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Effects of friendship and social status on resource allocation”

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Niklas Aaron Hungerländer, B.Sc.

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Dr. Lisa Horn

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Table of contents

Abstract	7
1. Introduction	11
1.1 Evolution of cooperation.....	11
1.2 Development during ontogeny.....	13
1.3 Research goals	20
2. Methods.....	21
2.1 Ethical approval and recruitment	21
2.2 Participants.....	22
2.3 Group observation.....	22
2.4 Questionnaires	23
2.5 Monopolization experiment	24
2.6 2D:4D ratio measurement	24
2.7 Resource allocation experiment	25
2.7.1 Apparatus	26
2.7.2 Setup and experimental design.....	27
2.8 Procedure	29
2.9 Experimental schedule	30
2.10 Data analysis	31
3. Results	34
3.1 Prosocial tendencies.....	34
3.2 Effects of different factors on prosocial choices.....	35
3.3 Additional effect in-between factors.....	37
4. Discussion	39
4.1 Effects of different factors on prosocial choices.....	41
4.1.1 Friendship.....	41
4.1.2 Interaction partners.....	42
4.1.3 Social status.....	43
4.1.4 Prenatal exposure to androgens.....	44
4.2 Additional effect in-between factors.....	45
4.3 Limitations	46
4.3.1 Monopolization experiment	46
4.3.2 Group observation.....	46
4.3.3 Inequity aversion.....	47
4.4 Conclusion	47
5. References	49
6. Appendices	53

Abstract

Humans frequently help nonrelatives and they do so even in cases where interactions are unobserved or unlikely to be repeated. This so-called prosocial behaviour seems to be developed fully by the age of 6 years. However, questions about which factors may modify prosocial behaviour at that age remain unresolved. Here I used a resource allocation paradigm to test prosocial behaviour in primary school children at the age of 6-9 years. Children could allocate a valuable resource (i.e. stickers) to themselves and to a same-gender receiver from their class. They had to decide between a selfish option (i.e. only one sticker for themselves) and a prosocial option (i.e. one sticker for themselves and one for the receiver). In order to prevent potential cueing by the experimenter, I used an apparatus that needed only limited instructions and no normative rules. I tested whether friendship, social status and prenatal androgen exposure (measured by 2nd to 4th digit ratio; 2D:4D ratio) had an influence on prosocial behaviour. I found a non-significant negative trend between within-class status and prosocial behaviour: Children with lower social status tended to choose the prosocial option more during the test. I found a non-significant positive trend between 2D:4D ratio and prosocial behaviour. Low levels of both prosocial behaviour and prenatal androgen exposure were correlated with a higher number of within-class interaction partners in girls. However, I found no effect of friendship on prosocial behaviour. My results give hint to the existence of factors modulating prosocial behaviour in children at the age of 6-9 years.

Keywords: prosociality, primary school children, friendship, status, prenatal androgen exposure

Zusammenfassung

Menschen helfen häufig Fremden und sie tun dies auch wenn die Interaktionen unbemerkt sind oder es unwahrscheinlich ist, dass diese wiederholt werden. Dieses so genannte prosoziale Verhalten scheint im Alter von 6 Jahren voll entwickelt zu werden. Allerdings bleiben Fragen, welche Faktoren das prosoziale Verhalten in diesem Alter verändern können, ungelöst. In dieser Studie habe ich ein Ressourcenzuweisungs-Paradigma verwendet, um das prosoziale Verhalten bei Grundschulkindern im Alter von 6-9 Jahren zu testen. Kinder konnten eine wertvolle Ressource (d.h. Sticker) sich selbst und einem gleichgeschlechtlichen Empfänger aus ihrer Klasse zukommen lassen. Sie mussten zwischen einer egoistischen Option (d. h. nur einen Sticker für sich selbst) und einer prosozialen Option (d. h. einen Sticker für sich selbst und einen für den Empfänger) entscheiden. Um ein mögliches Cueing durch den Experimentator zu verhindern benutzte ich einen Apparat, bei dem nur begrenzte Anweisungen und keine normativen Regeln notwendig waren. Ich testete ob Freundschaft, sozialer Status und pränatale Androgen Exposition (gemessen am 2. bis 4. Ziffernverhältnis, 2D:4D-Verhältnis) einen Einfluss auf das prosoziale Verhalten hatten. Ich fand einen nicht signifikanten negativen Trend zwischen innerhalb-Klassen-Status und prosozialem Verhalten: Kinder mit niedrigerem sozialen Status wählten die prosoziale Option öfter während dem Test. Ich fand einen nicht signifikanten positiven Trend zwischen 2D:4D-Verhältnis und prosozialem Verhalten. Niedrige Werte von prosozialem Verhaltens als auch von pränataler Androgenexposition, waren mit einer höheren Anzahl von Interaktionspartnern bei Mädchen korreliert. Allerdings fand ich keinen Einfluss von Freundschaft auf das prosoziale Verhalten. Meine Ergebnisse geben einen Hinweis auf die Existenz von Faktoren, die das prosoziale Verhalten bei Kindern im Alter von 6-9 Jahren modulieren.

1. Introduction

To help other individuals voluntarily is a common trait in humans. If donor and receiver of help are relatives their behaviour could be relatively easily explained by kin selection. Kin selection states that by helping relatives, chances that one's genes are successfully passed to the next generation are increased (Hamilton, 1964). However, humans also frequently help nonrelatives by showing prosocial behaviour. Prosocial behaviour is defined as actions intended to benefit one or more people other than oneself by helping, comforting, sharing or cooperating at no, or low costs (Batson, 1998). It is part of our everyday life, whether we vacate a seat on a crowded bus, hold open a door for others, pick up dropped items for others or donate to a charity. Not surprisingly, scientists seek to get a deeper insight into the mechanisms and evolution of prosocial behaviour. This goal can be achieved via two steps: First, by examining how the human ability to cooperate develops during ontogeny and second, how it has evolved over time.

1.1 Evolution of cooperation

Authors have claimed that social alignment (e.g. alignment with other individuals and the group) forms the base of human prosociality (Jensen, Vaish, & Schmidt, 2014). They argued that social alignment evolved in two steps: In a first step, humans became obligate collaborative foragers such that individuals were interdependent with one another and therefore had a direct interest in the well-being of their partners. In this context, they evolved new skills and motivations for collaboration and they helped their potential partners. In a second step, these new collaborative skills and motivations were scaled up to group life in general, as humans faced competition with other groups. As part of this new group mindedness, they created cultural conventions, norms, and institutions (Tomasello, Melis, Tennie, Wyman, & Herrmann,

2012). It has been shown that individuals who act more prosocially are more likely to be selected as mates (Goetz, Keltner, & Simon-Thomas, 2010). Moreover, prosocial behaviour is rewarded by some additional evolutionary benefits. Studies suggest that people help individuals, who offer help, more willingly (Boster, Fediuk, & Ryan Kotowski, 2001) and offering help increases one's status and reputation within one's community (Wedekind & Braithwaite, 2002). In summary, prosocial behaviour could be a successful strategy in order to identify other cooperative individuals among the population, where partner choices can turn strangers into interaction partners (Raihani & Bshary, 2015).

Despite those findings, recent studies suggest that prosocial behaviour is not uniquely human. Prosocial behaviour has been shown in different non-human species, including bonobos, chimpanzees, gorillas, capuchins, marmosets and macaques. (Burkart, Fehr, Efferson, & Schaik, 2007; de Waal, Leimgruber, & Greenberg, 2008; Pelé, Dufour, Thierry, & Call, 2009; Massen, Luyten, Spruijt, & Sterck, 2011, Horner, Carter, Suchak, & de Waal, 2011). However, Cronin (2012) pointed out that these studies are barely comparable with each other, because of methodological differences. The author claims that making results comparable, especially the extent of prosocial behaviour, is essential to reconstruct the evolutionary origins of prosocial behaviour.

Therefore, Burkart & van Schaik (2013) addressed this issue by using an identical experimental design testing prosocial behaviour in three different species. They introduced the "group service paradigm", where individuals were tested in their social group and could provide fellow group members with food although not obtaining any food for themselves. The authors tested independently breeding Japanese macaques, cooperatively breeding common marmosets and capuchin monkeys with an intermediate breeding system. They showed that prosocial behaviour was slightly higher in marmosets than in capuchins and much higher in both compared to macaques. The authors concluded that prosocial behaviour was positively

correlated with the extent of cooperative breeding. In a further study Burkart et al. (2014) conducted the “group service paradigm” to test 15 primate species, including human children at the age of 4 to 7 years. Again, they found that prosocial behaviour was positively correlated with the extent of cooperative breeding within a species, with humans being the most prosocial.

Further evidence for this finding and for the existence of prosocial behaviour in non-primate species comes from Horn, Scheer, Bugnyar, & Massen (2016). The authors found that azure-winged magpies, a cooperatively breeding corvid, showed prosocial behaviour. In contrast, prosocial behaviour wasn't found in territorially breeding ravens (Massen, Lambert, Schiestl, & Bugnyar, 2015) and only limited in colonially breeding jackdaws (Schwab, Swoboda, Kotrschal, & Bugnyar, 2012).

In summary, several studies have shown that prosocial behaviour has not just emerged in humans, but is rather present in several species. To get further insights into both the evolution of prosocial behaviour and its predictors, comparison between species is crucial.

1.2 Development during ontogeny

Researchers have spent much effort to investigate how prosocial behaviour develops during ontogeny. The number of published studies on prosocial behaviour in infants and children have literally exploded in the last few years. Reclusively, 20% of all studies on prosocial behaviour in children (0-12 years) were published in the last 6 years (Davidov, Vaish, Knafo-Noam, & Hastings, 2016).

As a result, the ability to behave prosocially has been broadly studied in children. Recent studies suggest that prosocial behaviour emerges very early in ontogeny, with some researchers arguing that it is a biological predisposition in humans (Warneken & Tomasello, 2009). By the

age of 14 months, infants already help in simple tasks when it is not costly for them to do so, such as handing a pleading person out of reach objects (Warneken & Tomasello, 2007). However, at this age prosocial behaviour is indiscriminate and limited to simple helping tasks. By the age of three, children behave more selectively by punishing or withdrawing cooperation from bad social partners (Warneken & Tomasello, 2013).

Sharing behaviour is elicited much later in childhood, because prosocial tendencies as well as cognitive capacities need to further increase. It has been shown that children failed to engage in equal sharing until the age of seven to eight years in a costly sharing task (Smith, Blake, & Harris, 2013).

