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Effect of Age and Sibling Status“

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Alisa Höflinger, September 2023

Abstract

Social dominance describes the ability to use the own knowledge and skills to acquire specific goals or resources, using prosocial or coercive strategies. Kindergarten children show a behavioral shift from coercive to more prosocial strategies in reaching social dominance, driven by cognitive development. Apart from these age-dependent processes, the cognitive development of young children was shown to benefit from caregiving and teaching interactions with siblings. It is still unclear how these two factors interact, and how sibling status affect this shifting process. My thesis focuses on this knowledge gap by investigating the effect of age and sibling status on social dominance behavior in kindergarten children. I conducted video analyses of children from six different kindergarten groups. Given that the groups were from one kindergarten (located at two different sites in Vienna), the sample offered a highly homogenous background regarding the pedagogical team and approaches. I hypothesized that age would be associated with an increase in prosocial dominance strategies and general prosociality, with a simultaneous decrease in coercive dominance strategies and general aggression. Regarding the shift from coercive to prosocial strategies, I hypothesized to find an interaction between age and sibling status. I was partly able to confirm these predictions. As hypothesized, I found an increase in prosocial dominance strategies with age, and sibling status to be a significant predictor for two out of three of the tested prosocial variables, one of which was an interaction with age. Looking at all types of competitions used to gain social dominance, I found children with siblings to show a significantly higher amount of prosocial competitions compared to children without siblings. I could not find any effects on coercive behaviors. Given that there was also an increase in general prosocial behaviors, it is likely that young children show general behavioral changes towards more prosocial behaviors, rather than a specific shift restricted to dominance strategies. In sum, my findings point towards an age-related increase in prosocial dominance strategies and general prosocial behaviors in kindergarten children and suggest an effect of sibling status on the expression of prosocial dominance behaviors.

Keywords: *Social dominance, prosocial, coercive, sibling status, age, competition, general aggression, general prosociality, kindergarten children*

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Introduction

Humans are highly cooperative individuals that, like non-human apes, evolved to live in social groups. Group-living provides the possibility for collaboration, but also evokes competition over limited resources (Chen Zeng et al., 2021; Pettay et al., 2016; Tomasello, 2020; Tomasello et al., 2012). Thus, social dominance, the ability to reach specific resources or goals by using the own skills and knowledge (Hawley, 2002), is an important aspect of humans, that was found to develop as early as preschool age (for a review see, Chen Zeng et al., 2021). The expression of social dominance in young children is mainly based on aggressive or coercive behaviors, but, associated with cognitive maturation processes, develops towards more prosocial strategies when children become older (Blake et al., 2015; Hawley, 1999; Strayer & Trudel, 1984). Beyond that, other factors that have been suggested as likely being associated with the expression of social dominance in young children include personality (Hawley, 2002; Hawley & Little, 1999), age (Strayer & Trudel, 1984; Teisl et al., 2012) and social experiences (Downey & Chondron, 2004; Kitzmann et al., 2002). Given that already three-year-old children were found to adapt their behavior towards other children depending on earlier interactions with them (Warneken & Tomasello, 2013), it becomes clear that the way in which we interact with others influences group-living and social relationships. Thus, the study of social dominance, its development and influencing factors constitutes an important aspect for the study of social interactions in group-living species.

Evolution of Social Dominance

Imagine the following theoretical example: Two individuals compete for a specific resource. They can either decide to act peacefully and divide the resource, or to fight against the other individual, if they want the entire resource for their own. If only one of the individuals decides to fight, while the other does not, the aggressor will receive the resource at no cost (Smith, 1982).

This model, the hawk-dove model (Smith, 1982), is an evolutionary game theoretical model that describes the contest between prosocial (dove), and antisocial (hawk) behavioral strategies, when fighting for a resource. It aims to provide a simplistic framework to investigate under which

conditions prosocial behavior evolved (Eldakar, 2020). Such contexts, involving fights over limited resources, are assumed to have contributed to the development of dominance hierarchies. Dominance hierarchies describe asymmetric access to limited resources, with more dominant individuals receiving better access to limited resources (Lahn, 2020; Qu et al., 2017). Fights or contests between individual members of a group are required for the formation of such a hierarchical ranking system (Lahn, 2020). As illustrated by the hawk-dove model, whenever resources are limited and desired by multiple individuals, competition for these resources emerges. In order to determine access to resources, reduce the risk of injury that would be associated with repeated competitions, and to maintain the stability of a group, the development of dominance hierarchies is essential (Chen Zeng et al., 2022; Lahn, 2020; Tibbetts et al., 2022). Aggressive fights play an important role for the formation of dominance hierarchies. Once a stable dominance hierarchy has been formed, „uncontested competitions“ become more frequent. This means that the dominant individual takes a resource at no cost, while the sub-dominant individual does not fight about it or get anything in return.

Given that dominance hierarchies arise from contests between single individuals, thereby constructing a dominant-subordinate order between single group members (Lahn, 2020), it is important to look at the definition and development of dominance more general. Drews (1993) reviewed thirteen definitions of dominance focusing on animal behavior, deriving the following definition:

Dominance is an attribute of the pattern of repeated, agonistic interactions between two individuals, characterized by a consistent outcome in favor of the same dyad member and a default yielding response of its opponent rather than escalation. The status of the consistent winner is dominant and that of the loser subordinate. (p. 283)

Originally, the concept of dominance in behavioral science is based on research by Schjelderup-Ebbe (1922) on the pecking-order in domestic chicks. In domestic chicks, the pecking order, the order in which individuals are given access to food by other chicks, is maintained by aggressive interactions - while dominant individuals peck subordinate chicks and get more access to food, subordinate individuals do not peck dominant chicks and get less access to resources (Kochhann, 2018). Hand (1986) described different dominance-strategies in animal species and distinguished between aggressive dominance, which she defines as dominance behavior exhibited between

„unfamiliar“ individuals, and social dominance, referring to behavioral dominance interactions between „familiar“ individuals. Dominance interactions have not only been described in non-human animals, but also in humans (Chen Zeng et al., 2022; Hawley & Little, 1999; Hermann, 2017). In humans, there are different ways to achieve high status in a social hierarchy. Prestige-based status, for instance, arises from knowledge or skills (Chen Zeng et al., 2022). When studying the development of the different dominance strategies that can be found in humans, it is particularly interesting to look at processes and developments during early childhood.

Much of the early research on social dominance was inspired by ethological research, in which dominance has often been equated with aggression (Hawley & Little, 1999; Omark et al., 1980). Traditionally, the outcome of aggressive interactions has been used to derive social dominance hierarchies, while other interactions that might also relate to social dominance have sometimes been neglected (Hawley, 1999). Sluckin and Smith (1977) examined dominance in preschool children, stating that the outcome of conflict situations could be well explained by the linear dominance hierarchy in the group. Hawley and Little (1999) were among the first to take a broader approach to the study of social dominance. Their definition of social dominance focused on resource control, rather than aggression, and considered intelligence, goal directness (i.e., persistence in achieving goals) and environment experience (social and physical) as equally important factors. Hawley (2002) defined social dominance as the ability to use the own knowledge and skills to acquire specific goals or resources. This shifted the focus from a negatively connotated aggression-based definition towards a more positively connotated definition of social competence, focusing on resource control as main outcome. Given that dominance behavior reflects an important characteristic for social group interactions, it is highly important to understand which factors influence the development and expression of dominance behavior in childhood.

