://news.feijiu.net/infocontent/html/201412/16/16320111.html> [Chinese].

compare economic incentive and social influence, which are acknowledged as two effective solutions to collective dilemma (Olson, 1965; Ostrom, 1990), in terms of their effects at promoting waste separation. We further investigated a range of psychological and socio-demographic factors that were expected to mediate or moderate these intervention effects, since it is helpful to better understand the mechanisms and scopes of such initiatives. Nonetheless, these factors are severely neglected by existing intervention-oriented studies within the domain of waste separation (Varotto and Spagnoli, 2017).

## 2. Two solutions to waste separation dilemma

In most cases, a successful collective action is indispensable for effectively providing a public good. Following the rational choice theory, Olson (1965) asserted that no self-interested person would contribute to public goods unless the group size is small or she/he is coerced or induced by some external devices such as selective economic incentives, which can increase individual payoff and conformity to collective interest. Subsequently, Ostrom (1990, 2000) and other scholars challenged this “zero contribution thesis” and proposed that self-organized governance system, where people voluntarily cooperate with each other to protect common resources, could be achieved with the strong social influence or conduct norms. In regard to waste separation situation, economic incentive and social influence are not only two sets of important determinants predicting waste separation behavior in psychological literature (e.g., Grazhdani, 2016; Kirakozian, 2016; Pakpour et al., 2014; Xu et al., 2017), but also the clearly theoretical references linked to the designing of behavioral interventions (Varotto and Spagnoli, 2017).

### 2.1. Economic incentive

Under the circumstance of voluntary provision, a rational agent will contribute nothing to public goods as she/he can still gain the non-excludible collective benefits at the expense of others' efforts. Harnessing this self-interested logic, rewarding participation (or punishing nonparticipation) in provision of public goods would effectively induce individual contribution and achieve group interest, since actions can bring about more personal benefits than inactions (Olson, 1965). Apart from the extrinsic inducement or price effect, economic incentives may also affect some psychological conditions. For example, incentives can be given on an individual level and act as a feedback about individual performance (Thøgersen, 2005), which may enhance recipients' feeling of *self-efficacy* and, in turn, increase their willingness to contribute (Finkel et al., 1989). On the other hand, however, reward schemes sometimes appear to backfire and have a negative effect on uptake of the recommended behavior. Of the range of mechanisms expected to be involved, the “overjustification effect” theorizing (Deci et al., 1999) has been widely adopted by scholars to explain this anomaly, which highlights the tendency of attributing contribution to the external factors and the so-called “crowding-out effect” on intrinsic motivations such as *personal norms*<sup>2</sup> (Arieli et al., 2009; Varotto and Spagnoli, 2017).

A variety of incentive-based strategies (e.g., pricing schemes, rewards, and gifts) have been applied to encourage domestic waste separation. Their effects are also analyzed by limited field studies,

<sup>2</sup> Intrinsic motivations can be based either on enjoyment of a task or on a sense of introjected regulation/ obligation, while the latter is more related to behaviors associated with more effort and less pleasure, such as civic and environmentally responsible actions (van der Werff, Steg, and Keizer, 2013). Furthermore, obligation-based intrinsic motivation is very similar to personal norms since both of them stress the feeling of being morally obliged to perform a targeted behavior (van der Werff et al., 2013). Hence, our study tested the negative mediation of personal norms, for examining the potential crowding-out effect of economic incentives.

suggesting that, (1) the overall effectiveness of economic incentives is still inclusive (Yau, 2010), with quite few studies failing to demonstrate the successfulness of economic instruments in increasing waste separation behavior (e.g., Allen et al., 1993; Scott, 1999; Timlett and Williams, 2008); (2) individual-based incentives are usually more effective than those contingent on group performance (Harder and Woodard, 2007); (3) incentives could achieve more for residents with lower initial separating rate (Harder and Woodard, 2007). More importantly, it seems that the systematically empirical evidence about effects of recycling incentives on intrinsic motivations is still lack to date.

### 2.2. Social influence

In sharp contrast with rational choice theory insisting the determinism of individual benefit balance sheet, social psychologists and sociologists instead value norms as another kind of general rule motivating voluntary behaviors (Kreps, 1997). Indeed, people are not perfectly rational actors in the real world filled with uncertainty and ambiguity. They might behave in a pro-social manner to just follow others or to live up to their own expectations without external incentives to do so. Social norms are beliefs about which actions are obligatory, permitted, or forbidden shared by members in a group (Ostrom, 2000), and those favoring reciprocity, trust, and cooperation can guide voluntary behaviors by forming social pressure and/or reshaping self-cognition. Specifically, people usually want to gain social approval and try to escape potential social criticism or sanctions by others (Abrahamse and Steg, 2013; Abrahamse et al., 2005; Suh, 2002), for which they may be more willing to act in a pro-social way under a strong social norm (Cialdini et al., 1990). Moreover, outer norms can further be internalized or introduced as personal norms and identification with the shared standards through a repeated communication, interaction, social learning, and cooperation in the longer term (Bertoldo and Castro, 2016; Ostrom, 1990). Evidently, those with a more salient sense of self-obligation might be more likely to avoid distressful cognitive dissonance, as well as consistently participating in volunteer behaviors. Besides, the comparison between individual performance and a predefined standard may function as a feedback and make residents more capable of voluntary engagement (Abrahamse and Steg, 2013; Varotto and Spagnoli, 2017). This increased self-efficacy can also be acquired by watching others' successful behavior (Bandura, 1986). Therefore, constructing or reshaping a supportive social environment can help resolve a collective-action problem. Self-efficacy and personal norms are also the key factors in understanding how social influence encourages one's contribution to collective goods.

There are at least two kinds of social influence techniques pertaining to promoting residential waste separation. For example, conveying information regarding either a predefined standard or performance of others who have been already dedicated to separating their daily refuse (e.g., friends, neighbors, groups or communities) can establish normative conducts and prompt social comparison (Abrahamse and Steg, 2013; Varotto and Spagnoli, 2017), helping people have a better understanding of currently social situations and expectations (Cialdini and Goldstein, 2004). Another application is social modeling, which means community members or volunteers who have performed recycling are recruited to act as block leaders to encourage actions of nonparticipants via communication, demonstration and/or door-stepping campaigns (Osbaldiston and Schott, 2012). As evidenced by a meta-analysis review conducted by Varotto and Spagnoli (2017), socially modeling waste separation behavior tends to outperform the sole information provision, which might be because face-to-face interaction among members occurring in social modeling situation are more conducive to increasing efficacy-related beliefs and accelerating a social learning process (Bandura, 1977).

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