This finding is in accord with those of Fehr, Bernhard, & Rockenbach, (2008). The authors used a resource allocation paradigm to test prosocial behaviour in children. Also, to get a more holistic view of the development of prosocial behaviour they tested three different age groups, between three and eight years. The subjects had to allocate units of sweets to themselves and/or to a receiver. Three treatments were performed: In the “prosocial” treatment, subjects had to decide whether to allocate one sweet to themselves and one to the receiver or one sweet only to themselves and none to the receiver (1:1 vs 1:0). In the second treatment, the so-called “costly sharing”, subjects had to choose whether to allocate one sweet to themselves and one to the receiver or two sweets to themselves and none to the receiver (1:1 vs 2:0). In the third “envy” treatment, subjects had to choose whether to allocate one sweet to themselves and one sweet to the receiver or one sweet to themselves and two to the receiver (1:1 vs 1:2). Additionally, an in-group and an out-group condition was performed across subjects in order to examine the question whether social relationships had an impact on prosocial behaviour. Conditions were indicated by group photos: in the in-group condition, the group photo showed the members of the subject’s kindergarten or school, whereas in the out-group condition it showed the members of a different kindergarten or school. The authors used the group photos

consciously, in order to rule out reciprocity expectation towards the receiver. The photos excluded the possibility that children behave prosocially because of the expectation of future benefits from the receiver that accrue as a result of prosocial behaviour in the current interaction.

Fehr et al. (2008) found that at age 3 to 4 the majority of children behaved selfishly, whereas at age 7-8 they most showed prosocial behaviour. Furthermore, children showed different behaviour dependent on whether they had to allocate to the in-group or out-group. In both, the “prosocial” and “costly” sharing treatment, children chose the egalitarian choice more often if the partner was an in-group member. Besides, the difference between sharing in the in-group and out-group conditions strongly increased with age. Children of 7-8 years of age showed a very strong in-group bias with very little willingness to share with an out-group member.

However, there are several limitations of their experimental setup when aiming for methods which enable a comparison between species: First, to represent the receiver only photos were used. This setup had the disadvantages that social relationships among children could not be adequately represented and no real-life interaction between donor and receiver was possible. Second, there was no physical barrier which prevented the child from collecting all sweets available. Therefore, children received detailed instructions and normative rules from the experimenter of how the resource allocation paradigm worked and what they must not do. Thus, experimenter bias cannot be excluded. Additionally, the use of explicit instructions also makes the methods less comparable with other species.

Burkart & Rueth (2013) conducted a study which sought to avoid the limitations of the study conducted by Fehr et al. (2008). Children at 2-5 years of age were tested in a real life situation by using the same methods that have been used with chimpanzees and by applying the

resource allocation paradigm. They overcame the limitations of Fehr et al. (2008) by using a setup where children had not to be verbally instructed. At the same time they conducted a pre-test in order to make sure that the children understood the consequence of their choices.

The authors got divergent results. Children did behave prosocially only in the “costly sharing” treatment (0:0 vs 0:1), but not in the “prosocial” treatment (1:0 vs 1:1). However, this study had two limitations: First, by using a side by side setting, children may not have paid attention to the receiver’s payoff in the “prosocial” treatment, since they were only focused on their own payoff. Second, the authors chose an age group where children do not behave prosocially according to Fehr et al. (2008).

Another study which used the same methods for children as well as non-human animals was conducted by House, Henrich, Brosnan, & Silk, (2012). Children at 3-8 years of age were tested in a real life situation by applying five test trials in the resource allocation paradigm. Furthermore, they overcame the limitations of Burkart & Rueth, (2013) by applying a face-to-face setting. The authors found out that children behaved prosocially in the “prosocial” treatment already at the age of 3-4 years. However, there were also some limitations in their study: First, the experimenter gave explicit instructions to the children and told them which actions were allowed and which prohibited. Therefore, experimenter bias cannot be excluded. Second, the experimenter put the food reward of the receiver side in a trash can the selfish option (1/0) was chosen. Therefore, it could be that children chose the 1/1 option to avoid wasting food, not because they wanted to be prosocial.

Since the studies introduced above came to different outcomes, it is quite possible that prosocial behaviour in children is influenced by various factors. One of these factors could be friendship. Friendship is defined as a distinctively personal relationship that is grounded in a concern on the part of each friend for the welfare of the other, for the other's sake, and that

involves some degree of intimacy (Helm & Benett, 2013). There are several studies which investigated the relationship of friendship and prosocial behaviour. The outcome of all these studies point in the same direction: First, it has been found that children and adults believe prosocial behaviour to be an important element of friendship (Rands & Levinger, 1979) and that they expect more prosocial behaviour between friends than between just familiar individuals (Bar-Tal, Bar-Zohar, Greenberg, & Hermon, 1977). Second, there are several studies which found a correlation between friendship and prosocial behaviour: It has been shown in a meta-analysis of 82 studies that children with friends in elementary school are more sociable and cooperative than children without friends. Sociability and cooperativeness were collected using various methods. (Newcomb & Bagwell, 1995). Furthermore, it has been shown that reciprocated friendship in elementary school leads to more altruistic and prosocial behaviour, compared to no reciprocated friendship when using questionnaires (Aboud & Mendelson, 1996).

Moore (2009) has already investigated how friendship influences prosocial behaviour when using a resource allocation paradigm. Children at 4.5-6 years of age had to allocate resources to three different receivers. They had to name a friend with whom they played regularly and a non-friend with whom they did not prefer to play at all. Also, a photograph of a strange child was shown to them. Children could then allocate stickers to each of the three children. The authors found that children were most likely to allocate stickers to the friend, followed by the stranger and at least likely to the non-friend. However, the setup which was used had some disadvantages: First, as friendship was determined by asking children to name a classmate with whom they like to play, it is uncertain if friendship was reciprocated. Second, children could have named popular children with whom they wanted to be friends and were therefore more likely to allocate resources to them. Third, there was no real-life interaction between donor and receiver.

Another factor mediating prosocial behavior could be social status. Social status is a summary measure of the degree to which a group member is liked or disliked by peers as a whole (Newcomb, Bukowski, & Patee., 1993). A key aspect of social status is social dominance. Social dominance is important to determine a group's organizational structure (Hawley, 1999). The author proposed that social dominance may be obtained by acquiring resources, regardless of the methods by which they were attained. She suggested that one's ability to compete for and control social or material resources determines the social dominance. Resources can be obtained and controlled through two mechanisms: prosocial and coercive behaviour. It is not clear if prosocial behaviour is used more by subordinates or dominant individuals. Subordinates could use prosocial behaviour in order to avoid negative sanctions from dominant individuals as well as obtaining resources from them (Henrich & Gil-White, 2001). On the contrary, dominant individuals could use prosocial behaviour in order to defend their resources and gain help from subordinates defending their dominance rank. Support for the first theory comes from Guinote, Cotzia, Sandhu, & Siwa (2015). The authors classified children into high- and low dominance dependent on the outcome of a choice game. Two children at a time were presented with a high- and low valued toy and were asked to choose one each. The child who got the high- valued toy was classified as the dominant and the other as the subordinate. In a next step, children were asked if they would donate stickers to a child in need. The authors found that children with low dominance donated significantly more stickers than children with high dominance. Also, they found that low- ranked adults were more likely to spontaneously assist another individual than high-ranked adults. (re-cite)

In non-human primates however, there is support for the second theory. Massen, van den Berg, Spruijt, & Sterck (2010) found that high-ranking despotic primates grant their partners access to food while low-ranking individuals withhold it. They explain this finding by arguing that dominant individuals behave prosocial to emphasize their dominance rank.

However, the social status of the receiver of potential prosocial behaviour seems to be important as well. It has been shown that children give high-status adults more resources than low-status ones (McGuigan, Fisher, & Glasgow, 2016).

Grammer (1979) investigated helping and supporting behavior in children at the age of 3 to 5 years in dependence of friendship relationships and status. The author conducted group observations to identify these two variables. It was found that friends were helping each other more than non-friends, but there was no such effect in supporting behaviour. Furthermore, helping behaviour was shown more often in children with similar status than in children with different status. There was no such effect in supporting behaviour.

A third factor which could be relevant in modifying prosocial behaviour is an individuals' prenatal exposure to androgens. Their exposure can be measured via the second-to-fourth digit (2D:4D) ratio because during prenatal development receptors for androgens are on the second digit and receptors for estrogens are on the fourth digit. Individuals with high prenatal androgen exposure have a relatively lower 2D:4D ratio, whereas individuals with low prenatal androgen exposure have a relatively higher 2D:4D ratio (Zheng & Cohn, 2011). Prenatal androgens are, in contrast to fluctuating androgens, constant over lifespan and therefore they can already be measured in children. Studies conducted with adults came to different results concerning the correlation between 2D:4D ratio and prosocial behaviour: Millet & Dewitte (2006) showed that subjects with lower 2D:4D ratio were more likely to act cooperatively (i.e. give a fair share) and less likely to act altruistically (i.e. give more than the fair share) and egoistically (i.e. give less than the fair share) in a public good game whereas Brañas-Garza et al. (2013) found that subjects with both high and low 2D:4D ratios acted less altruistically in a dictator game than subjects with intermediate digit ratios. In a further study Millet & Dewitte (2009) found that subjects acted more prosocially in a dictator game if they had a low 2D:4D ratio and the

situation was neutral. However, after exposure to an aggression cue the relationship inverted and subjects with high 2D:4D ratio acted more prosocial.

1.3 Research goals

I designed the current study to get further insights into the development of prosocial behaviour in humans and make my results comparable with those of non-human species. Furthermore, I wanted test if several factors alter prosocial behaviour. In this respect, only children came into consideration as test subjects. Children allow a better comparison between species, because they are probably less influenced by social norms and society than adults. Moreover, in contrast to adults, children only rarely distort their behaviour on purpose.

To achieve my goals, I adapted the experimental setup of studies introduced previously. I utilized only the “prosocial” treatment of the study of Fehr et al. (2008) due to time and attention limitation. These limitations occurred because I conducted several trials instead of only one. Because of the multiplicity of trials, I used stickers instead of sweets. I tested only children at 6-9 years of age because prosocial behaviour seems to be fully developed at this age according to Fehr et al. (2008). Children allocated resources to a real-life donor from the child’s social group and I used an apparatus which needed no normative rules. Furthermore, the donor sat face to face to the receiver and I conducted warm up trials to make sure that the donor also paid attention to the receiver’s payoff. In order to overcome the limitations of the study conducted by House et al., (2012), I put the stickers which were not chosen back into the box where they were stored after every trial.

Based on the findings of Fehr et al. (2008), I hypothesized that children would behave prosocially in general. Based on the findings of Moore (2009) I hypothesized that children

would behave more prosocially when allocating resources to a friend compared to a non-friend. Based on the findings of Guinote et al., (2015), I hypothesized that children with low social status will act more prosocial than children with high social status. Furthermore, I hypothesized that children will act more prosocially towards classmates with high social status than towards ones with low social status, based on the findings of McGuigan et al. (2016). I made no hypothesis concerning a relationship between prosocial behaviour and 2D:4D ratio, since literature is inconsistent and almost not existent for children.

2. Methods

2.1 Ethical approval and recruitment

In a first step, permission was obtained from the university's ethics commission (Ref.No.00103). In the next step, I contacted the principals of two primary schools in Vienna, via email and phone (see appendix A). After the principals and the teachers agreed to participate in the study with their respective classes, I contacted the "Wiener Stadtschulrat" to obtain permission to conduct the study at those locations. In a final step, teachers (see appendix C) as well as parents (see appendix B) were provided with a study description and a consent form before the start of the study. Children only participated if they voluntarily wanted to and if their parents gave consent. Children received an alphanumeric code at the beginning of the study and all data were collected anonymized.