Ontogenetic Development of Social Dominance

Understanding of Social Dominance

The ability to infer social dominance relations from relative group size was already found in six- to nine-month-old infants (Pun et al., 2016). This age period is especially interesting, as most children that age do not have much experience in social groups. Pun et al. (2016) presented

infants with short animations, depicting the actions and goals of agents belonging to two different groups. The agents of both groups were squares with faces, that differed in color, size, and number. However, overall surface area of the two groups was the same. One group consisted of three smaller squares, while the other group consisted of two larger squares. After the goal of the agents of both groups (crossing the platform) was introduced separately, infants were presented with agents from both groups (now identical in physical size) attempting to cross the platform at the same time. Two different outcomes were presented: one in which an agent of the numerically larger group succeeded (expected outcome), and one in which an agent of the numerically smaller group succeeded (unexpected outcome). Since infants looked significantly longer when they were presented with the unexpected outcome, they likely used the numerical group size as cue for social dominance. Similarly, using animated rectangles, Thomsen et al. (2011) found that 10 to 13-month-old infants, but not younger ones, were able to represent social dominance from relative size. Social dominance as determinant for the initiation of affiliative interactions was only found in older children. Strayer and Trudel (1984) observed social interactions between children from five age-stratified daycare groups. They investigated whether dominance status had an effect on the initiation of agonistic and affiliative interactions among children in the group, for instance, if individuals with higher status received more affiliative interactions from others. Indeed, it was found that, for the two older levels, dominance status affected the initiation of affiliative interaction between children. Affiliative interactions were preferably directed towards peers with higher social status. Social dominance is therefore assumed to be the earliest stable dimension of social organization in preschool peer groups (Strayer & Trudel, 1984). These findings suggest that preverbal children already have an implicit understanding of dominance. Investigating how this changes with age, when verbal abilities improve and children gain social experiences in groups may broaden the understanding of the development of dominance in social interactions during early childhood.

Expression of Social Dominance in Early Childhood

Social dominance describes an asymmetry in the relative ability of individuals in resource competition (Hawley, 2002). Different strategies to achieve social dominance, and thus to „win“ resources, can roughly be grouped into coercive and prosocial behaviors (Dodge, 2013; Hawley, 2002). Coercive behaviors involve harming interactions, including physical, verbal, and relational aggression (Hawley, 2002). In contrast, prosocial ways to attain social dominance

mainly rely on the use of social skills to maintain positive relationships, for example by using cooperation or polite requests. The attainment of social dominance in young children was found to be primarily based on coercive behaviors (Hawley, 1999; Strayer & Trudel, 1984). For instance, when a particular object is desired, younger children tend to be physically or verbally aggressive, taking objects from other children or using negative expressions or insults towards them (Hawley, 2002). A decline in physical aggression was found to occur at the age of four to five years, accompanied by a rise in importance of fairness and compromising (Blake et al., 2015; Hawley, 1999; Li et al., 2016). Accordingly, Hawley (1999) assumes age to play an important role regarding the choice of strategy used to obtain social dominance in children. Young children were found to primarily use coercive strategies to obtain social dominance. With increasing age, there was a shift in strategy use, resulting in the employment of more prosocial dominance strategies until there is a clear distinction between coercive and prosocial strategies in older children (Hawley, 1999). In line, age was also found to be correlated with dominance status, that, in turn, was associated with both resource-control strategies, prosocial (e.g., offering, suggesting, helping) and coercive (e.g., taking, insulting, thwarting) (Hawley, 2002). The strategies were correlated at the individual's level, meaning that children who were engaging in prosocial behaviors were also engaging in coercive behaviors. These behavioral developments were often attributed to age-related progresses in social, cognitive, and verbal expression. (Côté et al., 2006; Dodge, 2013; Roseth et al., 2007; Tremblay et al., 2004). In addition to general developmental influences, one must consider that the expression of social dominance behaviors in young children is also influenced by individual factors.

Factors Influencing the Expression of Social Dominance in Early Childhood

Personality and Gender

Previous studies have considered different factors as possible determinants for the expression of social dominance in children. At a very basic level, one could assume that differences in social dominance can be explained by differences in personality. Testing this hypothesis, Hawley and Little (1999) focused on persistence as specific personality trait possibly related with social dominance. Indeed, they found socially dominant individuals to be significantly more persistent than children who were less socially dominant. However, besides persistence, no other personality traits have been investigated in this study. A more extensive approach was taken by Hawley (2002), who analyzed parent questionnaires to investigate whether five different

personality traits (i.e., agreeableness, conscientiousness, ability to detect social cues, hostility, aggression) were related to the choice of coercive and prosocial strategies in three- to six- year-old preschool children. This assumption could not be supported, as none of the personality traits showed significant correlations with coercive or prosocial strategies.

Another profound factor that might be associated with social dominance is gender. Gender differences in social dominance were often attributed to hormonal differences, especially testosterone, which is considered to be a regulator of aggressive behavior (Geniole et al., 2020). For instance, high levels of testosterone were found to encourage dominance behavior in men (Mazur & Booth, 1998). Studies on aggression, which constitutes one particular aspect of social dominance, also reported gender differences linked to differences in testosterone level in adolescents and adults. (Björkqvist, 2018; Eliot, 2021; Geniole et al., 2020). Evidence for gender differences in aggression was also found in younger children (Murray-Close & Ostrov, 2009). Girls showed more relational aggression (Murray-Close & Ostrov, 2009) and overall higher social dominance (Hawley & Little, 1999), while boys exhibited more overt aggression on a physical or verbal level (Ostrov & Keating, 2004). Other studies considering multiple different behavioral strategies to attain social dominance did not find evidence for gender differences (Hawley, 2002; Roseth et al., 2007). Hawley (2002) argued that gender might need to be considered as relevant factor in studies using a more focused approach to social dominance (i.e., focusing primarily on aggressive behavior). Gender was not expected to play a significant role if a broader approach to social dominance was taken, in which multiple strategies were considered (Hawley, 2002). Gender differences in testosterone levels in young children do not appear before the age of 10 years, with males showing a much stronger increase in testosterone during puberty (Senefeld et al., 2020). Therefore, testosterone-associated gender differences in aggression are not yet expressed in preschool children. In sum, there is currently no clear indication for gender to play a significant role in social dominance expression in young children.

Age

There is consistent evidence that age affects the expression of social dominance in children (Hawley, 2002; Hawley & Little, 1999; Strayer & Trudel, 1984; Teisl et al., 2012). Hawley et al. (1999) found younger children to primarily use coercive strategies for reaching social dominance. When desiring a particular object, kindergarten children tended to be physically or

verbally aggressive (e.g., taking objects by force, or using insults towards other children to reach their goal) (Hawley, 2002). Strayer and Trudel (1984) analyzed dyadic interactions between 134 one- to six- year-old children. They found significantly more conflicts among children from the three younger age groups (mean ages approximately one, two, and three years) compared to the two older groups (mean ages approximately four and five years). Accordingly, a decline in physical aggression occurring at the age of four- to five- years, and a rise in fairness and compromising was also found in other studies (Blake et al., 2015; Hawley, 1999; Li et al., 2016). While, in sum, these findings conjointly point towards changes in the expression of social dominance at an age of four- to five- years, interactions between age and sibling status that possibly affect this behavioral development, have not been examined sufficiently yet.

Social Experiences

Social environmental influences such as family and peer groups constitute decisive factors for a child's cognitive development, as they provide them with behavioral examples which broaden behavioral and social repertoires (Bandura, 1986). Siblings in particular were shown to have a supportive effect on a child's cognitive development and social skill repertoire, due to shared caregiving and teaching experiences (Brody, 2004; Downey & Condran, 2004). Repeated interactions with siblings enable children to develop interpersonal skills that can further be applied in interactions with peers (McCoy et al., 1994). Sang and Nelson (2017) examined the effect of siblings on social competence in five- to seven- year-old children and reported highly complex interactions between age and gender effects. While, in sum, their findings supported the assumption that sibling interactions can have beneficial effects on social competences, they suggested that factors such as birth order or gender constellation are likely to be decisive for the extent of social competence benefits. Therefore, several studies suggested that not the sibling status (i.e., child has siblings or not), but rather the quality of the siblings relationship was decisive for these observed effects of siblings on social competence (e.g., Smorti & Ponti, 2018). In contrast, Kitzmann et al. (2002) did not report such complex interactions between sibling characteristics and effects on social competences when focusing on elementary school-age children. Children with siblings were found to have higher peer-related group-level social competences compared to children without siblings (Kitzmann et al., 2002). Exploratory analyses on third to sixth grade children in the same study indicated that children without siblings might have had disadvantages regarding conflict managing skills, that children with

siblings possibly acquired through sibling interactions. Similarly, Dunn and Munn (1986) identified interactions with siblings to be highly influential for the expression of prosocial behavior. Children at toddler- and preschool age, observed over six months, were found to have responded more prosocial, if they had received a higher amount of prosocial behavior from their sibling before (Dunn & Munn, 1986). Downey and Condrón (2004) analyzed data from 20,649 children that participated in *The Early Childhood Longitudinal Study*, a longitudinal study investigating children's knowledge, skills and development from kindergarten through the eighth grade (Early childhood longitudinal studies (ECLS) program, n.d). Their findings also point towards beneficial effects of siblings on children's interpersonal and social skills. Children with siblings were rated as having better self-control and fewer problematic externalizing behaviors (Downey & Condrón, 2004).

