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Social discounting rate is negatively correlated with fluid intelligence

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ABSTRACT

The purpose of the study was to verify a hypothesis, inspired by the handicap principle, of a positive relationship between subjective value of a hypothetical monetary reward shared with others and the level of fluid intelligence. Manipulation involved the amount of reward to be shared (small vs. large amount) and subject's relationship to recipients (related vs. unrelated). As expected, a positive correlation was found between the subjective value of a reward to be shared with others, measured as the area under the curve for the discounting function and Raven Advanced Progressive Matrices scores, but the relationship was only present for rewards shared with relatives. In addition, participants who made altruistic choices in all items scored higher in RPM than those who were not as consistent. The implications of results for the evolutionary interpretation of the relationship between intelligence and altruism are discussed.

1. Introduction

According to the handicap principle (Zahavi, 1975, 2003; Smith & Bliege Bird, 2000) costly altruistic behaviour may serve as a so-called "costly signal", providing a reliable indication of individual characteristics relevant to survival. The signal's costliness means that individuals with "inferior" genes cannot afford or are unable to emit it. This way its recipients can obtain reliable information about the genetic quality of a potential sexual or social partner. Consequently, altruists benefit by enhancing their sexual and social attractiveness. Natural selection should therefore favor both the individuals capable of emitting costly signals, and those that choose their partners on the basis of such signals.

Altruism can thus be a costly signal available only to individuals with high fitness levels. According to Millet and Dewitte (2007), one of the traits signalled by altruistic behaviour may be intelligence defined as the *g* factor (Spearman, 1927). Intelligence can be an all-purpose survival tool for solving a variety of adaptation problems, from challenges presented by the physical environment to issues encountered in social interaction. From the perspective of Millet & Dewitte's hypothesis referenced above, particularly important is the relationship between intelligence and access to resources. Studies have demonstrated that as a predictor of socio-economic status intelligence is more accurate than the status of parents (Gottfredson, 2004). Whether measured in childhood or adulthood, intelligence is predictive for the social status of occupation and income (correlation of 0.51 and 0.31, respectively) (Judge, Higgins, Thoresen, & Barrick, 1999). Indirectly, the relationship between intelligence and access to resources is confirmed by studies that have shown the level of general intelligence to be correlated with offspring survival rates (Čvorović, Rushton, & Tenjevic, 2008) and life span (Gottfredson & Deary, 2004; Rushton, 2004).

Thus, taking the handicap theory as our point of departure, we can assume that sharing or giving away resources is less costly for highly intelligent individuals than for those with lower IQ. In accordance with that hypothesis, Millet and Dewitte (2007) posited that altruistic individuals (contributing above the minimum required to obtain the provision point in a public goods game) score higher in the Raven Advanced Progressive Matrices test compared to egoists investing below the minimum and cooperating individuals investing exactly the minimum. Dewitte & De Cremer, 2005 (quoted in: Millet & Dewitte, 2007) also found that students investing in public good above the minimum share had better grades than students investing the minimum or below, which may suggest that altruism is related to intelligence (as far as grades are associated with intelligence). In a study on twins, Segal and Hershberger (1999) found a relationship between results in Wechsler's test and choices in the iterated prisoner's dilemma: higher IQ of players was associated with more choices of simultaneous cooperation ($r = 0.31$) and fewer of mutual exploitation ($r = -0.27$).

In that approach, altruism is one of the possible factors for assessing potential partners' intellectual capacity. Although there is no direct evidence that altruism is perceived as a characteristic

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of intelligent individuals (Mőttus, Allik, Konstabel, Kangro, & Pullmann, 2008), research has shown that it is a desirable trait in sexual partners (although this could be a function of direct benefits from interaction with such individuals rather than the signalling functions of altruism) (Phillips, Barnard, Ferguson, & Reader, 2008) and that individuals making high contributions for the public good are elected to be leaders (Hardy & Van Vugt, 2006). Thus, altruists benefit by enhancing their sexual and social attractiveness, which, due to the high cost of altruistic behaviours, should be more available to people with higher IQ.

The handicap principle-inspired interpretation of the relationship between intelligence and altruism refers to ultimate causes, i.e. the adaptive implications of that relationship: signalling one's quality through altruistic behaviour promotes biological interests of highly intelligent individuals. However, since psychology focuses on proximate causes, we should address the issue of mental mechanisms underlying that relationship. Some clues are offered by studies investigating how the rate of temporal discounting is related with intelligence and altruism/cooperation. Firstly, there is an empirically confirmed negative relationship between intelligence and temporal discounting, which means that self-control increases with intelligence while preference for smaller but immediate rewards decreases (Shamosh & Gray, 2008). The mechanism of this relationship is unclear. Since working memory load is associated with faster temporal discounting (Hinson, Jameson, & Whitney, 2003), the relationship in question may stem from the working memory's involvement in intelligence by maintaining an active mental image of the goal and integrating diverse information (Shamosh & Gray, 2008). An alternative explanation is offered in the meta-analysis by Shamosh and Gray (2008), which showed that taking into account non-verbal intelligence resulted in only a slight increase in the relationship between intelligence and temporal discounting. We can therefore assume that high verbal intelligence is what primarily facilitates the use of verbal strategies helping to maintain self-control (Olson, Hooper, Collins, & Luciana, 2007).