2.2 Participants

I tested sixty-seven 6-9-year-old children (30 male, 37 female) in two primary schools in Vienna (VS Felbigergasse, VS Prießnitzgasse 1/II) over a time period of $\text{mean} \pm \text{SD } 96.3 \pm 8.34$ months. The children were from two first grade and three second grade classes. For detailed composition of children participating in each class see table 1.

Table 1. Number of children participating in each class and sex distribution of participants.

Class	Grade	Number of participants	male	female
I	First	7	0	7
II	First	13	7	6
III	Second	16	8	8
IV	Second	17	7	10
V	Second	14	8	6
Total		67	30	37

Due to methodological issues, I had to excude class III from the final analysis (see also limitations section 4.3.3). Additionally, some children were absent during one or more parts of the study: Therefore, the final number of children included in the analysis was 45.

2.3 Group observation

I conducted observations of in-class interactions to identify friendship between and social status of the participants. Observations took place in the daily breaks between school hours. I arranged with teachers that children had free play time during these breaks and that they had to stay in classroom. Since all children, even those who did not participated, stayed in classroom, I was not able to make audiovisual recordings of the children, but I conducted live observations

instead. I used instantaneous sampling at sampling intervals of 10 seconds. At each sampling point I recorded two variables for one specific child: “Number of interaction partners” which is the number of children near the observed individual, that means within reach and “social status” which is the number of children who were turned towards the observed child within 3 meters (Grammer; 1979). The observation sequence was randomly defined and fixed for all observations. In total, I observed each child four times, two times on each day.

2.4 Questionnaires

I asked the children to indicate the names of their best friends (Ladd et al. ;1997) (see appendix E). This occurred during a lesson and children had to fill out the questionnaire one after another while sitting at an isolated desk. This guaranteed anonymity of each child’s answers and they were not influenced by the presence of other children.

Teachers had to state up to five best friends of each child as well as answer four questions concerning social status for each child (assertive, dominant, tells others what to do, stands up for self) (Pellegrini et al., 2007). Teachers could rate these four items on a graphic scale that was 100 mm long. I created the teacher questionnaires online on the website <https://www.soscisurvey.de> (see Appendix F) and the teachers filled it out online outside working hours.

2.5 Monopolization experiment

In order to assess resource control behaviour children played a skill game called Dr. Bibber (<http://www.hasbro.com/de-de/product/classic-operation-game:03B9FF5E-5056-9047-F5FF-D57592C4E2FE>), where children had to retrieve small objects with a pair of tweezers. Since there was only one pair of tweezers available, only one child at a time could actively play and the others had to wait to be next in line. Children positioned themselves around the table and before the game started I asked them if they knew the game, followed by an instruction how to play it (see appendix G). During playtime I recorded order of taking/receiving the pair of tweezers, playtime of each child, time possessing the pair of tweezers and behaviour during handing over the tweezers (see appendix H). However, the monopolization game did not elicit resource control behaviour. The order of taking and receiving the pair of tweezers was nearly always dependent of seating arrangements of children. Moreover, the playtime of each child was rather dependent on how skilled the child was and at which speed it retrieved the small objects, than it's dominance. Therefore, I decided to exclude this experiment from my further analyses.

2.6 2D:4D ratio measurement

I scanned both hands of every child in order to determine the second-to-fourth digit ratio. I did this with a "Canon LIDE 110" scanner. I attached a ruler on the scanning surface.

I measured the second and forth digits of both hands of each child via the program "TpsDig" (Rohlf, 2015). First, I received the appropriate dimension from the ruler. Second, I measured digits from the ventral-most proximal crease to the tip of the finger (J T Manning,

Scutt, Wilson, & Lewis-Jones, 1998). Both programs can be downloaded from <http://life.bio.sunysb.edu/morph/>.

I measured each digit twice and computed a mean of both measurements. If the first and the second measurement were more than 0.5 mm apart, I performed a third measurement. This occurred three times. Finally, I computed the 2D:4D ratio by dividing the length of the second digit by the length of the fourth digit.

For the intraobserver reliability I performed a repeated measurement ANOVA between the first and second measurement of 32 individuals. There was no significant difference between both measurements (Pillai-Spur=.005, $F=1.221$, $df= (1, 254)$, $p=.270$). Additionally, 126 of 128 measurements had a difference of ≤ 0.05 between first and second measurement.

For the interobserver reliability I performed a repeated measurement ANOVA between my measurements and measurements taken by a second person. Again, I used measurements of 32 individuals. There was no difference between my measurements and those taken by the second person (Pillai-Spur=.006, $F=1.514$, $df=(1, 254)$, $p=.220$). Additionally, 125 of 128 measurements had a difference of ≤ 0.05 between my measurements and those of the second person.

2.7 Resource allocation experiment

In this game, children could allocate stickers to themselves and/or to a receiver. In detail, a donor could choose between a prosocial option (1/1) and a selfish option (1/0). In the prosocial option, both, the donor and receiver got a sticker, whereas in the selfish option only the donor got a sticker.

2.7.1 Apparatus

The main apparatus consisted of two wooden boxes fixed on a wooden plate. Each box had the dimensions 84x20cm and the plate itself 100x80cm. Each of the boxes was divided in three compartments. For detailed layout and dimensions see figure 1.

The two big boxes were closed seamlessly on top with transparent Plexiglas lids, so that children could look inside the boxes but not get the stickers when the lids were closed. The middle compartments of each box was nontransparent and contained the electronical devices, which could be used to open the plastic lids remotely. These devices consisted of two battery packs with 8 type D batteries each, two electro magnets which could lift the Plexiglas from inside for 5 seconds and a “Tomtek Two-channel RF Codclock RFC11” which received and transmitted the signal of a small remote control. The remote control itself was a “Tomtek 4-channel transmitter”. The experimenter could either open the lids remotely and unnoticed with the hidden remote control or – in between trials – with a thin wire tool. Additionally, in front of the boxes on the donor side were two small wooden “money boxes” with a slit on top (Figure 1). Green plastic coins could be inserted through the slits by the participants and removed from the small boxes trough a plug on the lower side of the plate in-between sessions.

receiver side. To pass the “warm up” trials the child had to choose the 1/1 option in all trials. Otherwise, 4 more trials were performed with the same criterion. If the child again failed to choose the 1/1 option in all 4 trials the resource allocation experiment was terminated at this point. Otherwise the child participated in two conditions which were counterbalanced across subjects. Conditions were called “alone” and “together”. The condition “alone” tested how the donor chooses in the absence of a receiver. 10 trials were performed and the barrier was closed. The condition “together” tested prosocial behaviour towards a receiver. Again, 10 trials were performed and the barrier was closed.

In every trial I put 3 identical stickers (see fig. 2) in the boxes, two at the donor side and one at the receiver side. As a result, the donor could always choose between one reward on the donor side and one on the receiver side, these so called prosocial option (1/1) and only one reward on the donor side, the so called selfish option (1/0) (see fig. 2).

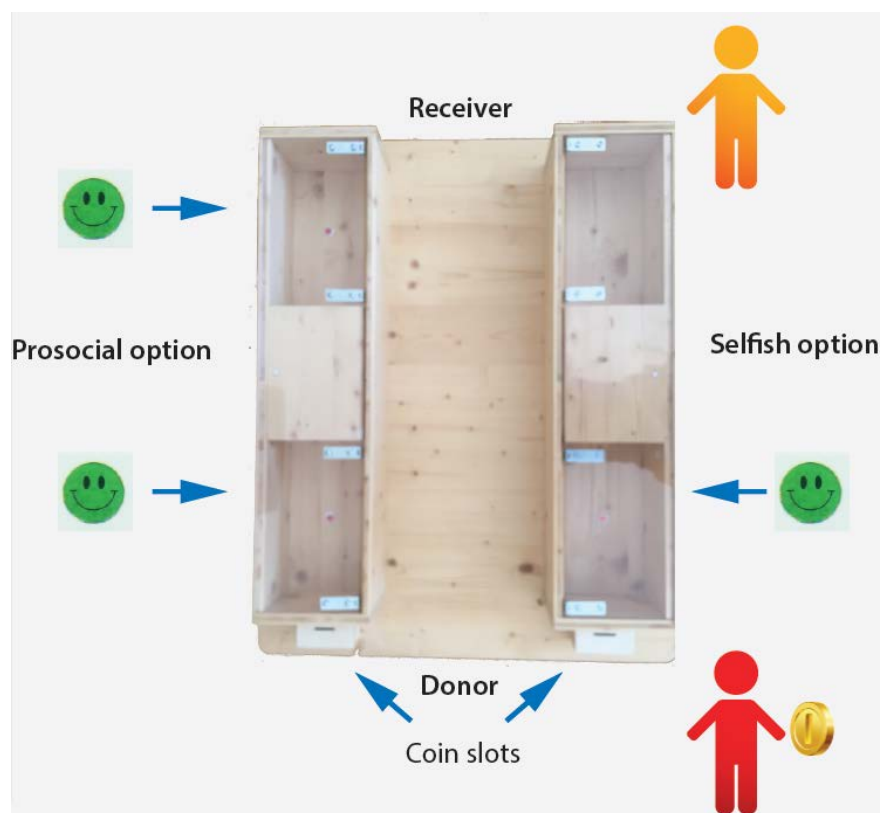


Fig. 2. Setup of the resource allocation game.

2.8 Procedure

In a first step I gave a short explanation in front of the whole class. I told them that they would play a game where they could allocate stickers and they would play both alone and in pairs. (for detailed explanation see appendix J)

The child who acted as the donor was asked to come to the separated room where the apparatus was located. I handed the first sticker album to the child with space for 18 stickers and asked to write his/her name on it. I took notes which hand the child used during writing.

After I made sure that the donor gave me his or her attention, I opened the with the thin wire tool and put the stickers in it. I then closed both boxes and gave the donor a plastic coin. The donor received instructions that he could open one of the two boxes with the coin. Also, I made the donor aware of the barrier. (for detailed instructions see appendix K)

The donor then played the “warm up” trials. After he or she retrieved the sticker/s of the chosen box, I put back the sticker/s of the other box to the sticker pool. After each trial I took notes which box the donor opened, which choice he or she made and with which hand he or she put the coin into the coin box. If the donor completed the “warm up” trials he continued with the condition “together”/“alone”. Before starting I told the donor that the way to the compartments at the receiver side was now blocked and gave the children a new sticker album with space for 10 stickers. Additionally, I took notes in the condition “together” regarding the behaviour of the receiver. That could be “verbal begging”, “nonverbal begging” and “describing the situation”. “Verbal begging” was defined as asking the donor verbally to open one specific box. “Nonverbal begging” was defined as indicating to the donor non-verbally to open a specific box (e.g. pointing with the finger at a specific box). “Describing the situation” was

defined as giving statements about the stickers in the boxes without making precise requests (e.g. “in this box is a sticker for me”). “Verbal begging” was shown in only four instances, “nonverbal begging” in only one instance and “describing the situation” was not shown at all. Therefore, no analyses could be made with those data. After every child had finished the resource allocation game they got a small glowing spinning top as reward.

