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The relationship between self-control and altruism in the light of discounting literature

Abstract: *On the basis of literature on delay discounting, potential mechanisms of relations between self-control and altruism are considered. The discussed possibilities are: cause-and-effect relationship (self-control enabling sacrificing immediate benefits caused by selfish behaviour in favor of future benefits associated with altruism, e.g. reciprocation), common mechanism (ability to learn behavioural patterns covering longer time periods), role of intelligence as a factor related both to self-control and altruism, and role of psychological distance (the idea of extended self and construal level theory). Relations between described perspectives are pointed out, and directions for further research are suggested.*

Keywords: *altruism, cooperation, delay, self-control*

Introduction

In behavioural psychology, the term ‘self-control’ means a preference for rewards that are bigger and temporally more distant, as opposed to smaller and immediate ones (for a review, see Green and Myerson, 2004). Such preference weakens as the time of awaiting for the reward increases. Therefore, the subjective value of the reward is being discounted by the magnitude of the delay.

Simon (1995) proposes a three-dimensional model of allocation of available goods which encompasses the consumption by (a) “the current person”, (b) “future self-persons” and (c) other individuals. Similarly, Rachlin and Jones (2009) associate the delay discounting with a “wider self” extended in time. This term refers to the degree in which the individual sees the relation between the “present self” and the “future self”. The extent to which those two selves overlap affects the degree to which the individual is capable of self-control, i.e. prefers the bigger reward for the “future self” as compared to the smaller reward for the “present self”. This conceptualisation of self-control as “intertemporal – intrapersonal” behaviour leads to a comparison of self-control to altruism, which

could be defined as intratemporal-interpersonal behaviour or choices (Yi et al., 2011), because the subject chooses between the behavior beneficial in the current time to himself/herself and behaviour beneficial in the same time to another person. Dewitte and De Cremer (2001) point to the similarity of conflicts experienced by the individual in the case of self-control and the choices made in social dilemmas: (1) cooperation could be treated as self-control, because the option “not to cooperate” is more attractive than cooperation, but it may render the subject’s situation worse in the long term, and (2) reversely, self-control could be described as cooperation with one’s past or future self.

Those arguments validate the question about relation between self-control and altruism. Further in this text, based on the research on discounting and for a purpose of systematization of the results of those studies, we will consider several potential mechanisms of this relation such as cause and effect relation, a common mechanism (for formation of behavioural patterns), the role of intelligence as a variable linked to both self-control and altruism, and the role of psychological distance. The term altruism will be used in the context of economic choices, where the choice less favourable for the subject means a greater benefit for

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other people. This condition is met, among others, by the so called “cooperation” in social dilemmas.

Cause and effect

The first, most obvious mechanism is a simple relation between cause and effect, which can be expected when we refer to the idea of reciprocal altruism (Trivers, 1971) and social exchange. Social exchange (reciprocal altruism) is an unequal exchange of favours, where (1) the benefit gained by the subject who takes the role of recipient is greater than the cost suffered by this subject when he/she takes the role of a provider, and (2) the benefit is conditional upon an earlier cost (Cosmides and Tooby, 1992). A formalised model of reciprocal altruism is the “tit for tat” strategy in the repeated prisoner’s dilemma (Fig. 1). In this game each player can either cooperate or defect. Cooperation (as an option potentially less beneficial to the subject and more beneficial to the opponent) can be here perceived as an altruistic choice, while defection as an egoistic one. If both players select cooperation, each of them gains a better result ($CC=3$) than in a situation in which both players choose defection ($DD=2$). At the same time the highest payoff corresponds to the choice of defection when an opponent in fact cooperates ($DC=4$). The lowest payoff corresponds in turn to the choice of cooperation when a partner actually defects ($CD=1$). In a one-shot game, independently of the choice of the opponent, the outcome maximizing strategy is to defect. In an iterated version of the game, in which the same partners apply “tit for tat” strategy for a sufficiently long period of time, only mutual cooperation or mutual defection (which is however less beneficial to players than mutual cooperation) occurs.