The effects of siblings on social competences can be analyzed in high detail, for instance by taking into account aspects of sibship quality (e.g., gender constellation or age differences). Nonetheless, sibling status also seems to be a valid and simple approach for the analysis of sibling effects, with studies conjointly pointing towards siblings to have beneficial effects on social competence and interpersonal skills in young children. Thereby, sibling status likely affects children's ability to balance prosocial and coercive strategies in resource competition.

Ontogenetic Development of Aggression and Prosociality in Early Childhood

The use of coercive and prosocial social dominance strategies in children might reflect a more general development of aggression and prosociality outside of resource competition. In the first two years after birth, children begin to show aggressive and prosocial behaviors (Brownell, 2013; Gill & Calkins, 2003; Hay et al., 2021). An important factor that was found to contribute to the development of both behaviors are social experiences. (Brownell, 2013; Reebye, 2005). Due to shared developmental influences, different forms of associations between aggression and prosociality were assumed; the two have been defined as contrary behaviors of one single dimension, as two distinct and negatively correlated dimensions, as two non-correlated dimensions, and as different, but positively correlated forms of social behavior (Hay et al., 2021). Gill and Calkins (2003) found indications for prosociality and aggression to be positively correlated in two-year-old children. In contrast, Romano et al. (2005) found a negative

correlation between prosociality and aggression in two- to 11- year-old children, possibly suggesting that a differentiation between these two constructs emerges when children become older. Accordingly, most studies focus on prosocial and aggressive behaviors as distinct concepts (Hay et al., 2021).

Aggression

During infancy, most children were found to begin initiating aggressive behaviors, in form of physical aggression. Physical aggression encompasses hitting, kicking or pushing other children, directly (i.e., with hands or feet) or indirectly (i.e., using objects or toys) (Tremblay et al., 2004). While in young children, physical aggression constitutes the main form of aggression, it was described to decrease between the age of three- to four- years (Alink et al., 2005; Cummings et al., 1989). In turn, other forms of aggression were found to occur instead. In older preschool children, physical aggression is often replaced by relational or verbal aggression (Côté et al., 2007). Relational aggression is characterized by behaviors intended to harm others by using non-physical strategies, such as exclusion from social activities or gossiping (Bowie, 2007). This behavioral change is assumed to be induced by cognitive developments, especially the improvement of verbal abilities (Roseth et al., 2007). Before entering primary school, children were found to have developed alternatives to physical aggression as well as regulation strategies (Tremblay et al., 2004).

Prosociality

Along the decrease in aggression, a rise in prosociality was described (Grueneisen & Warneken, 2022). In general, prosociality describes a multidimensional construct, commonly distinguishing three subtypes: helping, sharing, and comforting (i.e., helping distressed others) (Brownell, 2013; Paz et al., 2023). Even though all of these subtypes were found to occur during the second year of life, they are likely to require different cognitive prerequisites, thus causing considerable divergence regarding their prevalence in early years (Dunfield et al., 2011; Paz et al., 2023; Svetlova et al., 2010). While toddlers mostly show instrumental helping (e.g., getting a toy that is out of reach), motivated by sympathy for others, progress in cognitive development results in more complex prosocial behaviors as children become older (Grueneisen & Warneken, 2021). Accordingly, at the age of approximately five years, the cognitive abilities of children allow

them to use prosociality more strategically to achieve specific goals, such as improved reputation or to elicit reciprocity (Grueneisen & Warneken, 2021).

Hawley (1999) postulated a shift in social dominance strategies from primarily coercive to more prosocial strategies with increasing age in young children. Given that during preschool age also general behavioral changes in aggression and prosociality were described (Alink et al., 2005; Côté et al., 2007; Cummings et al., 1989; Dunfield et al., 2011; Grueneisen & Warneken, 2022; Paz et al., 2023; Svetlova et al., 2010), the postulated shift might reflect a more general behavioral development. Young children possibly show a decrease in aggression accompanied by an increase in prosociality not only in the use of coercive and prosocial dominance strategies, but also outside resource conflicts. It is therefore important to examine behavior inside as well as outside resource conflicts to differentiate a behavioral shift specifically occurring in social dominance strategies from more general behavioral adaptations.

Research Aim & Hypotheses

Dominance behavior is an integral part of human interactions when it comes to the acquisition of specific goals or resources, whose foundation is set already early in life (Hawley, 2002). It is therefore highly relevant to examine which processes and factors shape the development and expression of social dominance behavior in early childhood. Social dominance in young children was found to be primarily based on coercive behaviors in the early years, but, driven by processes in cognitive development, found to shift towards more prosocial behaviors in later kindergarten years (Hawley, 1999; Roseth et al., 2007; Strayer & Trudel, 1984). Studies on social dominance suggested several factors to have an effect on this development, including personality and age (Hawley, 2002; Hawley & Little, 1999; Murray-Close & Ostrov, 2009). Apart from these factors, the social environment and especially siblings were shown to be beneficial for the development of social competences (Kitzmann et al., 2002; Sang & Nelson, 2014). However, there is a lack in evidence regarding the effect of sibling status on the shifting process from coercive towards more prosocial behavior in reaching social dominance in young children. Given that in the year 2021 more than 20 % of Austrian children had no siblings in the same household (Kaindl & Schipfer, 2022), with the average number of children per family decreasing (Statistik Austria, n.d.), it is unclear how this change in family structure affects dominance behavior in children. In my study, I focus on this knowledge gap and examine how age and sibling status affect social dominance expression in kindergarten children. For single children, who have no social experiences with (similarly aged) siblings, social experiences with peers in the kindergarten become increasingly important. Most studies that have examined social dominance behavior in kindergarten children are based on different kindergartens, pedagogical teams, and approaches. My study is based on a sample of 92 children from two locations of a single kindergarten, offering a homogenous background regarding pedagogues, administration and pedagogical approaches. Due to the large sample covering an age span from four months up to almost seven years, my study enables insights into the development of social dominance behavior during the entire preschool period. Behavioral classifications are in line with Hawley (2002), differentiating between prosocial and coercive competitions to obtain social dominance. Additionally, I considered a third strategy; stable dominance relationships in groups prevent recurrent aggressive resource fights (Chen Zeng et al., 2022; Lahn, 2020; Tibbetts et al., 2022). Instead, „uncontested“ competitions occur more frequently instead, in which the dominant

individual takes a resource from another individual at no cost, without the other individual preventing or receiving anything in return. Therefore, I extended the dichotomous categorization of dominance strategies by additionally differentiating such uncontested competitions. Instead of fighting over a resource (e.g., a toy), in uncontested competitions, a child takes a resource from another child without force, without the other child trying to prevent it or receiving anything in return. A shift in social dominance strategies from primarily coercive to more prosocial strategies with increasing age in young children was postulated by Hawley (1999). As during preschool age, general behavioral changes in aggression and prosociality were described (Alink et al., 2005; Côté et al., 2007; Cummings et al., 1989; Dunfield et al., 2011; Grueneisen & Warnecken, 2022; Paz et al., 2023; Svetlova et al., 2010), it is likely that the postulated shift reflects a more general behavioral development. To differentiate between general behavioral changes and the specific shift in social dominance strategy suggested by Hawley (1999), I additionally included general prosociality and general aggression in my analyses to control for social behavior apart from social dominance interactions. My two main research questions were (1) how age affects the expression of social dominance and general social behavior, and (2) which effect sibling status would have on this process. For my first research question, I hypothesized that coercive dominance behaviors and general aggression would decrease with age. I further hypothesized that prosocial dominance behaviors as well as general prosociality would increase with age. Previous studies found that social skills and the cognitive development of young children benefitted from teaching and caregiving experiences with siblings (Brody, 2004; Downey & Condrón, 2004). For my second research question, I therefore hypothesized an interaction between sibling status and age for the shift from primarily coercive to more prosocial behavioral strategies to reach social dominance. Specifically, I predicted that children with siblings would show more prosocial and less coercive competitions than children without siblings. Additionally, I predicted that children with siblings would show a stronger increase in the ratio of prosocial in all competitions than children without siblings.

