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SENSITIVITY TO MEASUREMENT ERRORS IN STUDIES ON PROSOCIAL CHOICE USING A TWO-CHOICE PARADIGM

Abstract. Research on prosocial behaviors in primates often relies on the two-choice paradigm. Motoric lateralization is a surprisingly big problem in this field of research, as it may influence which lever will ultimately be chosen by the actor. The results of lateralization studies on primates do not form a clear picture of that phenomenon, which makes it difficult to address the problem during research. The authors discuss possible ways of managing this confounding variable.

Keywords: prosocial behaviour, two-choice paradigm, motoric lateralization, primates.

1. The main trends of comparative psychology and cognitive ethology

Comparative psychology (as well as evolutionary psychology and cognitive ethology) is based on the theory of evolution and thus focuses on the evolution of mind functions. What with there being many mind functions, researching them involves various fields and methods (Trojan, 2013). Moreover, many different mind functions can be used in a particular situation simultaneously. In spite of technological advances, behavioral sciences do not have direct access to the mind they aim to study. Regardless of which

species is being studied, comparative psychology has no other option but to study the functioning of the mind through observable behaviors. In his monograph on animal minds (Griffin, 2004), Donald R. Griffin, one of the pioneers in this field, pointed to three areas of study that may yield the best results:

- First of all, it is necessary to focus on finding neuronal correlates of mind functions, such as in the research on P300 wave (Comerchero, Polich, 1999), mirror neurons (Keysers, 2010; Rizzolatti, Craighero, 2004), or blindsight (Cowey, Stoerig, 1995).

- Secondly, research should be conducted on animal communication, with the assumption that communication is a process where there is a sender coding the message, an appropriate channel through which the message is transferred, and a receiver who decodes the information. During interactions between sender and receiver it is much easier to observe the functioning of the mind than if only the behavior of one subject is being observed. A good example of such studies is provided by experiments done on a large group of chimpanzees (Fouts, Fouts, Van Cantfort, 1989; Fouts, Waters, 2002).

- Thirdly, it is advisable to use controlled balanced choice conditions. This method is especially interesting to us because of the particular character of research on prosocial behavior, and more specifically, the prosocial choice paradigm. The researched subject should be able to choose one option over another (two choice paradigm). In such cases we study the decisions of one subject and its free choice of alternative behavior is indicative of either the presence or absence of a specific deliberate decision.

2. Prosocial behavior and the main methods of measurement in the study of social animal behavior

Prosocial behaviors are one of the areas of interest for researchers studying the evolution of the mind. Both experimental research and observations in the natural environment have shown so far that among many species there is a tendency to help each other, share resources or protection. This kind of behavior is possible in the case of animals creating specific social groups that involve, at least to some extent, the application of the theory of mind as well as memory processes and decision making.

Research on prosocial behavior within large social groups that are comprised of distantly related individuals is mainly based on the theory of reciprocal altruism by Robert Trivers (Trivers, 1971).

This theory assumes that reciprocal altruism emerges in groups with a high incidence of interactions (otherwise, selfish behavior prevails). It also requires good memory of past social situations.

The basic assumption, however, is that the behavior of the altruist must be less costly than what the beneficiary gains. This way the altruist does not risk too much, even if the other party actually cheats. It is therefore necessary to find within research on prosocial behavior forms of help that are a small enough strain on the part of the altruist that both partners in the social game tended to offer help easily.

Research findings suggest that many social animals demonstrate prosocial behaviors, both in the laboratory and in natural conditions (de Waal, 2008; Dugatkin, 1997; Kappeler and van Schaik, 2006; Price and Brosnan, 2012; Bräuer and Hanus, 2012). Research on altruism is done within one of two experimental paradigms: targeted (or instrumental) helping and prosocial choice paradigm. The aim of research conducted within the targeted help is to find out whether the animal will help another subject solve a task that is not easy to solve on one's own. For instance, such help may consist of handing the other animal a tool which may be used to access the reward. The point of prosocial choice is the possibility of granting another subject some kind of profit, with little to no effort on the part of the research subject. To put it simply, the animal has two options: one results in both participants receiving a reward (altruistic choice), the other rewards only the subject who makes the choice (selfish choice). It is essential to make sure that the value of the reward is the same regardless of the choice. Thus the prosocial choice does not involve any economic cost, only slight to moderate effort. This method of studying prosocial behavior is currently the most popular in behavioral sciences and its application across species has led to the discovery of important differences between them.