Fig. 1. Payoff matrix of 2-person Prisoner’s Dilemma Game (points earned)

		Player B		
		C	D	
Player A	C	3 / 3	1 / 4	C = cooperates D = defects
	D	4 / 1	2 / 2	

Self-control makes it possible to give up direct benefits involved in selfish behaviour (if nothing else, there is no cost incurred) in the name of future benefits related to the reciprocity on the part of the person to whom help was given. Therefore, it seems that reciprocal altruism requires the capacity to delay gratification.

Thus, the process of reward discounting over time could be seen as a barrier to social exchange (Hawkes, 1992, 1993; Rachlin, 2000; Smith, 2010; Stevens and Hauser, 2004; Carter et al., 2012). The choice between cooperation and defection is, in fact, a choice between a greater, delayed reward and a smaller, instantaneous reward. Studies indeed show that people who discount their delayed rewards faster

(high rate of discounting means that the subjective value of a reward fast decreases with the delay) have more inclination to act selfishly in economic games. Harris and Madden (2002) established that there is a positive relation between the discounting speed and the proportion of defection choice in a 40-round prisoner’s dilemma (Pearson’s $r=0.41$, $n=31$). A similarly strong relation (depending on the size of discounted reward, Pearson’s r -values from -0.41 to -0.45 , $n=31$) between discounting rate and proportion of cooperation choices in a 60-round game was recorded by Yi, Buchhalter, Gatchalian and Bickel (2007).

In another study, Yi, Johnson and Bickel (2005) took into account, next to the speed with which delayed rewards are discounted, also the speed with which delayed losses are discounted; they also manipulated the size of the discounted amount and the type of strategy used by the computer (“tit for tat” strategy or random choices). Similarly to previously described studies, there was a relation between the rate of delay discounting and the proportion of cooperation (in 60 games) at -0.27 to -0.39 (Spearman’s ρ , $n=30$) depending on the size of discounted amount, but only when the computer used the “tit for tat” strategy. When the computer applied a random strategy, the ρ -values ranged from -0.19 to -0.01 and did not reach the level of statistical significance. Systematically and independently of the size of the reward occurring the impact of the computer’s strategy on the relation examined allows to speculate that tendencies to cooperate are not a permanent characteristic of people capable of delaying the gratification, but rather the ability to delay is a factor that determines the capacity to gain benefit from cooperation when cooperation is profitable. In the case of discounting of delayed losses, even stronger relations were established (ρ -values from -0.54 to -0.65), similarly for reward delay only under “tit for tat” strategy. This result in turn may show that cooperation in the prisoner’s dilemma has a stronger tie to the ability to suffer immediate loss to avoid greater losses in the future than with the ability to delay gratification.

Studies also looked at the relation between self-control and a decision made in a single public goods dilemma. Curry, Price and Price (2008) stated that the rate of delay discounting is correlated with the size of investment in public good at Pearson’s $r=-0.27$ ($n=96$). Jones and Rachlin (2009), in turn did not reach any statistically significant relationship between the size of investment and the discounting over time (Pearson’s $r=0.01$, $n=92$). There is no doubt, however, that the time factor must be involved in the public goods dilemma since the decision to cooperate requires suffering immediate loss in the name of a future benefit. So it is possible that it would be easier to prove a relation between the size of investment and the discounting of delayed losses. It is also worth noticing that in game conditions, the delay is small, and this could explain the inconsistency of the results. In real-world conditions, when it takes a longer time to create a public good, the rate of delay discounting could determine the decision to join cooperation to a much greater extent.