Methods

Study Sample & Sample Information

My study is based on video data collected in 2018, including 105 children (43 female, 62 male) from 6 different kindergarten groups from 1 kindergarten (located at two different sites) in Vienna, Austria. Even though the kindergarten groups were located at 2 different sites, the administration as well as the pedagogical team and approaches were the same for both locations, thus offering a highly homogenous background and a large sample at the same time. The groups differed with regard to size and age distribution (age range: 4 months - 6.6 years; $M \pm SD = 38.85 \pm 20.33$ months) (Table 1). The group allocation was determined by the age of the children. In Austrian childcare facilities it is common that groups are roughly divided by age so that children are in a group with others of approximately the same age. A t-test ($t(102) = 0.08$, $p = 0.93$) indicated no significant age difference between females ($M \pm SD = 39.05 \pm 22.01$ months) and males ($M \pm SD = 38.71 \pm 19.70$ months).

Table 1. General information on groups, only including children that were considered for the model set-up.

Group-wise overview on total number of children, sibling status, mean age in months with standard deviation (SD), mean group size (how many children were present in an observation on average), and mean sessions present (how many sessions children were present on average). All values described as total values including males and females, and separately for gender.

	N	Gender	Sibling status (Yes / no / unknown)	Mean age in months (SD)	Mean group size (SD)	Mean sessions present (SD)
Group 1	9	All	3 / 6 / 0	12.89 (2.94)	7.11 (0.59)	7.33 (1.80)
	5	Female	3 / 2 / 0	13.00 (2.24)	6.86 (0.24)	7.40 (2.07)
	4	Male	0 / 4 / 0	12.75 (4.03)	7.38 (0.83)	7.25 (1.71)
Group 2	8	All	2 / 3 / 3	13.63 (3.02)	6.35 (0.31)	7.50 (1.60)
	4	Female	1 / 0 / 3	12.25 (3.95)	6.55 (0.12)	7.00 (0.82)
	4	Male	1 / 3 / 0	15.00 (0.82)	6.15 (0.32)	8.00 (2.16)

Table 1 Continuation

	N	Gender	Sibling status (Yes / no / unknown)	Mean age in months (SD)	Mean group size (SD)	Mean sessions present (SD)
Group 3	13	All	4 / 7 / 2	24.15 (5.16)	9.68 (0.43)	7.15 (1.34)
	6	Female	2 / 4 / 0	27.00 (5.93)	9.54 (0.40)	6.83 (1.47)
	7	Male	2 / 3 / 2	21.71 (2.89)	9.80 (0.45)	7.43 (1.27)
Group 4	18	All	12 / 4 / 2	42.17 (15.34)	11.65 (0.54)	6.28 (1.78)
	5	Female	3 / 1 / 1	39.20 (12.4)	11.86 (0.37)	6.80 (1.64)
	13	Male	9 / 3 / 1	43.31 (16.65)	11.57 (0.59)	6.08 (1.85)
Group 5	21	All	13 / 6 / 2	53.10 (15.03)	15.20 (0.51)	7.10 (1.97)
	8	Female	5 / 3 / 0	58.88 (12.06)	15.24 (0.52)	7.13 (1.73)
	13	Male	8 / 3 / 2	49.54 (15.98)	15.17 (0.52)	7.08 (2.18)
Group 6	23	All	10 / 9 / 4	53.09 (10.86)	19.12 (0.34)	8.17 (1.23)
	10	Female	4 / 2 / 4	53.70 (10.99)	19.12 (0.42)	8.60 (0.85)
	13	Male	6 / 7 / 0	52.62 (11.19)	19.11 (0.29)	7.85 (1.41)

Study Material

My thesis is part of a more extensive project on social dominance in children. It is exclusively based on the analysis of video data that was collected in the course of the project. For each of the groups, 10 observations with a duration of 40-50 minutes were analyzed. Like comparable studies investigating social behavior in kindergarten children (Berndt & Bulleit, 1985; Pellegrini et al., 2007; Roseth et al., 2007; Strayer et al., 1978), the recordings were carried out during free play time, therefore giving the children the opportunity to interact freely. Classrooms were equipped with 3 to 4 video cameras installed by the experimenter in fixed positions at the beginning of each session, covering different perspectives of the room. Due to technical problems, for some of the observations only 2 camera perspectives were available; for 3 observations, only 1 camera perspective was available for analysis, thus limiting the analyzable interactions. During the recording, the experimenter did not interact with the children to make sure that the play situation was as natural as possible.

Ethogram and Behavioral Video Coding

I used BORIS (*Behavioral Observation Research Interactive Software*, Friard & Gamba, 2016) for the coding of the videos. The coding was based on an ethogram that I derived in advance from video observations and earlier studies on social dominance behavior (e.g., Berndt & Bulleit, 1985; Dodge, 2013; Hawley, 2002; Pellegrini et al., 2007). Using a focal sampling approach (i.e., only one child was focused on, and coded at a time), in general, I distinguished between the targeted resource of the dominance behavior, that could either be material or social. Further, I differentiated the way in which these resources were obtained – prosocial, coercive, or uncontested. In contrast to previous literature that only differentiated between prosocial and coercive competition strategies, I included uncontested resource competitions as third category. Such uncontested competitions did not include aggressive behaviors as strategy for resource acquisition, but rather „taking without asking“, without any defense or prevention actions from the other child. Further, I included two more categories, general prosociality and general aggression, to control for general social behavior not referring to dominance behavior. I used specific example behaviors to define the different behavioral categories, but coded only the

categories and the strategy used (prosocial, coercive, uncontested), not the specific behaviors themselves (Table 2).

Table 2. Ethogram

Description of the classification of strategies and behaviors used for video coding.

BEHAVIOR CATEGORY	STRATEGY	DESCRIPTION & EXAMPLE BEHAVIOR
Dominance behavior targeting a specific resource		
<i>Material resource</i>		
	Prosocial	Exchanging a desired object; persuading others to give them something
	Coercive	Taking objects from others by force; physically preventing others from obtaining an object; verbally forcing others to give them something
	Uncontested	Displacing others from a place by entering a place or play area that others thereupon leave voluntarily; taking an object from another child without force, other child accepting it
<i>Social resource</i>		
	Prosocial	Persuading others to do something; showing a specific behavior to attract someones attention
	Coercive	Disrupting interaction between two other individuals (peers and/or teachers); Excluding others from social activities; Commanding what others should do
	Uncontested	Joining others with one or some of the peers leaving the playing interaction thereupon

Table 2 Continuation

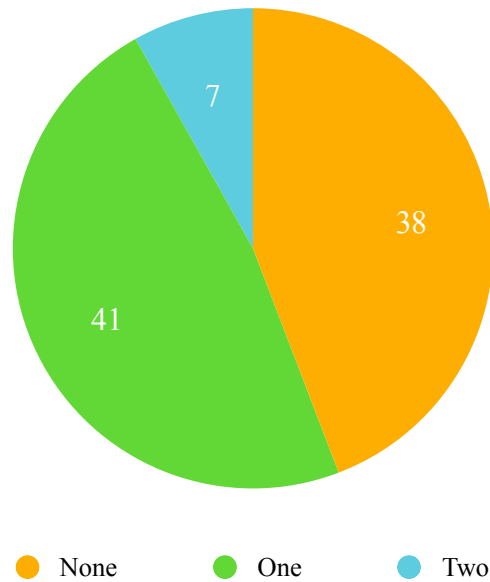
BEHAVIOR CATEGORY	STRATEGY	DESCRIPTION & EXAMPLE BEHAVIOR
<hr/> General social behavior <hr/>		
<i>General prosociality</i>		Helping others; Giving objects to others without demanding anything in return; including others in social interactions
<i>General aggression</i>		Hitting; kicking; intentionally bumping into someone or something; shouting; saying mean things to others; pulling someone's hair

Parent Questionnaire

Parents were asked to fill out questionnaires covering information on birth date, sibling status and some items for the larger research project on social dominance in children, that I did not process for my thesis. Data on sibling status was missing from 20 children, that therefore had to be excluded. Given that previous studies did not report higher benefits associated with more siblings (Downey & Condrón, 2004), I coded sibling status as dichotomous variable (i.e., child does or does not have household-sibling(s)), irrespective of the number of siblings reported in the parent questionnaire (Figure 1). As there were only 6 children with siblings not living in the same household (i.e., not enough cases for a sufficient analysis), only siblings living in the same household were considered for further analyses.