2.9 Experimental schedule

Before the start of the study, I obtained a class photo and a list of participants in order to get a first opportunity to identify the children. In a next step I visited the class on a single day for about an hour during a lesson, in order to introduce myself to the children as well as to make sure that the children were identified correctly. On this day, I recorded no data and individual conversation with the children was kept to a minimum.

The study itself was conducted in each class within three or four non-consecutive days, dependent on how many children participated. On the first day I conducted group observation. Also, children filled out the questionnaire. On a second, consecutive day I conducted the second group observation as well as the monopolization experiment and the 2D:4D ratio scanning. After the first two days, I computed friendship relationships and social dominance ranks and I grouped children accordingly in pairs. On the third and fourth day, when needed, I conducted the resource allocation experiment.

2.10 Data analysis

I performed statistical analyses with “Microsoft Excel 2016” and “SPSS 23”. I used following variables for the analyses: Age, Sex, 1/1 choices in condition “together”/”alone”, “order of conditions”, “number of warm up trials”, “side preference”, “friendship”, “number of interaction partners”, “social status”, “2D:4D ratio” and “delta value”.

I computed age in months. “Order of conditions” indicated if the child played the resource allocation game in the condition “together” first, which did 25, or in the condition “alone”, which did 20. “Number of warm up trials” had the following values: “passed in first four trials”, “passed in second four trials” and “not passed”. 36 children passed the criteria within the first 4 trials, 9 children within the second four trials and 4 children didn’t pass the criteria. “Side preference” indicated the frequency of opening the right box and had values between 1 and 10. Overall, I found no side preferences. Children chose the right box in both, condition “together” (Wilcoxon, $N=45$, $Z=-.296$, $p=.767$) and condition “alone” (Wilcoxon, $N=45$, $Z=-1.002$, $p=.307$) at chance level. “Friendship” had the values “reciprocal friends” and “reciprocal non-friends”. Children were classified as “reciprocal friends” if they both were stated as friends according to the children/teacher questionnaire. Children were classified as “reciprocal non-friends” if they both were not stated as friends according to the children/teacher questionnaire. I excluded “intermediates”, were one child was stated as friend, but not the other according to the children/teacher questionnaire. This was done because the friendship relationship between those children was not clear. This led to following numbers of pairs: 37 pairs in the children questionnaire, 19 friends and 18 non-friends, 41 pairs in the teacher questionnaire, 21 friends and 20 non-friends and 27 pairs in the group observation, 17 friends and 10 non-friends. Given that 20 “intermediates” were excluded in the group observation, I obtained only a small and unequal sample size. Therefore, I did not use this method in the

analyses and only took the data of children and teacher questionnaires into account. I made analyses of children and teacher questionnaires separately, but the classification of both significantly agreed on each other (Chi square, $N=38$, $p=.001$). I used for “social status” the data of the group observation and of the teacher questionnaire. Concerning the teacher questionnaire, I calculated the mean of the 4 ratings. The classification of both methods were significantly correlated (Spearman; $N=44$; $r=.354$; $p=.018$). For “2D:4D ratio” I included only the measurements of the right hands and excluded left handed individuals. This had three reasons: First it has been shown that the 2D:4D ratio of the right hand shows a stronger association with prenatal androgens than those of the left hand (Lutchmaya, Baron-Cohen, Raggatt, Knickmeyer, & Manning, 2004). Second, it has been shown that an increase of the 2D:4D ratio with age is smaller in the right- than in the left hand (Trivers, Manning, & Jacobson, 2006). Third, it has been shown that there is an interaction between handedness and 2D:4D ratio (Manning & Peters, 2009) which I wanted to control for. That led to a total number of 33 individuals. “Delta value” was computed by subtracting the number of 1/1 choices in the condition “together” from the number of 1/1 choices in the condition “alone”. This controls for a baseline preference for the 1/1 distribution. For descriptives see table 2. For normal distribution of variables see table 3. Results were corrected for multiple comparisons with Bonferroni-Holm (Gaetano, 2013).

Table 2. Mean, standard deviation, minimum and maximum of interesting variables.

VARIABLE	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
Age (in months)	96.24	9.52	80	117
1/1 choices in condition “together”	7.71	2.2	3	10
1/1 choices in condition “alone”	6.11	2.6	0	10
Side preference test	4.9	1.21	2	8
Side preference control	4.93	1.28	1	7
Number of interaction partners	6.61	3.58	1	16
Social status observation	3.55	1.873	0	8
Social status questionnaire Delta value	51.78 1.6	25.27 2.87	6.75 -3	99.75 9
2D:4D ratio	0.96	0.04	0.86	1.05

Table 3. Test of normality (Shapiro-Wilk, $df=39$) of interesting variables.

NORMALLY DISTRIBUTED	NOT NORMALLY DISTRIBUTED
Age ($p=.444$)	1/1 choices in condition “together” ($p=.001$)
2D:4D ratio ($p=.865$)	Delta value ($p=.004$)
1/1 choices in condition “alone” ($p=.120$)	Side preference condition “together” ($p=.005$)
Social status observation ($p=.204$)	Side preference condition “alone” ($p=.005$)
	Number of interaction partners ($p=.005$)
	Social status questionnaire ($p=.029$)

3. Results

3.1 Prosocial tendencies

Overall, children chose the 1/1 option in both condition “together” (Wilcoxon, $N=45$, $W=863.5$, $p=.000$) and condition “alone” (Wilcoxon, $N=45$, $W=537.7$, $p=.015$) above chance level.

Children chose the 1/1 option significantly more often in the condition “together” compared to the condition “alone” (see fig. 3) (Wilcoxon, $N=45$, $Z=-3.247$, $p=.001$). Splitting up the data revealed a significant effect in boys (Wilcoxon, $N=19$, $Z=-2.082$, $p=.037$) as well as in girls (Wilcoxon, $N=26$, $Z=-2.716$, $p=.007$).

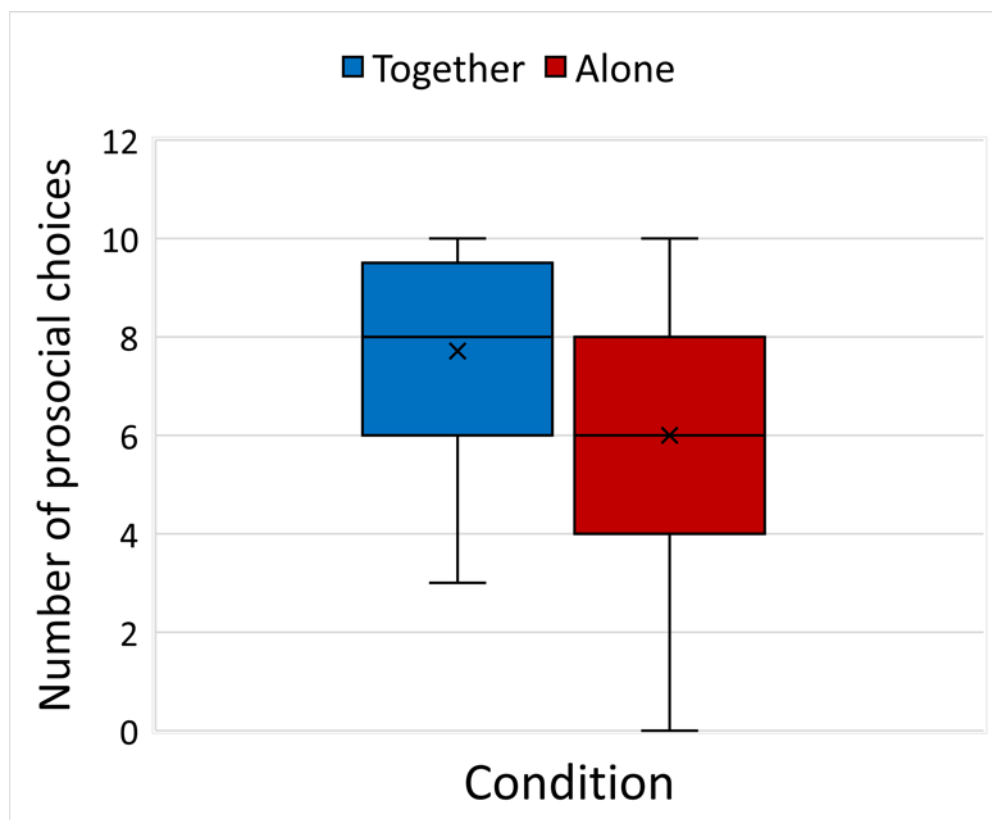


Fig. 3. Comparison between number of prosocial choices in condition “together” and “alone”.

3.2 Effects of different factors on prosocial choices

“Friendship” according to teacher (Mann-Whitney, $N=41$, $U=171.5$, $p=.310$) and children questionnaires (Mann-Whitney, $N=37$, $U=145$, $p=.424$) had no significant effect on “delta value” (see fig. 4). Furthermore, there was no significant effect of friendship on 1/1 choices in condition “together” (Teacher: Mann-Whitney, $N=42$, $U=224$, $p=.710$; Children: Mann-Whitney, $N=37$, $U=169.5$, $p=.963$).

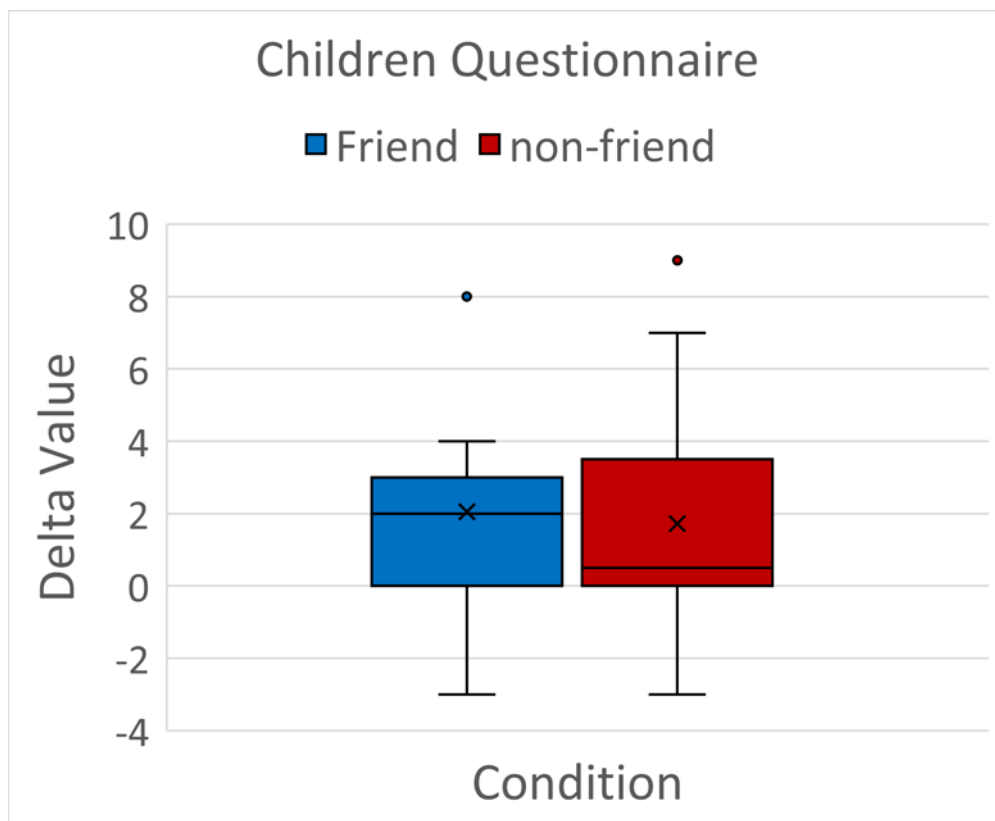


Fig. 4. Number of 1/1 choices in condition “together” minus number of 1/1 choices in condition “alone” in friend and non-friend group according to the children questionnaire.