Secondly, temporal discounting is correlated with choices that can be located on the altruism vs. egoism continuum. We know from research that temporal discounting is negatively correlated with the size of contributions in a public goods game (Curry, Price, & Price, 2008) and the number of cooperative choices in the iterated Prisoner's Dilemma (Harris & Madden, 2002; Yi, Buchhalter, Gatchalian, & Bickel, 2007), and positively correlated with social discounting, i.e. decreased subjective value of a reward due to it being consumed in part or in whole by others (Jones & Rachlin, 2009). A possible explanation of this relationship could be the delay in reinforcement for altruistic behaviour. Altruistic acts carry immediate costs, while potential benefits (which may compensate or even overcompensate these costs, such as social approval, prestige, reciprocation) emerge in a long-term perspective (Rachlin, 2000, 2002). Consequently, individuals who find a delay in obtaining a reward more devaluing may be less willing to engage in altruistic behaviour.

According to Millet and Dewitte (2007), individuals with higher IQ may find it easier to adopt a wider, more temporally extended perspective, which enables them to forego the immediate benefits associated with egoistic choices. However, the aspect of time does not have to be the sole determinant of this effect. According to Rachlin and Locey (2011), another important factor is the ability to see how the interests of others overlap with our own goals, which is the main factor reflected in the rate of social discounting. These authors point out the parallels between temporal and social discounting, since the former can be described as perceiving the relationships between present and future self, and the latter as awareness of the relationships between self and others. If the rate of temporal discounting depends on intelligence, it begs the question whether a similar relationship obtains with respect to discounting in the social sphere.

A mutual relationship is stronger, and consequently easier to recognize in the case of relatives. Consequently, the association of kin altruism with intelligence may be weaker than in the case of non-kin altruism, where a mutual relationship is less evident. For that reason we decided to take kinship into account in our analysis of the relationships between intelligence and altruism. From the handicap principle perspective, this relationship is expected to be more pronounced when beneficiaries are unrelated than in the case of relatives (being less attractive recipients of the signal since they cannot be sexual partners) or relatedness to beneficiaries should have no effect on.

The purpose of our study was to assess the relationship between altruism defined as the rate of social discounting and general intelligence. We decided to measure social discounting using the method proposed by Rachlin and Raineri (1992), i.e. through choices between a reward for oneself only and a reward to be shared with an increasing number of other people. This method of measuring altruistic tendencies should detect the relationship between altruism and intelligence predicted by the handicap principle, since the participants' personal benefit diminishes as the number of people rises (driving up the cost of altruistic behaviour). Consequently, in order to avoid participants' doubts resulting from having different numbers of kin at particular degrees of relatedness, the kinship manipulation involved the most general level – by specifying the group with which the reward was to be shared as kin or non-kin.

To sum up, in view of the empirical findings discussed above, social discounting is likely to be associated with intelligence, at least to the extent temporal discounting is involved in subjective evaluation of a reward to be shared with others. People with higher IQ should demonstrate a lower rate of social discounting (i.e. there should be a positive correlation between the level of intelligence and subjective value of a reward to be shared with others). In addition, subjective value of a shared reward should depend not only on expected future benefits, but also on the degree to which the subject sees his interests as compatible with the interests of others. The degree to which those interests are perceived as common appears to rely, among other things, on the ability to recognize the mutual dependence, which may be enhanced by intelligence. We can therefore predict that when the rate of temporal discounting is controlled for, the relationship between social discounting and intelligence should still be present. Finally, we expect the relationship between intelligence and social discounting to be present regardless of kinship manipulation, or to be stronger when the beneficiaries are non-kin.

2. Methods

2.1. Participants

Participants were 60 students of two higher education institutions – the Faculty of Psychology at the University of Warsaw ($n = 44$) and the Warsaw School of Economics ($n = 16$) aged 18–30 years (mean age 21.25, standard deviation 2.350), 30 females and 30 males.

2.2. Materials

The rate of social discounting and temporal discounting was measured using computer software.

In the social discounting portion, participants made hypothetical choices between a smaller monetary reward exclusively for themselves (option A) or a larger reward which they had to share