Figure 1. Overview on siblings

Data from parent questionnaire. Number of siblings reported to live in the same household as the child.



Data Processing

In a first step, I defined the sample for the data analysis, as some of the children needed to be excluded. In order to control for absence-related data shortage for individual children, I established the following exclusion criteria: First, a time-criterion, defining that only observations in which a child was present for at least 15 minutes would be counted. And second, an observation-criterion, defining that only children who were present for at least four of the ten observation sessions would be included in the data analysis. Thus, due to exclusion criteria, the final sample used for testing hypothesis 1 reduced to 92 children. And, since hypothesis 2 focused on effects of sibling status on the expression of social dominance behavior, the sample used to test hypothesis 2 reduced even more, to 79 children, because information on sibling status was missing for 13 children (Table 3, Appendix).

I processed the raw data in Excel. The raw data output contained the occurrence frequencies of the eight coded categories for each child and each observation session separately, so that there were eight values for each observation, for each child. For each child, I then identified all the

valid sessions and summed across all of these sessions. This resulted in eight total values, containing data for all the considered observation sessions. To control for different numbers of valid observation sessions across children, these total values were divided by the number of observations that were included in these summed up values, to calculate average values across all considered observation sessions.

I found that especially in the groups with younger children, the number of material and/or social competitions was very low (Table 4, Appendix). Continuing with the differentiation between material and social competitions would have resulted in many zero-values. I therefore decided to pool material and social competitions into one variable, for prosocial, coercive, and uncontested competitions, respectively. As material and social competitions were analyzed together, these values resulted in six variables of interest (Table 5). The first 3 variables of interest respectively summarize prosocial, coercive, and uncontested competitions a child has initiated. I included general prosociality and general aggression as additional variables to control for general social behavior, not targeting social dominance. I calculated the proportion of prosocial competitions in all competitions per child, by dividing the frequency of prosocial competitions by the overall number of competitions, resulting in a value between 0 (none of the child's competitions was prosocial) and 1 (all competitions were prosocial).

Data Analyses

For data analysis I used RStudio (R Core Team, 2023), and the packages dplyr (Wickham et al., 2023), psych (Revelle, 2023), DHARMA (Hartig, 2022), lme4 (Bates et al., 2015), MASS (Venables & Ripley, 2002), Hmisc (Harrell, 2023), and corrplot (Wei & Simko, 2021).

Checks for Confounding Gender Differences in Predictor Variables

Gender was not hypothesized to have a significant effect, which is why I tested possible confounding gender differences in the predictor variables. I tested gender differences in age by calculating a Mann-Whitney U-test and in sibling status by calculating Fisher's exact test. I further calculated Mann-Whitney U-tests to test for confounding gender differences in average

group size, and in the number of sessions in which a child was present. I calculated binomial tests to control if there was a significant gender imbalance in any of the groups.

Table 5. Description of variables of interest

Variable of interest	Description
<i>Prosocial competitions</i>	Material and social dominance behaviors initiated by a child, using polite requests or gestures, therefore maintaining positive relationships with others
<i>Coercive competitions</i>	Material and social dominance behaviors initiated by a child, using aggressive or offensive behaviors
<i>Uncontested competitions</i>	Material and social dominance behaviors initiated by a child, lacking defining features of prosocial and coercive competitions, but also not prevented by other child
<i>General prosociality</i>	Helping others; Giving objects to others without demanding anything in return; including others in social interactions
<i>General aggression</i>	Hitting; kicking; intentionally bumping into someone or something; shouting; saying mean things to others; pulling someone's hair
<i>Prosocial ratio</i>	Proportion of prosocial competitions in all competitions

Model Set-Up and Hypothesis-Testing

For testing hypothesis 1, I first calculated Spearman-correlations between age and all of the variables of interest. In a second step, I attempted to set up models, including age as predictor and group as random factor. The low occurrences of some behaviors, zero-inflation and over-dispersion were problematic for setting up the models, therefore I attempted both Generalized Linear Mixed Models (GLMMs) and negative-binomial GLMMs. For testing the model fit I used the R package DHARMA (Hartig, 2022) and found that GLMMs including age as predictor and

group as random factor could be constructed for the variables prosocial competition and prosocial ratio. For the remaining variables (coercive competition, uncontested competition, general prosociality, and general aggression), models did not work.

For testing hypothesis 2, I attempted to construct models, including the variables age and sibling status, as well as their interaction, as predictors and group as random factor. Again, I tried different model types and tested their fit using the R package DHARMA (Hartig, 2022). For prosocial competition, a negative binomial GLMM including group as random factor was calculated. GLMMs including group as random factor were calculated for uncontested competition, general prosociality, and prosocial ratio. Since models did not work for the variables coercive competition and general aggression, I conducted Spearman-correlations split by sibling status for these two variables.

Results

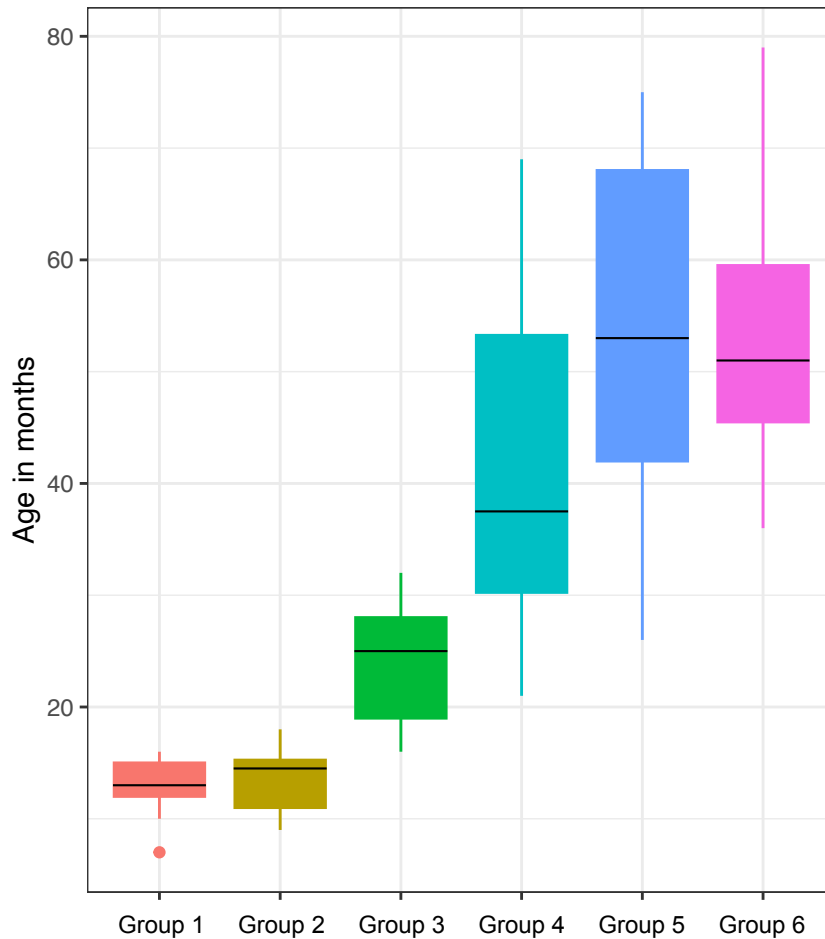
Predictor Variable Characteristics

In a first step, I conducted a descriptive analysis of the data, calculating a Mann-Whitney U-test to test for possible gender differences regarding age, finding no significant age differences between males and females ($W = 991.50, p = 0.79$). Likewise, with regard to the entire sample, a Fisher's Exact test did not indicate a significant association between gender and sibling status ($p = 0.23$). On the group level, Fisher's Exact tests indicated gender differences for sibling status ($p = 0.05$) within 1 group (group 6), where seven out of 13 males did not have siblings, whereas only 2 out of ten females reported not to have siblings. I found a non-significant trend towards such a difference in 1 other group, group 2 (Fisher's exact test, $p = 0.06$), as well.