“Number of interaction partners” was not significantly correlated with “delta value” (Spearman, $N=44$, $r=.057$, $p=.714$). There was a significant negative correlation with 1/1 choices in condition together (Spearman, $N=44$, $r=-.335$, $p=.026$), and a non-significant

negative trend in condition “alone” (Spearman, $N=44$, $r=-.273$, $p=.073$). When splitting the data, the significant negative correlation with 1/1 choices in condition “together” persisted further only in girls (Spearman, $N=25$, $r=-.440$, $p=.028$), but not in boys (Spearman, $N=19$, $r=-.316$, $p=.187$). However, the significant correlations disappeared after correction for multiple comparisons.

“Social status observation” of the donor was not significantly correlated with “delta value” (Spearman, $N=44$, $r=-.123$, $p=.425$). However, there was a non-significant negative trend with number of 1/1 choices in condition “together” (Spearman, $N=44$, $r=-.257$, $p=.092$). “Social status questionnaire” of the donor was neither significantly correlated with “delta value” (Spearman, $N=45$, $r=-.114$, $p=.455$), nor with number of 1/1 choices in condition “together” (Spearman, $N=45$, $r=-.194$, $p=.201$).

“Social status observation” of the receiver was neither significantly correlated with “delta value” (Spearman, $N=45$, $r=.128$, $p=.409$), nor with number of 1/1 choices in condition “together” (Spearman, $N=45$, $r=.069$, $p=.657$). “Social status questionnaire” of the receiver was neither significantly correlated with “delta value” (Spearman, $N=45$, $r=-.036$, $p=.815$), nor with number of 1/1 choices in condition “together” (Spearman, $N=45$, $r=-.150$, $p=.326$).

“2D:4D ratio” was not significantly correlated with number of 1/1 choices in condition “together” (Spearman, $N=33$, $r=.084$, $p=.642$), but there was a non-significant, positive, linear trend with delta value (Spearman, $N=33$, $r=.335$, $p=.057$) (see figure 5).

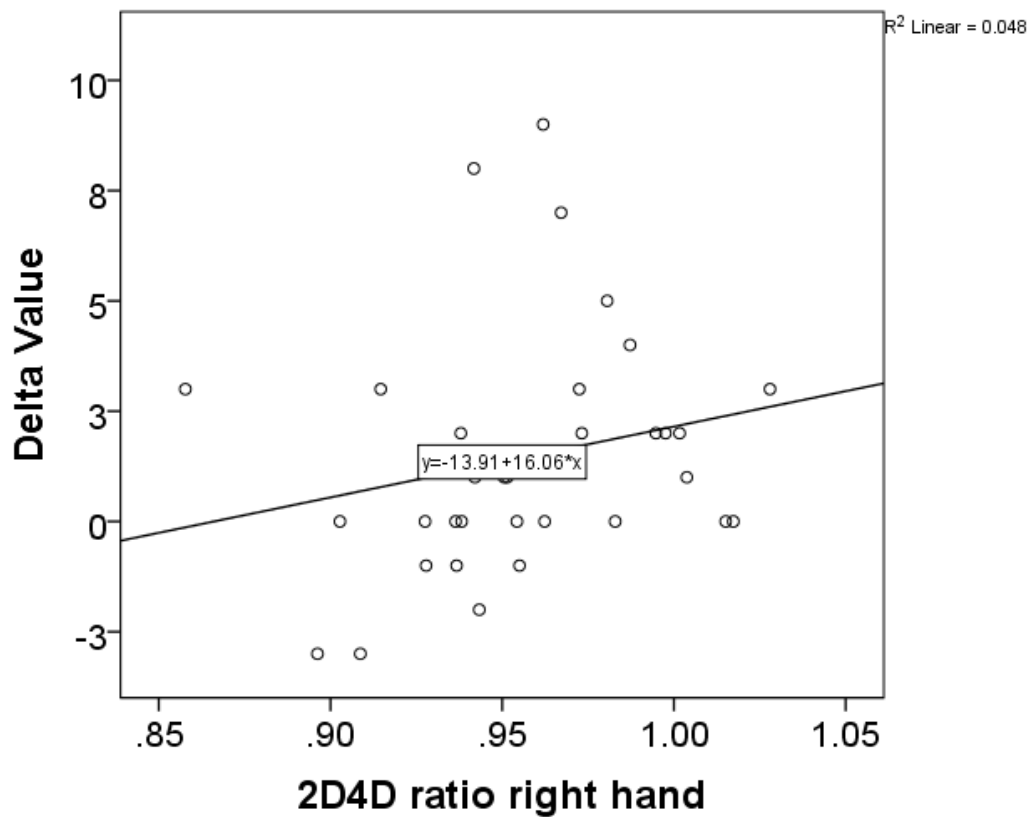


Fig. 5. Number of 1/1 choices in condition “together” minus number of 1/1 choices in condition “alone” correlated with second to fourth digit ratio of right hands.

3.3 Additional effect in-between factors

The choices in the first trial after the “warm-up” trials were not significantly different from the choices in the last trial of the same condition (McNemar (1,45) = .071, $p = .791$). There was a non-significant trend of sequence, which means that children seem to have chosen more often the prosocial choice in the condition “together” after they performed the trials of the condition “alone” (Mann-Whitney, $N = 45$, $U = 168.5$, $p = .058$).

Neither age (Spearman, $N = 43$, $r = .067$, $p = .669$), sex (Mann-Whitney, $N = 45$, $U = 258$, $p = .798$), “number of warm-up trials” (Mann-Whitney, $N = 45$, $U = 175.5$, $p = .706$) or “order of conditions” (Mann-Whitney, $N = 45$, $U = 284.5$, $p = .425$) had a significant effect on “delta value”.

There was a significant positive correlation between “social status observation” and “social status questionnaire” (Spearman; $N=44$; $r=.354$; $p=.018$). However, when splitting the data this effect only remained significant in boys (Spearman, $N=19$, $r=.616$, $p=.005$), but not in girls (Spearman, $N=25$, $r=.088$, $p=.676$). The significant correlations disappeared after correction for multiple comparisons.

There was a significant positive correlation between “social status observation” and “number of interaction partners” (Spearman, $N=$ $r=.599$, $p<.001$).

Age (Pearson, $N=31$, $r=.400$, $p=.026$), but not sex ($t(40)=-.306$, $p=.761$), had a significant positive effect on “2D:4D ratio”. However, when splitting the data this effect only remained significant in boys (Pearson, $N=13$, $r=.668$, $p=.013$) but not in girls (Pearson, $N=18$, $r=.155$, $p=.540$). The significant correlations disappeared after correction for multiple comparisons.

There was a significant positive correlation between “2D:4D ratio” and “number of interaction partners” in female (Spearman: $N=18$, $r=.524$, $P=.026$), but not in male participants (Spearman: $N=14$, $r=-.416$, $p=.139$). The significant correlation disappeared after correction for multiple comparisons.

“Number of interaction partners” was not significantly correlated with “number of friends” children stated in the children questionnaire ($N=44$, $r=.242$, $p=.113$). However, when splitting the data, a non-significant positive trend was revealed in boys (Spearman, $N=19$, $r=.453$, $p=.052$), but not in girls (Spearman, $N=25$, $r=-.080$, $p=.704$).

The “number of friends” children stated in the children questionnaire was significantly positively correlated with “number of friends” teacher stated for each child in the teacher questionnaire (Spearman, $N=45$, $r=.359$, $p=.015$). However, girls stated significantly more classmates as their friends than boys did ($t(34,3)=-2.544$, $p=.016$), but this difference was not

present when teachers rated the number of friends for each child ($t(61)=-.745$, $p=.459$).

Furthermore, children stated significantly more friends than teachers did for each child (Mann-Whitney, $N=127$, $U=2,965.5$; $p<.001$). When splitting the data this result remained significant only in girls (Mann-Whitney, $N=70$, $U=1,002.5$; $p<.001$), but not in boys (Mann-Whitney, $N=57$, $U=520$, $p=.057$).

4. Discussion

In the current study I tested prosocial behaviour in human children with a resource allocation paradigm adapted by Fehr et al. (2008). Children could allocate stickers to themselves and/or to a receiver and they could either allocate one sticker to themselves and one to a receiver, or only one sticker to themselves and zero to the receiver. Additionally, two conditions were performed: In the condition “together” children could allocate the stickers to a receiver, whereas in the condition “alone” there was no receiver present.

In accordance with my hypothesis I found that children chose significantly more often the 1/1 option when a receiver was present than when a receiver was absent. This result has already been found by Fehr et al. (2008), who showed that children at the age of seven to eight years chose the prosocial option in 78% of trials when allocating units of sweets.

However, while Fehr et al. (2008) used group photos representing the receiver I conducted real life interactions. This adaption had the advantage that my results were better comparable with other species, but the disadvantage that children may had reciprocity expectations. Furthermore, in contrast to Fehr et al. (2008) I used an apparatus which needed only limited instructions and a physical barrier which prevented the children from collecting all sweets available. Therefore, I did not need the use of normative rules of how the resource

allocation paradigm worked and what children must not do, which minimized experimenter bias.

Surprisingly, children chose the 1/1 option both with and without a receiver above average. A possible explanation could be that the warm-up trials, where choosing the 1/1 option was rewarded by two stickers for oneself, had a carry-over effect on the choices in the condition “together” and “alone”. However, children’s choices in the condition “alone” did not significantly differ regardless whether the warm-up trials or the condition “together” trials have been conducted previously.

Concerning the condition “together”, I found a non-significant trend of sequence. Children seem to have chosen more often the 1/1 distribution in the condition “together” after they performed the trials of the condition “alone” compared to after they performed the warm-up trials. In this respect, the warm-up trials seemed to have no enhancing effect on the number of 1/1 choices in the condition “together”. However, this finding could also be interpreted as children being more excited and more willing to choose the 1/1 option towards a real life receiver, after they performed ten trials without a receiver where their choices had literally no effect on the receiver. This has to be considered in future studies. However, warm-up trials seem not to have any carry-over effect since I found no significant difference between the choices made in the first trial after the “warm-up” trials and the choices made in the last trial of the same condition.

4.1 Effects of different factors on prosocial choices

4.1.1 Friendship

Most surprisingly, friendship had no significant effect on prosocial behaviour. This finding is divergent to my hypothesis as well as the majority of studies examining this topic (Aboud & Mendelson, 1996; Moore, 2009; Newcomb & Bagwell, 1995). However, except the study conducted by Moore (2009), these studies did not conduct the resource allocation paradigm to test prosocial behaviour. Furthermore, it is uncertain if friendship was reciprocated in the study conducted by Moore (2009).

