Human altruistic tendencies vary with both the costliness of selfless acts and socioeconomic status

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Altruism toward strangers is considered a defining feature of humans. However, manifestation of this behaviour is contingent on the costliness of the selfless act. The extent of altruistic tendencies also varies cross-culturally, being more common in societies with higher levels of market integration. However, the existence of local variation in selfless behaviour within populations has received relatively little empirical attention. Using a 'lost letter' design, we dropped 300 letters (half of them stamped, half of them unstamped) in 15 residential suburbs of the greater Perth area that differ markedly in socioeconomic status. The number of returned letters was used as evidence of altruistic behaviour. Costliness was assessed by comparing return rates for stamped vs unstamped letters. We predicted that there is a positive association between suburb socioeconomic status and number of letters returned and that altruistic acts decrease in frequency when costs increase, even minimally. Both predictions were solidly supported and demonstrate that socioeconomic deprivation and elevated performance costs independently impinge on the universality of altruistic behaviour in humans.

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Abstract

Altruism toward strangers is considered a defining feature of humans. However, manifestation of this behaviour is contingent on the costliness of the selfless act. Evidence shows that the extent of altruistic tendencies also varies cross-culturally, being more common in societies with higher levels of market integration. However, the existence of local variation in selfless behaviour *within* populations has received relatively little empirical attention. Using a 'lost letter' design, we dropped 300 letters (half of them stamped, half of them unstamped) in 15 residential suburbs of the greater Perth area that differ markedly in socioeconomic status. The number of returned letters was used as evidence of altruistic behaviour. Costliness was assessed by comparing return rates for stamped vs unstamped letters. We predicted that there is a positive association between suburb socioeconomic status and number of letters returned and that altruistic acts decrease in frequency when costs increase, even minimally. Both predictions were solidly supported and demonstrate that socioeconomic deprivation and elevated performance costs independently impinge on the universality of altruistic behaviour in humans.

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41 **1. Introduction**

42 Prosocial sentiments, i.e. caring about the welfare of others, have emerged as hallmarks of
43 humans (Gintis 2003; Henrich *et al.* 2004; Hill *et al.* 2009; Alvard 2012); but see (Burton-
44 Chellew & West 2013). Altruism represents a special case of prosociality in which an actor
45 helps others at a personal cost. Altruism can become fixed in stable groups of humans and
46 other animals through kin selection, a process whereby individuals accrue indirect benefits
47 through the successful reproduction of relatives (Hamilton 1964). Explaining altruism
48 directed at unrelated individuals requires the framework of direct reciprocity (Trivers
49 1971) or indirect reciprocity (Alexander 1987). In direct reciprocity, the temporary costs
50 individuals incur by performing an 'altruistic' act will be recouped by subsequent
51 generosity on the part of the recipient. In indirect reciprocity, lending a helping hand can
52 enhance the reputation of individuals and increase the likelihood of others cooperating
53 with them in the future.

54 However, when altruism surfaces in large anonymous groups of unrelated individuals
55 canonical evolutionary approaches based on nepotistic biases, direct reciprocity and
56 indirect reciprocity can largely be ruled out as explanations . It has been argued that large-
57 scale cooperation can be maintained when behaviourally rather homogenous groups of
58 prosocial individuals gain a competitive edge against groups of less prosocially cohesive
59 individuals (cultural groups selection) (Henrich 2004; Richerson et al. 2016; but see
60 Yamagishi and Mifune 2015).

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62

Despite its ubiquity in human societies, the propensity for altruism varies and is expected to be superseded by selfish motives when acts of altruism are more costly, that is when they entail larger sacrifices to one's own payoff (Fehr & Fischbacher 2003). This argument has been substantiated through economic games such as the dictator game, e.g. when the cost of relinquishing one monetary unit to the recipient increases, the dictator donates less (Andreoni & Miller 2002). In a study using children it was shown that in a costly sharing game (when delivering rewards to a recipient required personal sacrifice) the likelihood of prosocial behaviour was lower than in a prosocial game (in which offering a reward to a recipient had no inherent costs) (House et al. 2013). Further evidence for cost-dependent variation in altruism is presented by Stewart-Williams (2007) who used questionnaires about help exchanged with individuals of different relatedness classes and found that with increasing costs of help, nonkin received a smaller share of the help given than kin.