To test for possible confounding age differences between groups, I calculated a Kruskal-Wallis test and, as predicted by children's age depended group assignment, I found significant group differences for age ($\chi^2(5) = 52.18, p < 0.001$) (Figure 2). Post-hoc calculated Mann-Whitney U-tests revealed significant age differences between almost all groups, apart from groups 1 and 2 ($W = 31.50, p = 0.70$), and groups 5 and 6 ($W = 238.00, p = 0.94$), which did not differ significantly in age. A Chi-Square test did not indicate significant group differences for sibling status ($\chi^2(5) = 7.63, p = 0.18$). Looking at within-group imbalances, I tested if there were significant gender imbalances in any of the groups, by calculating binomial tests, but did not find that there were significantly more males than females, or vice versa, in any of the groups (Group 1: $p = 1.00$; Group 2: $p = 1.00$; Group 3, $p = 1.00$; Group 4: $p = 0.10$; Group 5: $p = 0.38$; Group 6: $p = 0.67$).

Figure 2. Box plots showing age differences between groups

Age shown in months. Horizontal bars represent median. Length of whiskers determined by largest value, but maximally 1.5 fold of interquartile range. Value beyond whiskers considered as outlier, represented as dot.



Variables of Interest - Gender and Group Differences

After checking for possible confounding gender or group differences in the predictor variables, I tested if there were such differences in any of the variables of interest, by calculating average values for the variables of interest separately for males and females (Table 6). In the entire sample, I did not find significant gender differences, but a Wilcoxon rank sum test indicated a non-significant trend ($W= 803.50$; $p = 0.07$) towards males ($M = 0.42$; $SD = 0.73$) showing slightly more general aggression than females ($M = 0.17$; $SD = 0.32$). However, analyses were not calculated separately for males and females, and gender was not included as factor in the hypothesis-testing models. I did not find any significant differences in the variables of interest between the groups.

Table 6. Variables of interest. Descriptive statistics for total sample and separated by gender

Mean values per child, per observation with standard deviation (SD), minimum (Min) and maximum (Max). Gender differences in variables of interest indicated by Wilcoxon W with significance (p) and degrees of freedom (df). Group differences in variables of interest indicated by Kruskal-Wallis χ^2 with significance (p) and degrees of freedom (df).

Variable of Interest	Gender	Mean (SD)	Min	Max	Gender difference Wilcoxon W	p	Group difference Kruskal-Wallis χ^2 (df)	p
General Prosociality	All	0.80 (0.72)	0.00	3.33	1140.50	0.36	56.14 (45.00)	0.12
	Female	0.90 (0.78)	0.00	3.33				
	Male	0.74 (0.68)	0.00	2.86				
General Aggression	All	0.29 (0.58)	0.00	4.22	803.50	0.07	22.71 (26.00)	0.65
	Female	0.17 (0.32)	0.00	1.63				
	Male	0.42 (0.73)	0.00	4.22				
Prosocial Ratio	All	0.79 (0.19)	0.14	1.00	1061.50	0.78	54.88 (41.00)	0.07
	Female	0.78 (0.20)	0.30	1.00				
	Male	0.78 (0.19)	0.14	1.00				
Prosocial Competition	All	4.14 (3.35)	0.17	19.25	831.00	0.12	80.56 (76.00)	0.34
	Female	3.36 (2.29)	0.38	9.89				
	Male	4.68 (3.85)	0.17	19.25				
Coercive Competition	All	0.59 (0.65)	0.00	3.78	852.00	0.17	29.01 (39.00)	0.88
	Female	0.53 (0.60)	0.00	2.50				
	Male	0.64 (0.68)	0.00	3.78				
Uncontested Competition	All	0.30 (0.39)	0.00	2.50	1165.00	0.27	25.10 (23.00)	0.35
	Female	0.29 (0.25)	0.00	1.00				
	Male	0.32 (0.46)	0.00	2.50				

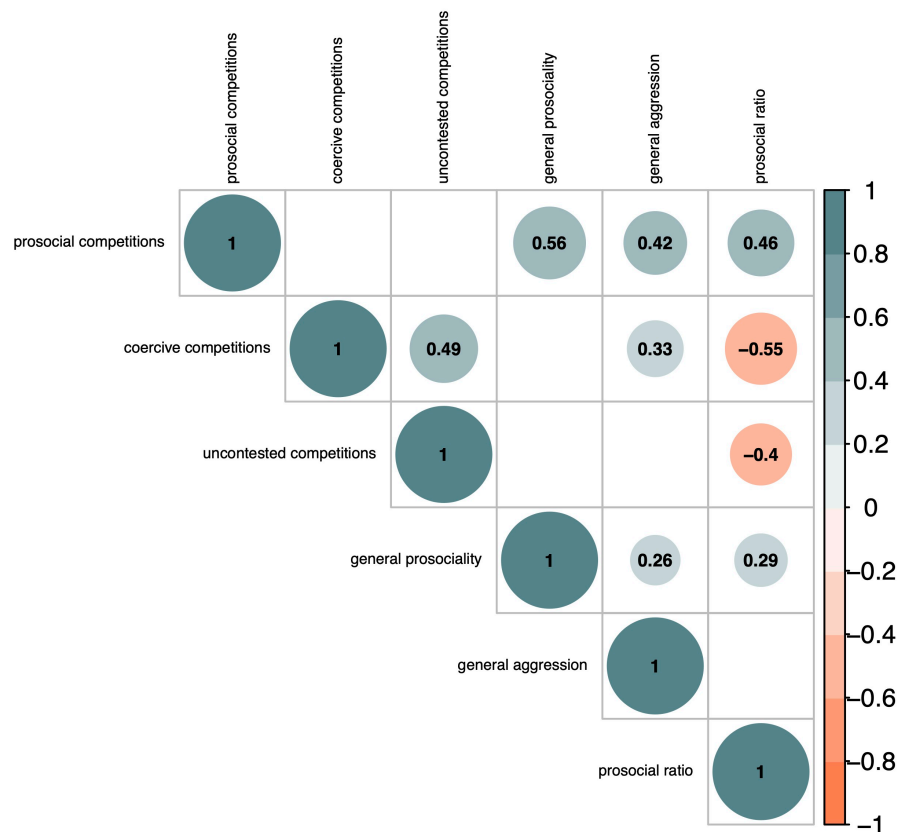
Correlations

An overview between the Spearman correlations of the different variables of interest can be seen in figure 3. I found significant correlations between prosocial competitions and the variables general prosociality, general aggression, and prosocial ratio. The variable coercive competitions was significantly correlated with uncontested competitions, general aggression and prosocial ratio. Prosocial ratio, in turn, was also significantly correlated with uncontested competitions and general prosociality. Moreover, there was a significant correlation between general aggression and general prosociality.

Figure 3. Correlation matrix of the variables of interest.

The magnitude of the Spearman-correlations is indicated by the color scale, values for Spearman's rho are written inside the circles. Only significant correlations are shown. Effect sizes according to Cohen (1988): small (0.1 -0.29), moderate (0.3 - 0.49), large (≥ 0.5).