If there is a relation between the delay discounting and cooperation in the prisoner’s dilemma, then manipulation

of the time when the reward is received should affect that player's decision. For instance, when the temptation to gain immediate benefit related to the defection choice is eliminated, this should shift the choice proportions towards cooperation. Those anticipations were confirmed in a study performed on blue jays (*Cyanocitta cristata*) (Stephen, McLinn and Stevens, 2002). Birds playing against each other (but only one in a pair was making choices on its own, the second was forced to choose either C or D, according to its preprogrammed strategy) received food in line with a payoff matrix for the prisoner's dilemma either directly after they performed the reinforced reaction or cumulatively after several rounds of the game. As expected, in the second scenario where the possibility to be rewarded immediately was eliminated, the level of cooperation was higher. Another method of affecting the discounting process was used by Locey and Rachlin (2012) in the study performed on people. The method involved manipulation of the time between the player's choice to the partner's reply (the partner being a computer following the "tit for tat" strategy). The results reached by those researchers show that the level of cooperation goes up when this time is shortened, even with very low values of delay (from approx. 7 down to 1 second).

Curry and colleagues (2008) offer three explanations for the correlation between the ability to delay gratification and cooperation. Firstly, there could be a universal ability for self-control, expressed also in altruism/cooperation. In this approach, "patience" could be considered a condition to altruism. Secondly, there could be separate, domain-specific mechanisms for the delay, determining the discounting speed at a level favourable for a specific field, e.g. selection of food or social exchange. This possibility seems very likely in light of research pointing to an absence of mutual correlations between the rate of discounting of various types of delayed rewards (Jimura et al., 2011). Positive relationship between the rate of discounting in various domains may result from the fact that discounting in the both considered domains is under influence of the third variable, e.g. age or intelligence, which will be addressed in the further section. In this sense, the general speed of discounting becomes an abstractive measure to reflect the operation of a number of mechanisms. Thirdly, discounting cash rewards can engage the cognitive mechanism developed evolutionarily for the purposes of social exchange, because – as Dawkins (1996) put it – money is a formal "token of delayed reciprocal altruism" (p. 188).

Predisposition to learn behavioural patterns

According to Rachlin (2002), the relation between self-control and cooperation in a repeated prisoner's dilemma is visible on two levels. Firstly (as discussed in the earlier section), because the choice of a smaller reward leads to a more favourable situation in the next round, the current choice depends on the degree in which the reward from a future round is discounted over time. Furthermore, however, the participants of iterated prisoner's dilemma who follow the "tit for tat" strategy provide reinforcements

for each other. Choosing defection brings good results in the current round, at the same time, however, this results in a low outcome in the next round. In each round of the game, defection gives a higher result than co-operation, at the same time, however, a sequence of defections gives a worse result than a sequence of cooperation. For the payoff matrix in Fig. 1, a sequence of three choices to cooperate gives a higher result ($3 + 3 + 3 = 9$) than defection ($4 + 2 + 2 = 8$). Thus, the problem faced by a participant of the prisoner's dilemma is not a simple choice between a smaller reward available sooner and a greater reward available later, but a choice between the behaviour that is more rewarding as a single behavioural act and the behaviour which is more rewarding as a behavioural pattern. Hence, the "inherited tendency to pattern behaviour" (ability to form behavioural patterns) becomes the second level of relation between self-control and cooperation (Rachlin, 2000, 2002, 2015; Rachlin and Locey, 2011). According to Rachlin's hypothesis, throughout their entire life people gain experience which indicates that creating behaviour patterns, which cover increasingly longer periods of time, is worth the effort even though the consequences of single acts making up those patterns could be little attractive. This mechanism is supposedly responsible for both increasing self-control with age (Green, Fry and Myerson, 1994; Olson, Hooper, Collins and Luciana, 2007; Scheres et al., 2006; Steinberg et al., 2009), and for altruism. In line with this vision, people deal with situations that have the structure of prisoner's dilemma, learn to recognise those situations and learn that cooperative behaviour system in such situations is rewarded (primarily with reciprocity, but also, for example, with approval), while selfishness is punished (with refusal to cooperate, ostracism). Consequently, another common element between mutual altruism and self-control is the fact that in both cases we are dealing with reinforced behaviour *pattern* (Rachlin and Locey, 2011).