3. Problems with the paradigm of prosocial choice

In the literature, the subject that makes a choice is called an actor or benefactor, and the passive subject is called a beneficiary, recipient or observer (Szymańska, Sikorska, Durka, Trojan, 2014). It is worth emphasizing that it is essential in this kind of research to create conditions in which the subject receives a reward of identical value regardless of the choice made. Thereby altruistic choice is reduced to a moderate physical effort (e.g. pulling a lever or passing a token). Propensity for altruistic be-

havior in experiments conducted within the prosocial choice paradigm has been observed in platyrrhine New World monkeys (capuchins): Lakshminarayanan, Santos, 2008; de Waal, Leimgruber, Greenberg, 2008; Takimoto, Fujita, 2011; Takimoto, Kuroshima, Fujita, 2010; de Waal, 2008; marmosets: Burkart, Fehr, Efferson, van Schaik, 2007; cotton-top tamarins: Cronin, Schroeder, Snowdon, 2010; and Macaca (java macaques): Massen, van den Berg, Spruijt, Sterck, 2010. On the other hand, it seems that when it comes to the species which is the closest to us in the evolutionary sense, the chimpanzee, the tendency to behave in a prosocial manner becomes particularly problematic and sensitive to the slightest increase in the costs borne by the actor, even if the cost is a relatively slight physical effort. For example, chimpanzees, as opposed to capuchins, do not produce prosocial behaviors during lever-pulling tasks (pulling one equals a prosocial choice, the other – a selfish one; Jensen, Hare, Call, Tomasello, 2006) or if a rope needs to be used at the same time (Silk et al., 2005; Vonk et al., 2008). However, when tokens are used instead of levers (containers filled with plastic elements in two colors of the same number are placed in the cage and the actor is supposed to hand those over to the experimenter), the tendency to choose tokens of the color assigned to the prosocial choice becomes more apparent (Horner, Carter, Suchak, de Waal, 2011), although even in token research the results were very differential. Why does it happen? Presenting a subject with a choice between two options assumes that only one of those means an altruistic choice, and the other – a selfish one. In the case of such an alternative, a random choice comes with a probability of $p = 0.5$. Such probability can be recorded when a subject is not making a deliberate decision, but chooses randomly, does not understand the task, or the cost of the altruistic behavior is too high because of an uncontrolled confounding variable. The only time that a result of circa $p = 0.5$ in research on prosocial choice can be obtained is from the control group. When the subject that is making a choice remains alone and has no one to present its attitude to, we expect the choices to remain at this level of probability. The reason for this is that every choice involves a reward for the subject making the effort, regardless of the chosen option. However, in an experimental situation expectations are quite reverse. In such case we expect a certain attitude. Either altruistic or selfish choices should prevail, otherwise if the subject behaves with ambivalence we are not able to say anything about its altruistic or selfish tendencies.

4. Interference motor lateralization in studies using the paradigm of prosocial choice

The key to understanding the high variance of heterogenous results of research on chimpanzees is how sensitive the scientific method is to the functional asymmetry of the brain in the chimpanzee that results in them chiefly being right-handed.