Prosocial inclinations are also contingent on the social and ecological environment (Lamba & Mace 2011). House et al. (2013) demonstrated the emergence of population-specific variation in costly prosociality during middle childhood. A cross-cultural study of behaviour in ultimatum games showed that levels of prosociality increased with market integration and the reliance on cooperative partners from outside the immediate family (Henrich *et al.* 2005; Henrich *et al.* 2010). However, the existence of local variation in prosocial behaviour *within* such industrialized populations has received relatively little empirical attention (but see Wilson et al. 2009; Nettle et al. 2011; Holland et al. 2012; Silva & Mace 2014, 2015).

A simple but powerful way to quantify pure altruism toward strangers in a naturalistic setting (urban context) is through the lost letter experiment. This experiment involves dropping letters on the sidewalk and counting the number of letters that are picked up by passers-by and mailed to the addressee (Milgram *et al.* 1965). Previous applications of this methodology have found that letter return rates were correlated with perceived neighbourhood quality (Wilson *et al.* 2009) and objective neighbourhood wealth and socioeconomic status (Nettle *et al.* 2011; Holland *et al.* 2012; Silva & Mace 2014).

In the present study we aim to apply the lost letter technique to simultaneously disentangle the effects of both socioeconomic status and the inherent costs of executing a task on the prevalence of altruistic behaviour in an urban setting. We first predicted that spontaneous prosociality would be less prevalent in areas of low socioeconomic status because poorer neighborhoods are characterized by low neighbourhood quality (Wilson *et al.* 2009), high crime rates (Sampson *et al.* 1997; Nettle *et al.* 2011), low social capital and trust (Sampson *et al.* 1997; Li *et al.* 2005; Nettle *et al.* 2011), and low rates of civic engagement (Li *et al.* 2005). Hence letters dropped in socioeconomically poorer areas should have a lower likelihood of being returned. We also predicted that increased costs of returning the letter would decrease altruism (Fessler 2009). That is, among the returned letters there would be fewer unstamped letters; due to the additional financial expense required to post an unstamped letter, it can be implied that returning unstamped letters imposes a larger cost to the actor.

2. Methods

2.1 Data collection

We (the authors) dropped a total of 300 letters (150 stamped and 150 unstamped) were dropped in 15 residential suburbs in the Perth Metropolitan area that differed in levels of socioeconomic deprivation/affluence. We distributed twenty letters, ten stamped and ten unstamped, face up on sidewalks of each suburb. We addressed envelopes to one of the author's home address; we did not drop any letters in the suburb that the letters were addressed to. We chose the addressee's name to be 'S. Roberts', as we considered it to be a gender-neutral name. We chose a 'Western' name to remove any potential ethnic biases (Ahmed 2010). There was no 'return to sender' address. We addressed all the letters in the same handwriting in the same standard white envelope. Since the letter was handwritten, it can be deduced that the letter did not contain official documents, utility bills or company letters. The content of the letter was a folded piece of A4 paper containing the name of the suburb the letter was dropped in and a note on whether it was stamped or unstamped. The content of the letter was indistinguishable from the outside.

We dropped all 300 letters in their respective suburbs on the same evening between 17:00 and 19:00. We dropped the letters on a Saturday evening to ensure no postmen would pick up the letters, as they do not work until Monday morning. We dropped the letters strategically dropped on a weekend that had no rain forecasted to avoid damage to the letters. We dropped the letters approximately 5 meters from a house driveway or front gate on the pedestrian walkway to ensure visibility. We did not drop any letters in front of any of the small businesses that exist in the residential suburbs, and also avoided construction sites. This increased the likelihood of the letters being returned by actual members of the area rather than short-term visitors. We did not drop any letters in sight of a post box or post office so as to make it more likely that the effort the finder would have to

131 go to was roughly consistent across suburbs. There was only a maximum of one letter in
132 each street to maximize the spread of the letters within the suburb, which reduced the
133 likelihood of a participant coming across more than one letter and potentially alerting them
134 to the nature of the experiment.
135 Ethics approval for the above project was granted in accordance with the requirements of
136 the National Statement on Ethical Conduct in Human Research and the policies and
137 procedures of The University of Western Australia (RA/4/1/7801).
138
139 2.2 Data analysis
140 Suburbs were classified according their economic status. The Socio-economic Indexes for
141 Areas (SEIFA) was used to determine the socioeconomic status of the different suburbs in
142 which the letters were distributed. Specifically, the Index of Relative Socioeconomic
143 Disadvantage (IRSD) was used which ranks areas on a scale from most disadvantaged to
144 least disadvantaged. The index takes into account 16 different variables from the 2011
145 census data, with each variable receiving a different weighting. Some of the more heavily
146 weighted variables included the percentages of low-income houses, jobless parents,
147 individuals living without internet and other variables including education level,
148 occupation and average rent (Australian Bureau of Statistics 2009, 2014). These variables
149 are combined to produce a decile ranking of deprivation for specific areas, on a scale of 1 to
150 10 (henceforth termed *socioeconomic index*). A score of 1 for an area shows that the
151 residents in that area are in the most disadvantaged 10% in the nation. Some suburbs are
152 composed of smaller statistical areas; for these suburbs the median rating of deprivation
153 was taken (Supplemental File 1). Suburbs characterized by large socioeconomic variation

(difference between maximum and minimum IRSD for statistical areas >300) were not included in the experiment.