There are some possible reasons for obtaining this outcome: First, I asked children as well as teachers to name up to five best friends, which is approximately 20% of members of a class. It may be necessary to only identify the closest friend of each child, in order to get a more evident distinction between friends and non-friends. Therefore, I would suggest that in further studies it should be asked for only one or two best friends. Second, I defined non-friends as dyads where neither of both children named the other one as friend. This method had the disadvantage that it is not clear if children really did not like each other or just had a neutral attitude towards the other child. Therefore, further studies should consider explicitly ask children with whom they do not like to play, as done by Moore (2009), in order to identify non-friends. Third, two-third of children of each class were participating at most. As a result, some important friendship relationships could have got lost. Additionally, friendship reciprocity was harder to obtain with such a reduced sample. Fourth, children could have expected reciprocity and therefore made no distinction in their choices between friends and non-friends.

Apart from these limitations, ratings of both questionnaires which I used to determine friendship relationships, significantly agreed on each other. This is an indication that both

children and teachers can be consulted to properly determine friendship relationships within class.

4.1.2 Interaction partners

One outcome of the study was that girls, who had fewer interaction partners in the group observation, chose the 1/1 option significantly more often than girls who had more interaction partners. In contrast, boys were not influenced by the number of interaction partners. A possible explanation for this outcome could be, that the number of interaction partners was more important for girls than it was for boys and girls with less interaction partners tried to raise their number of interaction partners by being prosocial.

In line with this explanation it was found that adolescent girls valued social goals like having friends or helping others more than adolescent boys (Ford, 1982). Furthermore, girls in middle childhood were more likely to adopt relationship-maintaining goals (Rose & Asher, 1999) and goals of resolving peer problems (Rose & Asher, 2004) than boys. Also, it was shown that girls were more worried about abandonment, peer evaluation and loss of relationships than boys were (Henrich et. al, 2001; Rudolph & Conley, 2005).

Furthermore, I found that girls named significantly more classmates as friends than boys did. In contrast, there was no such difference when teachers rated the number of friends for girls and boys. Additionally, girls stated significantly more friends than teachers did for girls, but this effect was not present for boys.

However, there are also some limitations which question the findings and interpretations mentioned above: First, the number of interaction partners was significantly correlated with the social status of the group observation. Therefore, it cannot be ruled out that the number of interaction partners was rather a measurement for social status than for the number of friends as originally defined by Grammer (1979). Second, there was no significant difference when

comparing the choices made when a receiver was present from those made when a receiver was absent. This finding indicates that girls with less friends had a general desire to choose the 1/1 option more often rather than choosing it in order to obtain more friends.

4.1.3 Social status

I found a non-significant trend of children with a low social status choosing the 1/1 option more often than children with a high social status, but only when a receiver was present. This finding is in line with a study conducted by Guinote, Cotzia, Sandhu, & Siwa (2015) who showed that low-status pre-school children were more likely to help a child in need compared to high-status children.

However, in the current study the effect was only significant when using the data of the group observation, but not when using the data of the teacher questionnaire or when comparing the choices made when a receiver was present from those made when a receiver was absent. Therefore, this outcome supports my hypothesis only partially. Unlike predicted, I found no effect of the receiver's status on prosocial behaviour.

Both measures which I used, questionnaires for teachers and data of the group observation, were significantly positively correlated in boys, but not in girls. One explanation for this outcome could be, that the behaviour which indicates social status was for teachers more apparent in boys than it was in girls. Boys are more often participating in rough and tumble play than girls, where they can compare their strength and determine their status (Martin & Fabes, 2001). Therefore, it could have been easier for teachers to notice the social status of boys than of girls.

This problem did not occur in the group observation, because children are quite well aware of the status of other children and it is important for them to pay attention to the high status individuals. It has been shown that children who are in focus of attention are those who

show initiating, organizing, aggressive and patronizing behaviour (Hold, 1977). In this respect, the group observation seemed to be the better tool to identify social status for boys and girls equally well.

4.1.4 Prenatal exposure to androgens

I found a non-significant positive trend between 2D:4D ratio and number of 1/1 choices when comparing the choices made when a receiver was present from those made when a receiver was absent. This means that children with low prenatal androgen exposure tended to choose the 1/1 option more often than children with high prenatal androgen exposure. This finding is in accord with a study conducted by Millet & Dewitte (2006) who showed that individuals with a low 2D:4D ratio acted less altruistically. However, in another study Millet & Dewitte, (2009) found that individuals with a low 2D:4D ratio did behave more prosocially in a dictator game, but this finding was reversed after the exposure to an aggression cue. Other studies found that both low and high 2D:4D ratio individuals did behave less prosocially than individuals with an intermediate 2D:4D ratio (Brañas-Garza, Kovářík, & Neyse, 2013; Galizzi & Nieboer, 2015). These contradictory findings show that the relationship between prenatal androgens and prosocial behaviour is ambiguous.

However, in the current study both prenatal exposure to androgens as well as social status were negatively correlated prosocial behaviour. These findings are interesting to that effect, as two studies have shown that social status is negatively correlated with prenatal exposure to androgens (Manning & Fink, 2008; Mazur & Booth, 1998).

A possible explanation for the lack of significance could be a too small sample size. Differences in the 2D:4D ratio are quite small and therefore most studies which obtained significant effects had sample sizes above 100 (e.g. Brañas-Garza et al., 2013; Galizzi & Nieboer, 2015; Trivers, Manning, & Jacobson, 2006). Also the lack of finding a sex difference

in the 2D:4D ratio could be an indication for a too small sample size. Sex differences were found in several studies using sample sizes over 100 (Hönekopp & Watson, 2010; Manning, Scutt, Wilson, & Lewis-Jones, 1998; Manning, Stewart, Bundred, & Trivers, 2004; Putz, Gaulin, Sporter, & McBurney, 2004) with only one study which did not obtain this effect (Lutchmaya, Baron-Cohen, Raggatt, Knickmeyer, & Manning, 2004). Not surprisingly the study which did not find a significant effect had only a sample size of 33.

4.2 Additional effect in-between factors

I found a significant positive correlation between the prenatal exposure to androgens and the number of interaction partners in girls, but not in boys. Girls with a high 2D:4D ratio, that is low prenatal testosterone and high prenatal estrogen, had significantly more interaction partners during the group observation than girls with a low 2D:4D ratio. A possible explanation for this outcome is provided by Del Giudice & Angeleri (2015): The authors found that girls at 8-10 years of age scored lower in anxiety and higher in preoccupation than boys did, when filling out a coping strategies questionnaire. Moreover, a higher 2D:4D ratio was significantly correlated with lower avoidance and higher preoccupation scores. Preoccupation was defined by the authors as neediness, vulnerability and constant concern about the availability and commitment of coping partners.

4.3 Limitations

4.3.1 Monopolization experiment

Unlike predicted, children played the monopolization game (Dr. Bibber) in a self-arranged fixed sequence where no single individuals made the rules or played the game longer than the other ones. The game failed to elicit resource control behaviour and therefore, social status could not be identified. A possible explanation for the failing could be, that the experimenter was present during play. Children are very familiar with board games like the one which was used and they learn from adults that they have to play fair. During my school visits incidences occurred where children who played board games and did not want others to join were reproved from teachers. Although these observations were anecdotally, they could give a hint that children were playing fair in dependence of the presence of an adult. Therefore, further studies should consider to apply a setting where children are only filmed during play with no adult present in the same room.

4.3.2 Group observation

Unfortunately, the data of the group observation could not be used to identify friendship relationships, because there were too few dyads with reciprocated interactions. One explanation could be that the small number of sample points was too low for obtaining friendship relationships adequately. Another explanation could be that the group observation only revealed the best friend of each child. Given that two-third of children of each class participated at most, reciprocated friendship could not be recorded in one-third of instances on average. Therefore, further studies should consider taking more sample points of each child as well as try to get all members of a class to participate.

4.3.3 Inequity aversion

Unfortunately, I had to exclude one class from analysis, because of using methods which triggered inequity aversion. By using only one sticker album in this class, instead of three, receivers had always more stickers than donors at the start of the condition “together”. As a result, donors almost exclusively denied allocating stickers to the receivers, until they both had the same amount of stickers. With the use of three separate sticker albums in the remaining classes, I could eliminate the effects of inequity aversion. Further studies should be careful of not unintentionally using methods which can trigger such inequity situations.

4.4 Conclusion

In the current study I could replicate the findings of Fehr et al. (2008) that children are prosocial in a paradigm which needed no normative rules. Children chose the 1/1 option significantly more often when a receiver was present than when a receiver was absent.

I found no significant effect of friendship on prosocial choices. It is well possible that this lack of significance was due to the limitations when defining friendship relationships. Further studies should therefore consider using methods which allow a clear distinction between friends and non-friends. Furthermore, I showed that girls with less friends acted more prosocially, but the underlying factors for this behaviour remain unclear.

I found that social status had an effect on prosocial choices, but only when taking the data of the group observation. Children with low social status did behave more prosocially than children with high social status. However, this was only a non-significant trend and therefore more research on this topic is needed.

I found that children with a high exposure to prenatal androgens did behave less prosocially than those with a low exposure. However, this effect was not significant, probably because of a too small sample size. Further studies investigating effects of prenatal androgen exposure on prosocial behaviour should consider to use a greater sample size than the current one did.

In summary, my results give hint to the existence of factors modulating prosocial behaviour in children at the age of 6 to 9 years.

5. References

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List of tables

Table 1. Number of children participating in each class and sex distribution of participants.	22
Table 2. Mean, standard deviation, minimum and maximum of interesting variables.	33
Table 3. Test of normality (Shapiro-Wilk, df=39) of interesting variables.	33

List of figures

Fig. 1 Dimensions of the apparatus.	27
Fig. 2. Setup of the resource allocation game.	28
Fig. 3. Comparison between number of prosocial choices in condition “together” and “alone”	34
Fig. 4. Number of 1/1 choices in condition “together” minus number of 1/1 choices in condition “alone” in friend and non-friend group according to the children questionnaire.	35
Fig. 5. Number of 1/1 choices in condition “together” minus number of 1/1 choices in condition “alone” correlated with second to fourth digit ratio of right hands.	37

6. Appendices

Appendix A

Betreff: Anfrage bezüglich Teilnahme an Studie zum Thema Kooperation unter Kindern

Sehr geehrte Damen und Herren,

Mein Name ist Niklas Hungerländer und ich führe gerade meine Master-Arbeit an der Universität Wien am Department für Kognitionsbiologie unter der Leitung von Univ.-Prof. Mag. Dr. Thomas Bugnyar durch. Gemeinsam mit meiner Betreuerin Mag. Dr. Lisa Horn untersuche ich prosoziales und altruistisches Verhalten bei Kindern im Alter zwischen 6 und 8 Jahren. Durch unsere Studie erhoffen wir, tiefere Einblicke in die Entwicklung von sozialen Verhaltensweisen wie Helfen und Teilen bei Kindern zu bekommen.