Rachlin's theses could be empirically confirmed by the results achieved by Brown (Brown and Rachlin, 1999), which show that the "patterning" solution, involving planning several choices ahead (which strengthens self-control), applied to the prisoner's dilemma (planning choices in several rounds in advance), increases the level of cooperation. Rachlin (2000; Baker and Rachlin, 2002) anticipated also the effect discussed in the previous paragraph, namely manipulation of interval between game rounds – shortening those breaks should be favourable to perceiving the series of rounds as a functional whole. On the other hand, however, contrary to Rachlin's expectations, it was established that in a game where rewards were paid off on a "tit for tat" basis (i.e. choice of a greater reward out of the two possible caused a less attractive pair of rewards available in the next round, but the tested person was aware that he/she is playing against him/herself), the extending of the breaks between the rounds (from 1 to 20 seconds) enhances self-control (Fantino, Gaitan, Meyer and Stolarz-Fantino, 2006). Such a result may indicate that contrary to formal similarities in the structure of self-control problem and repeated prisoner's dilemma, the

psychological mechanism for performing choices is entirely different.

Intelligence as a moderating factor

Intelligence is among key variables that determine how an individual operates. Studies' results show that intelligence is also involved in self-control and altruism, so it should not be missing in our analysis. Shamosh and Gray (2008) performed a meta-analysis covering the results of 24 studies and stated that the rate of delay discounting is negatively correlated with the level of intelligence (i.e. individuals with higher intelligence show a greater degree of self-control). The mechanism behind this relation is unclear. As the rate of delay discounting increases when working memory is burdened (Hinson, Jameson and Whitney, 2003), the reasons for this relation could be sought in the working memory's contribution to intelligence, which involves maintaining an active vision of the goal and integration of information (Shamosh and Gray, 2008). In turn, Shamosh and Gray (2008) shows that the correlation between intelligence and discount rate is only slightly higher among studies that measure both verbal and non-verbal intelligence, compared to studies that measure only verbal intelligence. We can consequently assume that it is primarily a high level of verbal intelligence that supports the use of verbal strategy facilitating the maintenance of self-control (Olson, Hooper, Collins and Luciana, 2007).

As regards altruistic behaviour, Millet and Dewitte (2007) stated that individuals whose contribution in the public goods dilemma ranks above the minimum required to gain collective commission get higher results in Raven Advanced Progressive Matrices test than subjects who invest below minimum and subjects who invest exactly the minimum. Dewitte and De Cremer, 2005 (as cited in: Millet and Dewitte, 2007) also determined that students who invest in public good above the minimal contribution have better grades than students who invest at a minimum level or below it, and this also works in favour of a relation between altruism and intelligence (to the extent in which the grades are related to intelligence). The same conclusion can be reached by following the meta-analysis performed by Jones (2008), covering the results of research performed on American students over several decades (the relationship between school's average Scholastic Assessment Test score and level of cooperation in economic games has been found). Segal and Hershberger (1999) too, in a study concerning twins, determined a relation between Wechsler test results and choices in iterated prisoner's dilemma – as the players' intelligence grows, cooperation is simultaneously selected more often (Pearson's $r=0.31$, $n=93$) and mutual defection less often ($r=-0.27$). Similar to self-control, it is not clear what mechanism ties altruism to intelligence.

One of the possible interpretations is Zahavi's handicap hypothesis (1975, 2003). Under this concept, sharing can be treated as an costly signal of access to resources (Millet and Dewitte, 2007) or, directly, as a signal

of intelligence, which is an important criterion in sexual partner selection (Buss, 1994). Both explanations, although they assume different functional relations, are based on the empirically documented relationship between intelligence and material situation. Studies show that the level of intelligence is a predictor of social and economic situation and is a better forecast indicator than the parents' status (Gottfredson, 2004), but also that intelligence measured in childhood and at adult age turns out to be a predictor of social status, occupation and income (Judge, Higgins, Thoresen and Barrick, 1999). Indirectly, the relation between intelligence and access to resources can be indicated by the correlation between the level of general intelligence and offspring mortality rate (Čvorović, Rushton and Tenjevic, 2008) and life expectancy (Gottfredson and Deary, 2004; Rushton, 2004). Thus, we can assume that more intelligent individuals gather more resources and therefore can share those resources more often and more generously. In this approach, altruism and self-control are linked only to the extent to which the intelligence determines both those phenomena.