We first ran a Generalized Linear Mixed Model with binomial error structure and logit link function using the glmer function from the lme4 package (Bates *et al.* 2015) in R (R Development Core Team 2014) version 3.1.0. The response variable – letter returned vs. not returned – was binary. Fixed effects were socioeconomic status, and whether or not a letter was stamped or unstamped. We also included number of postboxes in a suburb as a control variable. Suburb was classified as a random effect and included in the statistical model. Next, using a likelihood ratio test, we compared a saturated model containing all fixed effects with a null model containing none of the fixed effects but the same random effect as the saturated model (Forstmeier & Schielzeth 2011). The interaction between stamped/unstamped and socioeconomic status was not significant and was therefore not retained in the final model. P-values for individual predictors were calculated based on Satterthwate's approximations using the lmerTest package (Kuznetsova *et al.* 2014).

3. Results

A total of 92 stamped and 46 unstamped letters were returned (Supplemental Files 1, 2). A comparison of the full model to the null model showed that the set of predictors had a strong effect on whether a letter would be returned or not ($\chi^2 = 45.373$, $p < 0.001$). An analysis of the individual predictors in the model showed that unstamped letters had a significantly lower chance of being returned (estimate = -0.320, SE = 0.054, $p < 0.001$) (Fig. 1). Socioeconomic index also had a significant effect on whether or not a letter was

176 returned (estimate = 0.035, SE = 0.011, p = 0.00167) (Fig. 2). A confounding effect of
177 density of postboxes could be ruled out (estimate = -0.002, SE = 0.012, p = 0.919).

178

179 **4. Discussion**

180 A steady stream of recent research has undermined the original characterization of
181 humans as *Homines economici* by uncovering substantial levels of prosocial behaviour
182 (Gintis 2003; Henrich *et al.* 2004; Hill *et al.* 2009; Alvard 2012). The present field
183 experiment using lost letters demonstrating people's willingness to engage in truly
184 altruistic acts conforms with this paradigm. However, our experimental approach has
185 revealed that these altruistic tendencies vary strongly with both levels of neighborhood
186 socioeconomic status and the costs involved in performing the altruistic act. Cost of the act
187 has rarely been investigated within this experimental paradigm. When there was the likely
188 added cost of going to a post office and purchasing a stamp, a letter was roughly half as
189 likely to be returned. This is in line with results from economic games (Isaac & Walker
190 1988; Andreoni & Miller 2002), questionnaire-based studies on helping behaviour
191 (Stewart-Williams 2007) and two earlier implementations of the lost letter experiment
192 (one of which was not couched in an evolutionary framework) (Simon 1971; Fessler 2009).
193 The negative effect of low socioeconomic status on letter return rates is in agreement with
194 most studies that utilized the lost letter technique to measure altruism.

195 The lower level of altruistic behaviour evident in poorer suburbs has been suggested to be
196 a consequence of individual or neighborhood characteristics associated with
197 socioeconomic deprivation (Holland *et al.* 2012). Individuals facing financial hardship, poor

198 health and general life instability are likely to be preoccupied with achieving immediate
199 needs, leaving less time and effort available to spend on benefiting a stranger (Lynam *et al.*
200 2000; Holland *et al.* 2012). In contrast, resource-rich individuals are not likely to be
201 affected by such time and financial constraints. Individuals residing in poorer
202 neighborhoods are also less likely to be embedded in a socially cohesive and supportive
203 network and are exposed to higher levels of crime, conditions that discourage the
204 development of trust required for civic efforts and prosociality (Holland *et al.* 2012).
205 Wilson et al. (2009) found a good match between individual prosociality and the quality of
206 the neighborhood (or more specifically the prosociality of the individuals' social
207 environment) and reasoned that "this empirical result explains why it is possible for
208 prosociality to succeed as a behavioural strategy in contemporary human life. Very simply,
209 those who give to others also get from others." (p. 198).