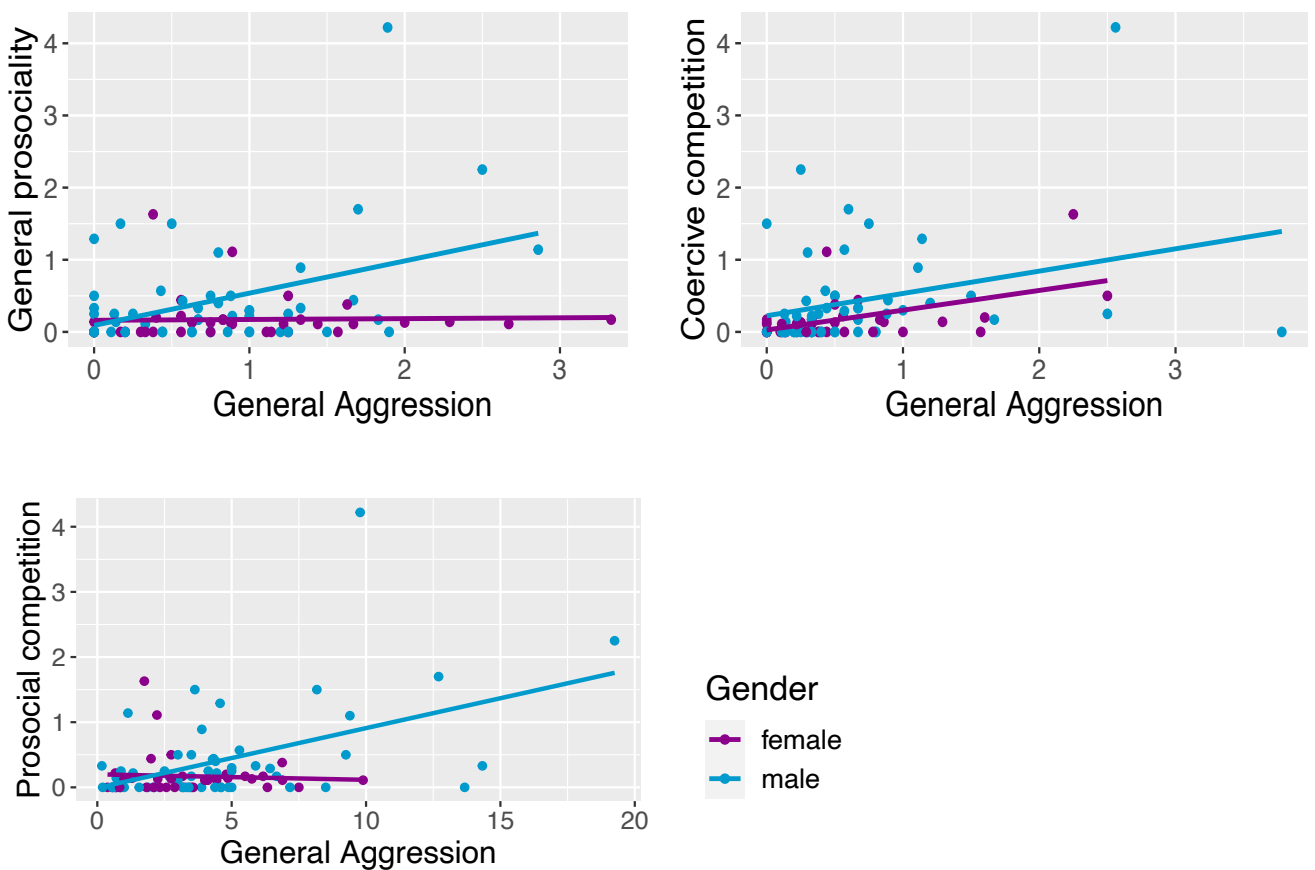
Besides the Spearman-correlations between coercive competitions and general aggression ($p = 0.00$), between general prosociality and prosocial ratio ($p = 0.00$) and between general prosociality and general aggression ($p = 0.01$), all correlations had p -values < 0.001 .



Given that I found a non-significant trend towards gender differences in general aggression, I separated the correlations containing general aggression by gender. I found that the correlation between general aggression and general prosociality was only significant in males ($r(52) = 0.42$; $p = 0.00$), but not in females ($r(36) = 0.03$; $p = 0.87$) (Figure 4). Similarly, the correlation between general aggression and prosocial competition was only significant in males ($r(52) = 0.48$; $p < 0.001$), but not in females. ($r(36) = -0.06$; $p = 0.72$). In contrast, the correlation between general aggression and coercive competition was significant in both, females ($r(36) = 0.52$; $p < 0.001$), and males ($r(52) = 0.29$; $p = 0.03$).

Figure 4. Spearman-correlations between general aggression and general prosociality / prosocial competition / coercive competition

Depicted separately for males and females.

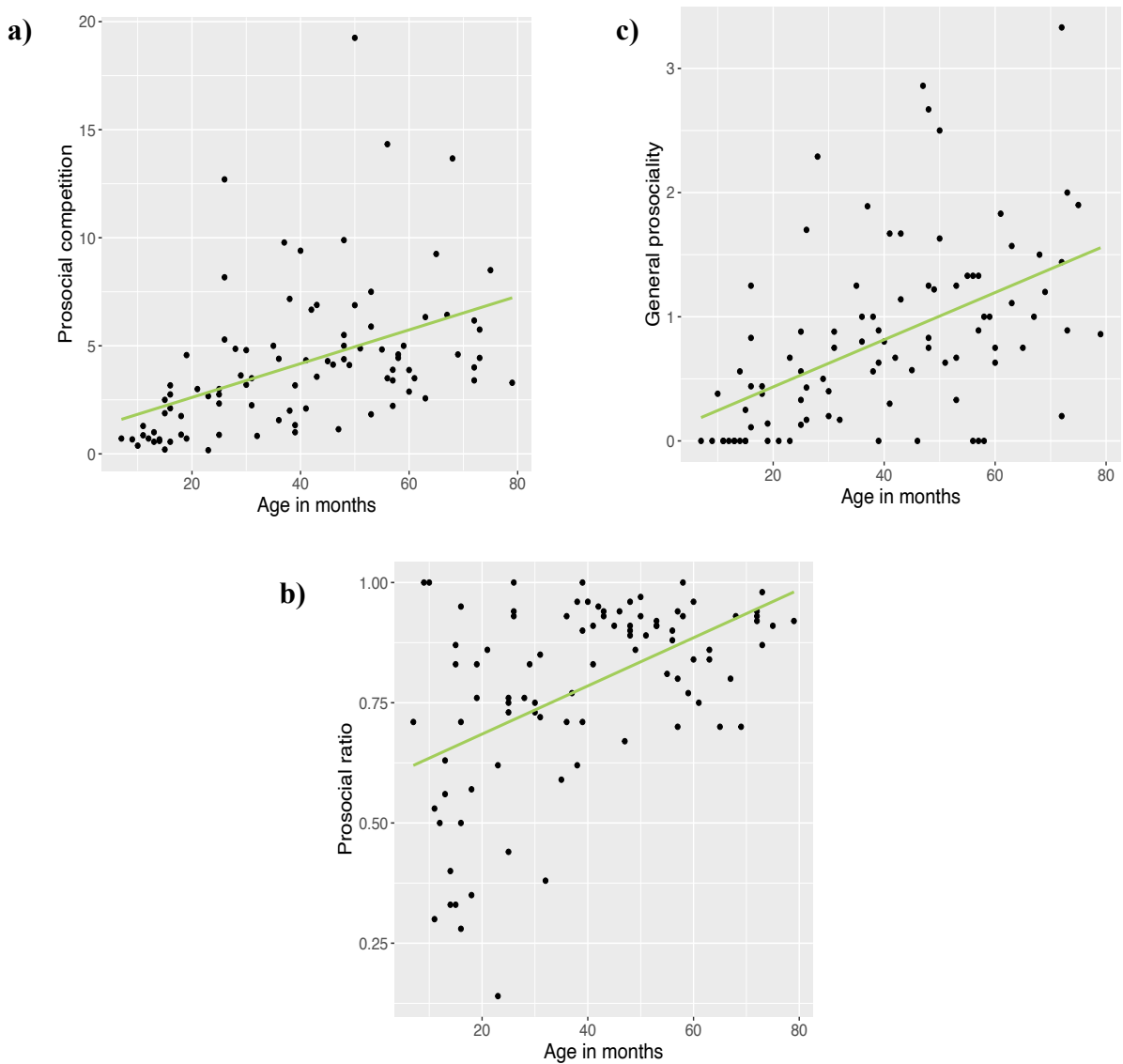


Hypothesis one - Effect of Age

I found significant positive Spearman-correlations between age and prosocial competition ($r(90) = 0.61$; $p < 0.001$), general prosociality ($r(90) = 0.57$; $p < 0.001$), and prosocial ratio ($r(90) = 0.43$; $p < 0.001$) (Figure 5). Correlations between age and coercive competition ($r(90) = -.13$; $p = 0.23$), uncontested competition ($r(90) = 0.12$; $p = 0.28$), and general aggression ($r(90) = -0.02$; $p = 0.86$) were not significant. Due to the non-significant trend ($p = 0.068$) towards males ($M =$

Figure 5. Scatterplots for hypothesis 1

Depicting correlations between age in months and prosocial competition, general prosociality, and prosocial ration, respectively; with linear trend line.