Psychological distance

As follows from section devoted to the learning of behavioural patterns, according to Rachlin (2000) the source of altruism is the balance between one's own short-term and long-term interest (the balancing occurs in line with the function of discounting over time). However, that author points to yet another source of altruism – balance between one's own interest and the interest of other people (balancing in line with the function of social discounting) (Rachlin, 2000; Rachlin and Locey, 2011). Just like the process of discounting over time determines the attractiveness of delayed reinforcements which are a consequence of acts of altruism (e.g. social approval, reciprocity), the process of social discounting determines the attractiveness of rewards for other people, depending on the social distance between the subject and those people. The value of those rewards can be modeled as a hyperbolic function of the distance (Jones and Rachlin, 2006; Rachlin and Jones, 2008). In the approach taken by Rachlin and Jones (2009), both discounting over time and social discounting is linked to "extended self" – discounting of delayed rewards depends on the self's extension in time, while social discounting – on the self's extension in social space; just like one can miss the relation between the self now and the self in the future, it is also possible not to see the actually existing relations between one's own interest and that of other people. As the social distance grows, those mutual relations and links become more difficult to see. So self-control depends on the self extended in time, while altruism – on self-control and the self extended in social space.

Trope and Liberman (2003) assume in their construal level theory that time and social distance are examples of dimensions that make up psychological distance understood as the level of specificity of mental constructs. Since construal abstraction increases as a function of temporal

and social distance, events distant in time or in the social dimension are less real to the subject. This means that the relation between social discounting and time discounting could be boiled down to the importance of representation level – the abstract representation of “future self” and a person with high social distance can be similar, and this means that the choice between present self and future self (delay discounting) resembles the choice between the present self and another person (social discounting). Thus the fact that the subjective reward value is a delay function can be interpreted as favouring the “present self” against the “future self”, which can lead to the statement that people tend to treat their “future self” as a different person (Pronin et al., 2008) and to the expectation that people who treat their “future self” better tend to treat other people better as well. The studies of economic choices discussed in the first section (Curry, Price and Price, 2008; Harris and Madden, 2002; Yi et al., 2007; Yi et al., 2005) confirm the existence of such a relation. Furthermore, in line with the above expectations, Jones and Rachlin (2009), in their study which involved typical measuring of discounting speed based on questionnaires, established a positive relation between the rate of discounting over time and the discounting in social space (Pearson’s $r=0.28$, $n=93$), while Garon et al. (2011) stated that the more preschoolers discount over time, the more they favor (share their favourite toys) friends over non-friends (max $r=0.31$). This second outcome in particular should be considered important, because it pertains to actual behaviour towards real people (so we can believe that we are not dealing only with an artifact resulting from a similar construction of tasks in the questionnaire used to measure the rate of social and time discounting) and refers to nepotism, which is the essence of social discounting (low speed of social discounting is the wider self covering also those who are socially distant).

It is also known that through manipulations in the delay dimension one can affect the social discounting rate – delaying the reward for oneself and other person by the same amount of time shifts the preference towards a reward for another person (Yi et al., 2011). This effect can be easily explained with delay discounting – delaying a reward for oneself results in a decrease in its subjective value, which makes it easier for one to forgo it to the benefit of another person. However the concept of “extension of self” in time and social space, put forth by Rachlin and Jones (2009) and the construal level theory (Trope i Liberman, 2003), provides an incentive to consider more subtle relations between altruism and delay discounting. Based on those two concepts, we can expect that delaying rewards in a situation where a choice is to be made between the reward for oneself and the reward for someone else, will result in greater altruism in a degree dependent on the social distance between the subject and the other person (recipient). If the recipients who rank high on the social distance list are a part of the wider, extended “self” to a higher degree than those who take a distant rank, then the same reward delay should equally discount the value of reward for oneself and for someone close, and to a greater