210

211 One mechanism by which altruistic behaviour to unrelated individuals can be explained is
212 reputation enhancement (Nowak & Sigmund 2005). In our study, a number of the returned
213 envelopes were annotated, detailing that the person had found and returned the letter on
214 their own goodwill. In one instance, the mobile phone number of the finder was written on
215 the envelope. In addition, one letter was hand delivered to the addressee's house. These
216 actions suggest that the actors desired recognition of their good deed, supporting the
217 theory of reputation enhancement.

218 Overall, our findings show that the willingness of individuals within a community to be
219 altruistic decreases with increasing costs and social disadvantage. More broadly, this

research shows that ecological variation within a given population can evoke divergent patterns of helping behaviour. In the context of business and industry, these results can aid charities and other crowd-funded organizations in directing their efforts to where they will likely receive the greatest return. Data such as the ones collected in this study provide a reflection of community attitudes and may therefore prove relevant to municipal government for policy development and intervention.

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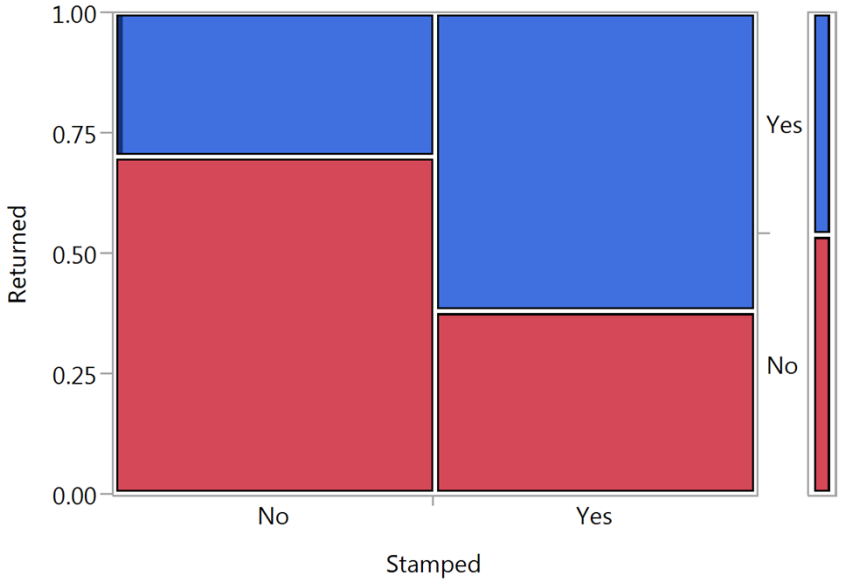
Figure captions

Figure 1: Mosaic plot illustrating the percentage of returned letters as a function of whether they were stamped (Yes) or unstamped (No).



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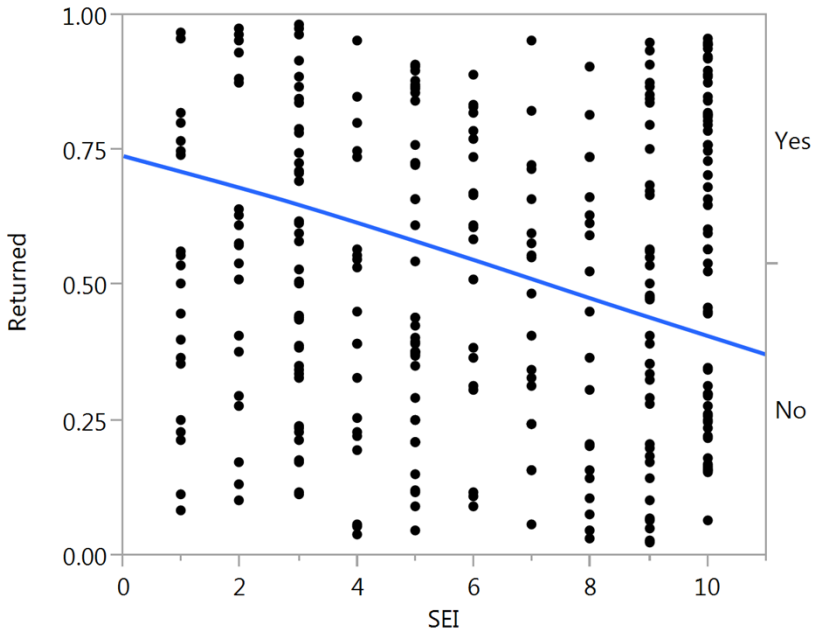
341 *Figure 2*: Visualization of the effect of socioeconomic index (SEI) on whether a letter was
342 returned or not (dichotomous variable). Letters dropped in high (10) SEI suburbs were
343 more likely to be returned. The blue line represents a cut-point and not a trend line.



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