Motoric lateralization is a surprisingly big problem in two-choice paradigm research. If our aim is to observe behavioral indicators of decision-making processes in the laboratory, we need to create such options for the subject that will be absolutely equal in terms of the exhibited behavior. However, such a solution works well only at the theoretical level. In reality, if we choose a classic choice test – the T-maze for rats (Olton, 1979), – and make sure that the apparatus is symmetrical, appropriately lit and cleaned very well, it seems that the condition of equality of options should be fulfilled. However, what if rats with certain motoric lateralization tend to choose one arm of the maze over the other (Zięba, Poloński, 2012)? That dilemma appears in practically all possible situations that can be arranged within the two-choice paradigm. Lateralization in a chimpanzee may influence which lever will be chosen more often, even after having ascertained that it requires exactly the same amount of effort to pull each of them (Jensen, Hare, Call, Tomasello, 2006). We have observed a similar problem in our own research (still in progress) on prosocial choice among chimpanzees living in the City Zoological Garden in Warsaw. In our study, the subjects can pass tokens of one of two colors. A large number of tokens is available in the food dispenser. Passing a red token results in food being available for the actor, passing a green one means that not only the actor receives food, but the other subject who does not have access to tokens and are at the mercy of the actor with access to tokens (Szymańska, et al., 2014). However, as we were able to check, it is enough to separate tokens physically (psychologically at the same time as well perhaps?) into two piles of five per color, for the effect of lateralization to manifest itself fully. The tested chimpanzees (especially males) tended to choose tokens from one pile only – the one with the easiest access for the dominant hand. We would obtain single-color distributions lasting up to 10 days during a single study. Even though the distance between the piles was only 10 cm, strong lateralization obscured the prosocial preferences of the chimpanzees completely.

Similar concerns about the results being possibly distorted were disclosed in a study by Horner, Carter, Suchak, de Waal (2011). Distortions of the distribution of passed tokens were clearly caused by constant use of the

same dominant hand (for all tested animals it was the same, right, hand). It is possible that strong motoric lateralization influences the choices made in experiments where chimpanzees had to use more complicated equipment such as rods, pushbuttons, or ropes. When using tokens, the only way is to mix them thoroughly after every choice. Despite the fact that a large number of studies on this kind of lateralization in primates is available in literature, the results do not form a consistent picture of that phenomenon (Fitch and Braccini, 2013). They suggest that occurrence of hand preference depends on many factors, such as the kind and difficulty level of the task, gender, age, etc. (Fagot, Vauclair, 1991). Because of the high genetic kinship they share with humans, chimpanzees have been largely the focus of research on motoric lateralization in primates. Many results prove that right-handedness exists in the population of this species that live in captivity (e.g. Hopkins, 1993). Meanwhile, though, observations from field studies do not lead to the same conclusions, which makes forming unequivocal conclusions rather difficult. Some studies prove that in the case of many activities chimpanzees manifest right-handedness at the population level (for instance, reaching for an object (Olson, Ellis, Nadler, 1990), eating (Hopkins, 1994), crawling (Hopkins, Bard, Griner, 1996), grooming (Hopkins, Russell, Rekmus, Freeman, Schapiro, 2007). On the other hand, in field studies preference for the left hand was observed at the population level when it comes to catching termites, but the right hand was preferred for splitting nuts (Lonsdorf, Hopkins, 2005).

5. Conclusion

This heterogenous picture of available data renders it necessary to ensure that the subject have the most symmetrical situation where all possible confounding variables are controlled, if one is to take advantage of the two-choice paradigm while avoiding artifacts. And therefore, firstly, it is necessary to strive for maximum symmetry between two behavioral choices. In the case of the abovementioned method using tokens placed in a container, it would suffice to mix tokens after every trial in such a way, that no two separate piles of different colors would form and that they would be spread equally throughout the dispenser. It seems that the use of levers or pushbuttons arranged in various patterns will always reveal the influence of motoric lateralization on the frequency of such objects/manipulators being used.

Another important issue in research conducted within the two-choice paradigm is compulsory use of a control group. Only when we check how

a chimpanzee passes the tokens with no companion present, can we be sure that the choice is not motivated by the color of the token or any other clue. Perhaps the best option would be to create a new alternative method of studying prosocial behaviors in primates, one that would eliminate completely the influence of lateralization and would engage other kinds of behavioral indicators.

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