degree reduce the value of reward for oneself as compared to a reward for a distant person. A useful contribution to such considerations has been made by the construal level theory (Trope and Liberman, 2003). It has been shown that an increase in the distance in one psychological dimension, decreases the sensitivity of the subject to distance in another (Maglio, Trope and Liberman, 2012). Delaying a reward should then result in a steeper decrease in the reality of reward for oneself than in the case of a reward for another person (that, due to the social distance, is represented at a low level of concreteness). As a result, we can expect that delaying rewards when the choice is between a reward for oneself and one for another person enhances altruism and the extent of that enhancement is dependent on social distance between the subject and the other person. This expectation was confirmed empirically (Osiński and Karbowski, 2017), and this shows that the conceptualisation of the issue of relation between self-control and altruism, as outlined in this paper, can be useful.

Conclusions

The results of studies discussed in this article show that there is a relationship between (1) delay discounting and altruistic behaviour operationalized as choices made in economic games and (2) social discounting what may lead to the conclusion that people who treat better their “future self” tend to treat better other people as well. However, it is not fully clear what are the grounds for the above relationship. The explanations presented were arranged rather arbitrarily, so they should not be considered separately. For instance, the role of intelligence – to which a separate section was devoted – could become a part of the explanation provided in the section on cause and effect relationship. Individuals with a higher intelligence level find it easier to take a wider, more long-term perspective, which helps them go beyond the instantaneous benefits connected with selfishness (Millet and Dewitte, 2007). This way, the psychological availability of altruistic behavioural strategies could be greater in the case of more intelligent people. Similarly, the connection between social discounting and time discounting as discussed in the section on social distance could be sought in the common mechanism dimension – the ability to form behavioural patterns.

In the presented areas of research there are still numerous gaps, e.g. only few studies addressed the relationship between altruism and discounting of delayed losses and the exploration of that relationship seems to be strongly justified (since altruism demands bearing of immediate cost, the persons unwilling to bear it would not engage in altruistic behaviour). The deeper exploration of the relationship between altruism and discounting of probabilistic rewards is also required. First, it is known that the rate of delay discounting is positively correlated with the rate of discounting of probabilistic rewards (Jones and Rachlin, 2009; Myerson, Green, Hanson, Holt and Estle, 2003). One of the possible interpretations of the above relationship says that delayed rewards are burdened with

uncertainty, so probability discounting may be primal process in relation to delay discounting. Second, Jones and Rachlin (2009) demonstrated a relationship between the rate of discounting of probabilistic rewards and investments made in public goods game (Pearson's $r = -0.27$, $n = 93$). Considering the problem structure in the public goods dilemma (uncertain outcome due to inability to affect decisions made by other players), this relation seems even more understandable than the relation to the speed, with which delayed rewards are discounted. Moreover, Jones and Rachlin (2009) observed the relationship between probabilistic and social discounting (Pearson's $r = 0.334$, $n = 94$) interpreted by Rachlin as altruism. The results of studies also show that both processes change in the identical way dependently of the manipulation of the size of the reward: in social and probability discounting large rewards are discounted faster than small rewards, in contrast to delay discounting in which the large rewards are discounted slower (Myerson et al., 2003). It may mean that altruism is to a higher extent associated with probability discounting rather than delay discounting.

The conceptualisation proposals discussed open the path for subsequent hypotheses. For instance, the fact that a delay of reward reduces the rate of social discounting and this happens pro rata to the distance between the subject and the beneficiary (Osiński and Karbowski, 2017) begs the question about the importance of the self-control level in this process. Based on the idea of "extended self", presented by Rachlin and Locey (2011), we could expect that giving up the reward for oneself should be less problematic for people who do not see a relation between their "present self" and "future self", namely people characterized by fast delay discounting. This would mean that the relation between self-control and altruism could prove to be more complex than would follow from the thesis maintaining that those who treat their "future self" better, treat other people better as well.

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