In diesem Sinne möchte ich mich an Sie wenden: zur Durchführung unserer Studie suchen wir Schulklassen, die ab Herbst 2015 an einem spannenden und für die Kinder sicher auch unterhaltsamen wissenschaftlichen Projekt teilnehmen möchten.

Die Studie

Unsere Studie untersucht prosoziales Verhalten von Kindern. Hierfür werden Kinder gebeten ein Verteilungsspiel zu spielen, in dem Ressourcen (kleine Knabbereien, Sticker) in verschiedenen Situationen gleich oder ungleich verteilt sind, und sie die Zuteilung bestimmen können. Vor dem Hintergrund bereits bestehender sozialer Beziehungen zwischen den Kindern soll unterschiedlichen Vorlieben der Kinder bei der Verteilung dieser Ressourcen nachgegangen werden. Das heißt beispielsweise: Wie werden die Ressourcen verteilt? Ist dies von der Identität des anderen abhängig? Fragen wie diese sollen in der geplanten Studie näher untersucht werden.

Die Umsetzung erfolgt in zwei Schritten:

Zunächst beobachte ich die SchülerInnen in Situationen, in denen freies Spielen erlaubt ist (z.B. Freistunde, Pause). Mein Fokus liegt auf den sozialen Interaktionen der Kinder, d.h. wer mit wem befreundet ist, welche Untergruppen sich bilden, und von welchen Kindern diese angeführt werden. Zusätzlich soll den Kindern ein neues, von mir mitgebrachtes, Spielzeug präsentiert werden. Während die Kinder mit diesem spielen, beobachte ich wiederum ihre Interaktionen.

In einem zweiten Schritt werden die Kinder paarweise in einem Raum gebeten. Eines der beiden Kinder kann dann in einem Spiel die Verteilung von Ressourcen (beispielsweise Sticker oder, nach vorheriger Absprache mit den Eltern, Süßigkeiten) bestimmen.

Die einzelnen Teile der Studie wurde von der Ethikkommission der Universität Wien begutachtet und genehmigt (Bearbeitungsnummer 00103). Die Teilnahme an der Studie ist selbstverständlich freiwillig und die Zustimmung der Eltern wird vor Beginn der Studie in schriftlicher Form eingeholt. Die Kinder können zu jedem Zeitpunkt von der Studie zurücktreten. Die Daten werden anonymisiert – das heißt ohne die Namen der teilnehmenden Kinder –

weiterverarbeitet. Die Ergebnisse der Studie werden der teilnehmenden Schule nach Abschluss zu Verfügung gestellt.

Details zur Durchführung

Die Studie würde für die Schule keine Kosten verursachen, kein zusätzliches Personal benötigen und nur minimale Unterrichtszeit in Anspruch nehmen.

Während der Beobachtungsphase würde ich zweimal für 20-30 Minuten in Pausen oder in Freistunden (z.B. Nachmittagsbetreuung) anwesend sein, jedoch nicht mit den Kindern interagieren. Das Spielzeug würde ich an einem dritten Tag, ebenfalls in Pausen, für Mädchen und Burschen getrennt, präsentieren.

Falls die Schulleitung sowie alle Eltern einverstanden sind, würde ich gerne in der Beobachtungsphase sowie beim Präsentieren des Spielzeuges die Kinder filmen, was eine detailliertere Erfassung des Verhaltens ermöglichen würde.

Zur Durchführung des zweiten Schrittes würden wir einen kleinen Extraraum benötigen, wo wir mit je zwei Kindern gleichzeitig das Verteilungsspiel machen können. Wir mit je zwei Kindern gleichzeitig das Verteilungsspiel machen können. Zuletzt würden wir die Kinder und die Lehrer noch nach den besten Freunden und dem genauen Alter der Kinder fragen. Neben dem Alter und den Freundschaftsbeziehungen der Kinder scheint auch die vorgeburtliche Hormonumgebung einen Einfluss auf die Art des Teilens zu haben. Dies ist jedoch bis dato hauptsächlich bei Erwachsenen untersucht worden. Deshalb würden wir – das Einverständnis der Eltern und Kinder vorausgesetzt – auch gerne auch die Zeige- und Ringfinger der Kinder vermessen, deren Verhältnis ein anerkanntes Proxy darstellt, um diesen Aspekt mit aufzunehmen.

Selbstverständlich werde ich mit den entsprechenden Lehrern vorab persönlich sprechen und detaillierte Informationsblätter weitergeben. Zur Durchführung aller Schritte der Studie würden die Eltern der betreffenden Kinder sowie das Lehrpersonal eine Beschreibung des Ablaufs der Studie von uns erhalten. Das Einverständnis für die Teilnahme wird in schriftlicher Form gegeben. Die teilnehmenden Kinder werden mündlich nach ihrem Einverständnis gefragt und aufgeklärt, dass sie zu jedem Zeitpunkt von der Studie zurücktreten können.

Ich hoffe, Ihnen einen schlüssigen Einblick in unser Vorhaben gegeben zu haben. Zweifelsohne handelt es sich um eine außerordentlich interessante und bisher kaum erforschte Materie, die spannende Einblicke in das prosoziale und gruppensdynamische Verhalten von Kindern geben wird.

Sehr gerne würde ich die Gelegenheit nutzen, Ihnen unsere Studie persönlich vorzustellen und allfällige Fragen direkt zu beantworten. Zusätzlich können Sie sich jeder Zeit auch per Email an mich (niklas.hungerlaender@univie.ac.at) oder meine Betreuerin Mag. Dr. Lisa Horn (lisa.horn@univie.ac.at) wenden.

Wir würden uns wirklich sehr über eine Zusammenarbeit mit Ihnen freuen und hoffen auf eine baldige Rückmeldung.

Mit freundlichen Grüßen, Niklas Hungerländer, BS



Elternbrief

Betreff: Studie „Wie verteilen Kinder Ressourcen untereinander?“

Sehr geehrte Damen und Herren, liebe Eltern!

Ich, Niklas Hungerländer BSc, arbeite zusammen mit meinen Betreuern Mag. Dr. Lisa Horn und Prof. Dr. Thomas Bugnyar von der Universität Wien an einem Projekt, das untersucht, wie Kinder Sticker untereinander verteilen und wie dies mit verschiedenen anderen Variablen (z.B. Alter, Geschlecht) zusammenhängt. Ich bitte Sie, Ihr Kind an meiner Studie teilnehmen zu lassen. Ihr Kind wird in dieser Studie mehrmals die Möglichkeit haben, Ressourcen zwischen sich und anderen aufzuteilen. Dazu verwenden wir zwei Boxen, die leicht von den Kindern bedient werden können. Zusätzlich benötige ich das Alter, die Körpergröße und die Fingerlängen Ihres Kindes und werde Ihr Kind nach seinen/ihren besten Freunden befragen. Außerdem werden die Kinder – Ihre Zustimmung vorausgesetzt – vor Beginn des Versuchs zweimal ca. 10 Minuten in der Bildungsstätte beim freien Spiel beobachtet, um herauszufinden, mit wem sie in der Gruppe besonders viel Zeit verbringen und einmal bringe ich den Kindern ein neues Spiel in die Schule mit, mit dem sie 15 Minuten spielen dürfen. Die einzelnen Teile der Studie werden an vier verschiedenen Tagen direkt in der Bildungsstätte Ihres Kindes in Absprache mit dem/r LehrerIn durchgeführt. Zum Abschluss des Experiments bekommen die Kinder noch ein kleines Dankeschön von uns (z.B.: einen Stift, einen Radiergummi o.Ä.)

Haben Sie noch Fragen?

Bei Fragen zu unserer Studie können Sie mich jederzeit per Email (niklas.hungerlaender@univie.ac.at) oder per Telefon (0660 5619494) erreichen.

1. Alle Informationen, die Sie und Ihr Kind uns in dieser Studie geben, werden anonymisiert und vertraulich behandelt.
2. Die Studie wird mit Ihrem Kind nur dann durchgeführt, wenn Sie zustimmen und es freiwillig daran teilnimmt.
3. Sie können die Teilnahme Ihres Kindes an der Studie zu jedem Zeitpunkt zurückziehen, ohne eine Begründung zu geben.
4. Während der Studie würden wir gerne zur ungestörten Beobachtung Videoaufzeichnungen von den Kindern machen.
5. Diese Videoaufzeichnungen helfen uns bei der Analyse und diese werden danach sofort gelöscht!
6. Falls Sie Videoaufzeichnungen ablehnen, kann ihr Kind trotzdem an der Studie teilnehmen, ohne dass Videoaufzeichnungen gemacht werden.

Wenn Sie sich dazu entscheiden, unsere Forschung zu unterstützen, geben Sie uns bitte die erforderlichen Informationen auf Seite 2, unterschreiben die beiliegende Einverständniserklärung und geben diese bitte Ihrem Kind wieder in die Schule mit. Herzlichen Dank für Ihre Unterstützung und ich verbleibe mit freundlichen Grüßen, Niklas Hungerländer, BSc
Department für Kognitionsbiologie (<http://cogbio.univie.ac.at/>)
Universität Wien

Einverständniserklärung

Bitte füllen Sie die Einverständniserklärung vollständig aus, auch wenn Ihr Kind nicht an der Studie teilnehmen darf.

Bitte geben Sie die Einverständniserklärung ihrem Kind mit in die Schule.

Vielen Dank für Ihre Unterstützung!

Ich bin einverstanden, dass meine Tochter/mein Sohn mit Namen

_____ (Vorname/Nachname)

an der Studie „Wie verteilen Kinder Ressourcen untereinander?“ teilnehmen darf.

JA

NEIN

Geburtsdatum Ihres Kindes (TT.MM.JJJJ): _____

Ich habe die Beschreibung der Studie gelesen und verstanden:

JA NEIN

Ich habe verstanden, dass ich mein Kind zu jedem Zeitpunkt aus der Studie zurückziehen kann:

JA NEIN

Ich hatte die Möglichkeit, Fragen zu stellen, und meine Fragen zur Studie wurden ggf. in

ausreichendem Maße beantwortet:

JA NEIN

Ich bin einverstanden, dass Videoaufzeichnungen gemacht werden. Die Videos werden sofort nach der Analyse gelöscht und nirgends veröffentlicht.

JA NEIN

Der/die Erziehungsberechtigte:

Name: _____ (Vorname/Nachname)

Unterschrift: _____

Datum: _____ Ort _____



Einverständniserklärung für LehrerInnen

Betreff: Studie „Wie verteilen Kinder Ressourcen untereinander?“

Sehr geehrte Damen und Herren, liebe LehrerInnen!

Ich, Niklas Hungerländer BSc, arbeite zusammen mit meinen Betreuern Mag. Dr. Lisa Horn und Prof. Dr. Thomas Bugnyar von der Universität Wien an einem Projekt, das untersucht, wie Kinder Ressourcen (= Sticker) untereinander verteilen und wie dies mit verschiedenen anderen Variablen (z.B. Alter, Geschlecht) zusammenhängt. Ich bitte Sie, mit Ihrer Klasse an meiner Studie teilzunehmen. Die Kinder werden in dieser Studie mehrmals die Möglichkeit haben, Ressourcen zwischen sich und anderen aufzuteilen. Dazu verwenden wir zwei Boxen, die leicht von den Kindern bedient werden können. Außerdem werden die Kinder – Ihre Zustimmung vorausgesetzt – vor Beginn des Versuchs zweimal 10 Minuten in der Bildungsstätte beim freien Spiel beobachtet, um herauszufinden, mit wem sie in der Gruppe besonders viel Zeit verbringen und einmal bringe ich den Kindern ein neues Spiel in die Schule mit, mit dem sie 15 Minuten spielen dürfen. Die einzelnen Teile der Studie werden an vier verschiedenen Tagen direkt in der Bildungsstätte und in Absprache mit Ihnen durchgeführt. In einem elektronischen Fragebogen werden Sie außerdem noch nach den besten Freunden der Kinder befragt. Zum Abschluss des Experiments bekommen die Kinder noch ein kleines Dankeschön von uns (z.B.: einen Stift, einen Radiergummi o.Ä.)

Haben Sie noch Fragen?

Bei Fragen zu unserer Studie können Sie mich jederzeit per Email (niklas.hungerlaender@univie.ac.at) oder per Telefon (0660 5619494) erreichen.

Alle Informationen, die wir in dieser Studie aufnehmen, werden anonymisiert und vertraulich behandelt.

Die Studie wird mit Ihrer Klasse nur dann durchgeführt, wenn Sie und die Eltern der jeweiligen Kinder zustimmen und die Kinder freiwillig daran teilnehmen. Sie können die Teilnahme Ihrer Klasse an der Studie zu jedem Zeitpunkt zurückziehen, ohne eine Begründung zu geben. Während der Studie werden zur ungestörten Beobachtung Videoaufzeichnungen von den Kindern gemacht, sofern eine Zustimmung der Eltern besteht.

Diese werden von den VersuchsleiterInnen aufbewahrt und für wissenschaftliche Analysen verwendet. Diese Videoaufzeichnungen werden nicht veröffentlicht.

Wenn Sie sich dazu entscheiden, unsere Forschung zu unterstützen, unterschreiben Sie die beiliegende Einverständniserklärung (Seite 2).

Herzlichen Dank für Ihre Unterstützung und ich verbleibe mit freundlichen Grüßen,

Niklas Hungerländer, BSc
Department für Kognitionsbiologie (<http://cogbio.univie.ac.at/>)

Universität Wien

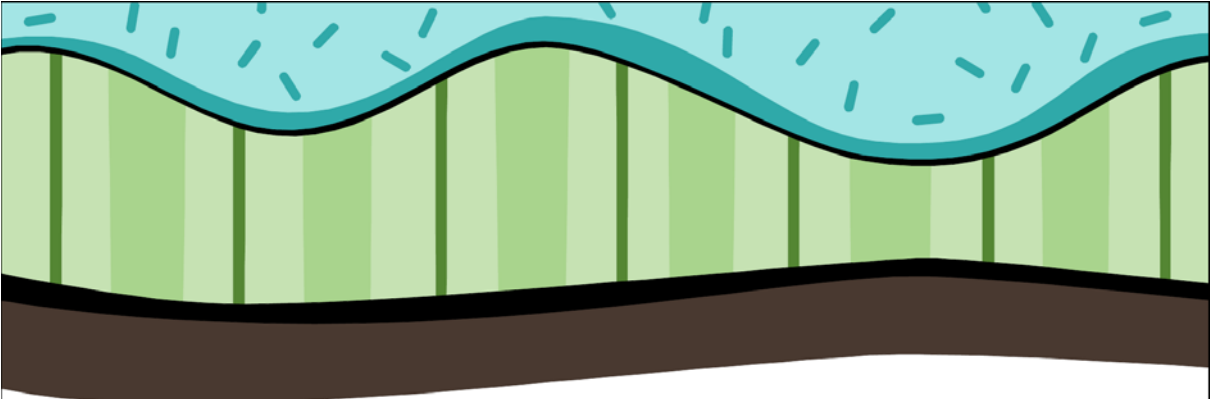
Appendix D

Data sheet used for social network analysis

ID	Anzahl Aufmerksamkeit	Wer/wie viele in der Nähe	Verhaltensweise (I, B, X, P)

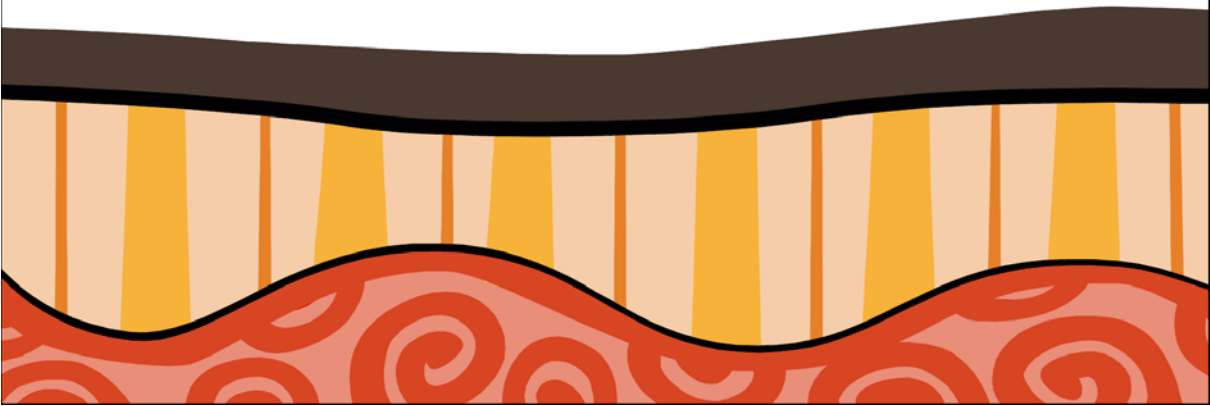
Appendix E

Questionnaire for children



Wer sind deine besten Freunde/Freundinnen?

VPnr.: _____



Appendix F

Questionnaire for teachers



0% ausgefüllt

1. Wer sind die besten Freunde des Schülers?

(1-5 Antworten möglich)

Leon

☐ Anas	☐ Hena
☐ Angelo	☐ Jusuf
☐ Anna	☐ Leon
☐ Arda	☐ Lucia
☐ Atakan	☐ Marcel
☐ Betül	☐ Marco
☐ Charlotte	☐ Medine
☐ Christine	☐ Raffaella
☐ Dana	☐ Raphael
☐ Elisa	☐ Yousef
☐ Emma	☐ Zayneb

2. Eigenschaften

trifft nicht zu  trifft sehr zu

durchsetzungsfähig	
dominant	
behauptet sich selbst	
sagt anderen, was zu tun ist	

Weiter

Appendix G

Instruction of dominance game

„Ihr dürft jetzt 10 Minuten mit einem neuen Spielzeug spielen. Es heißt Dr. Bibber. Wer kennt dieses Spiel schon? Das Ziel des Spieles ist es mit dieser Pinzette die Objekte aus dem Patienten zu holen. Aber Vorsicht: Wenn ihr zu nahe an den Rand kommt ertönt ein Signal („Das sollte nicht passieren“) Habt ihr noch Fragen?“

Appendix H

Coded behaviour and data sheet and used for dominance game

Behaviour during handing over the tweezers which could be either active giving, active taking or passive. Active giving was defined as giving the pair of tweezers voluntarily to a specific person. Active taking was defined as losing the pair of tweezers involuntarily by taking it away by another person. Passive was defined as laying the pair of tweezers voluntarily aside, without determining a new owner.

[illegible]

Appendix I

Different versions of sticker album

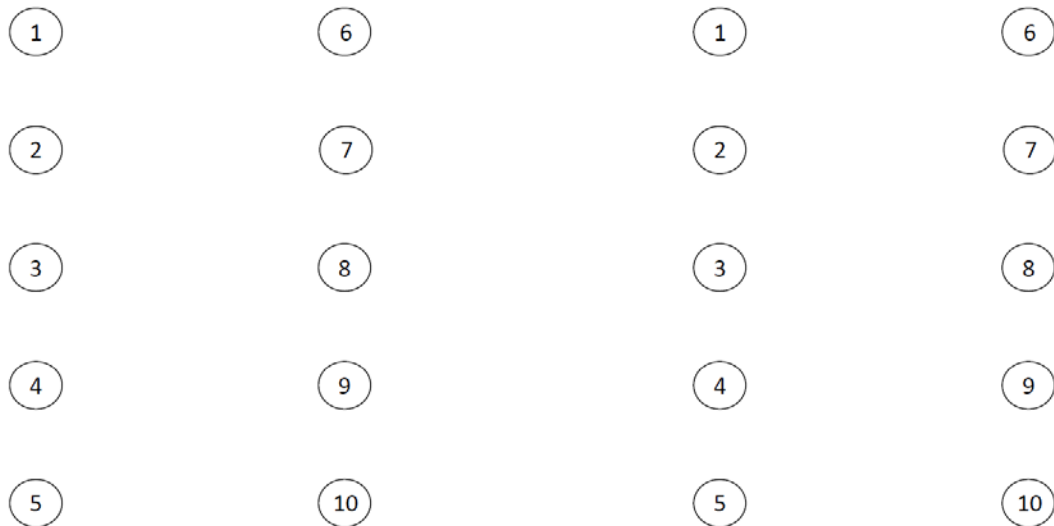
First:



Name: _____

1	7	13
2	8	14
3	9	15
4	10	16
5	11	17
6	12	18

Second and third:



Appendix J

Explanation in front of whole class

English:

“Today, we will play a game with every one of you. In this game you can allocate stickers, which you can insert into a sticker album. After every one of you has finished the game, you can trade your sticker album for a little gift. You will always play the game in pairs and I will call you up one after another. When you are done with playing you can go back to class. The most important thing is that you don’t talk about the game with you classmates, until everyone has finished playing.”

German:

„Heute werden wir mit jedem von euch ein Spiel spielen. In dem Spiel könnt ihr Sticker erhalten, die ihr in einen Sammelpass einkleben könnt. Mit dem Sammelpass könnt ihr euch heute, wenn alle von euch dran waren, ein kleines Geschenk abholen. Ihr werdet immer zu zweit das Spiel spielen und ich werde euch der Reihe nach aufrufen. Wenn ihr mit dem Spielen fertig seid, könnt ihr zurück in die Klasse gehen. Aber es ist wirklich wichtig, dass ihr nicht über das Spiel redet, bis alle mit dem Spielen fertig sind.“

Appendix K

Explanation in front of each donor

English:

“There are two boxes in front of you. There are stickers located in the boxes, but both boxes are closed. With this coin you are able to open one of the two boxes, if you drop it into the small box, but the other big box will remain closed. Since the barrier is now open you may take all stickers out of the box and paste them into your sticker album.”

German:

„Vor dir stehen 2 Boxen. In den Boxen befinden sich Sticker, jedoch sind beide Boxen verschlossen. Mit dieser Münze kannst du eine der beiden Boxen öffnen indem du sie in die Münzbox wirfst, die zweite Box bleibt jedoch weiterhin verschlossen. Da die Barriere gerade offen ist, darfst du dir alle Sticker aus der geöffneten Box rausnehmen und dir behalten.“