0.42; $SD = 0.730$) showing slightly more general aggression than females ($M = 0.17$; $SD = 0.32$), the correlation between age and general aggression was also calculated separately for males ($r(52) = -0.03$; $p = 0.83$) and females ($r(36) = -0.00$; $p = 0.10$), neither indicating significant correlations between these two variables in females nor in males.

Generalized Linear Mixed Models

The GLMM results for hypothesis 1 are shown in table 7. Age was a significant positive predictor ($z = 5.71$; $p < 0.001$) for prosocial competition, and prosocial ratio ($z = 5.48$; $p < 0.001$).

Table 7. GLMM results for hypothesis one

	Predictor	Estimate	SE	z	p
<i>Prosocial Competition</i>	Intercept	0.52	0.18	2.93	< 0.001
	Age	0.02	0.00	5.71	< 0.001
<i>Prosocial ratio</i>	Intercept	0.58	0.04	14.53	< 0.001
	Age	0.01	0.00	5.48	< 0.001

Hypothesis two - Effects of Age and Sibling Status

Generalized Linear Mixed Models

Table 8 shows the GLMM results for hypothesis 2. I found that age ($z = 3.97$; $p < 0.001$) and sibling status ($z = 2.01$; $p = 0.04$) were positive predictors for prosocial competition (children with siblings: $M \pm SD = 4.59 \pm 3.10$; children without siblings: $M \pm SD = 3.12 \pm 2.26$). Similarly, prosocial ratio (children with siblings: $M \pm SD = 0.82 \pm 0.15$; children without siblings: $M \pm SD = 0.74 \pm 0.23$) was significantly positively predicted by age ($z = 3.77$; $p < 0.001$), and there was a non-significant trend of an effect of sibling status ($z = 1.86$; $p = 0.07$) (Figure 6c). Age ($z = 4.88$; $p < 0.001$) was also a positive predictor for general prosociality. For general prosociality (children with siblings: $M \pm SD = 0.85 \pm 0.65$; children without siblings:

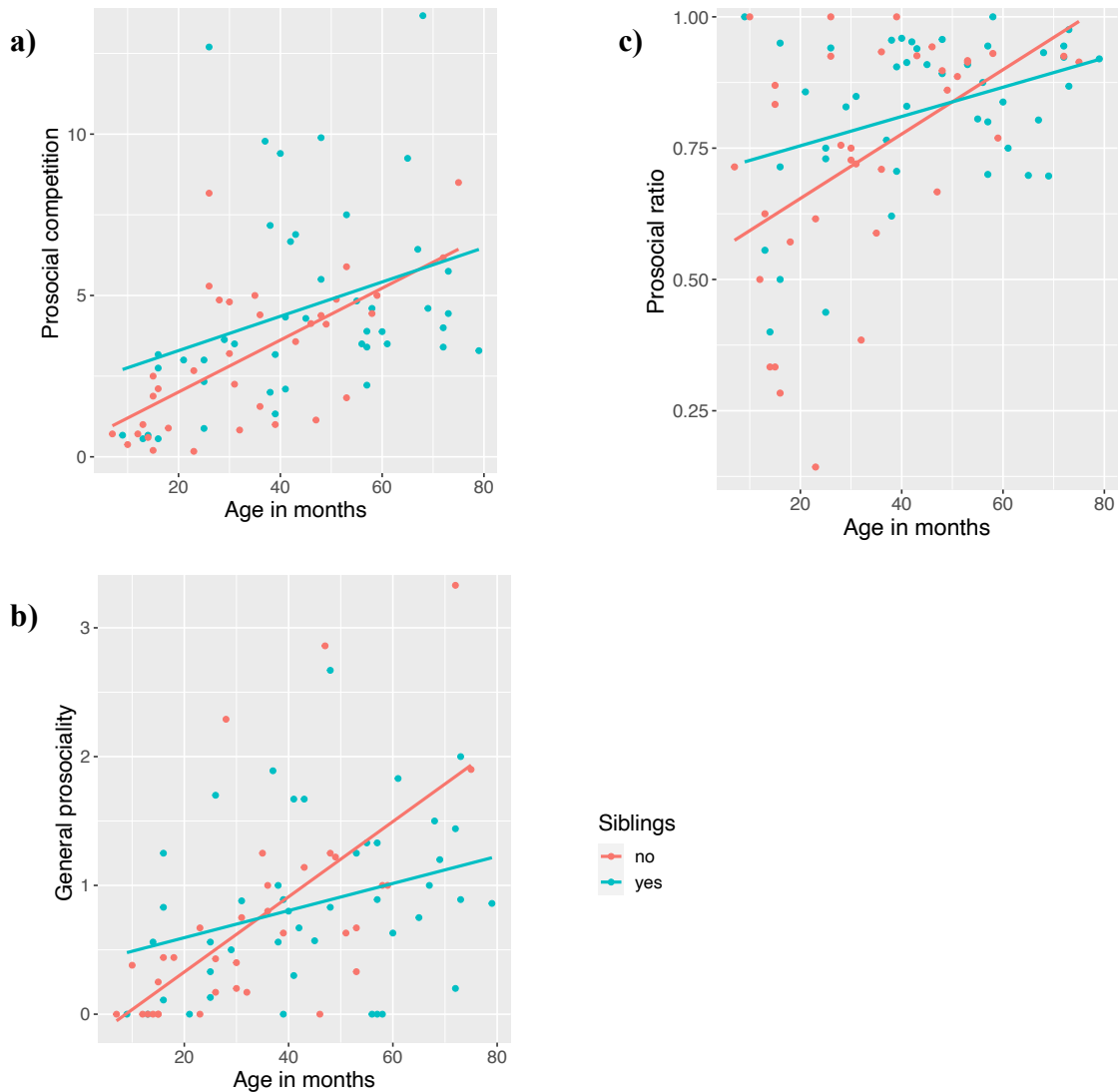
$M \pm SD = 0.73 \pm 0.81$), I found the interaction between age and sibling status to be a negative predictor ($z = -2.41$; $p = 0.02$). Moreover, there was a non significant trend for sibling status to be a positive predictor for general prosociality ($z = 1.94$; $p = 0.06$).

Table 8. GLMM results for hypothesis two

	Predictor	Estimates	SE	z	p
<i>Prosocial Competition</i>	Intercept	0.22	0.27	0.80	0.42
	Age	0.02	0.01	3.97	< 0.001
	Siblingsyes	0.72	0.36	2.01	0.04
	Age:Siblingsyes	-0.01	0.01	-1.53	0.13
<i>Prosocial ratio</i>	Intercept	0.53	0.06	8.56	< 0.001
	Age	0.01	0.00	3.77	< 0.001
	Siblingsyes	0.17	0.09	1.86	0.07
	Age:Siblingsyes	-0.00	0.00	-1.59	0.12
<i>General prosociality</i>	Intercept	-0.26	0.23	-1.12	0.27
	Age	0.03	0.01	4.88	< 0.001
	Siblingsyes	0.64	0.33	1.94	0.06
	Age:Siblingsyes	-0.02	0.01	-2.41	0.02

Figure 6. Scatterplots for hypothesis 2

Depicting correlations between age in months and prosocial competition, general prosociality, and prosocial ration, respectively. Separated by gender and with trend line.



As it was not possible to compute models for the variables coercive competition, uncontested competition and general aggression, I calculated Spearman-correlations with age for these variables and compared mean values of the variables split by sibling status. For coercive competition, I did not find a significant Spearman-correlation with age in the group of children with siblings ($r = -0.10$; $p = 0.52$), and also in the group of children without siblings ($r = -0.05$; $p = 0.77$). For general aggression, neither the correlation in the group of children with siblings ($r = -0.21$; $p = 0.17$), nor in the group of children without siblings ($r = 0.26$; $p = 0.13$) was

significant. For uncontested competition, Spearman-correlations with age were not significant for children with siblings ($r = 0.21$; $p = 0.17$), and also not for children without siblings ($r = 0.09$; $p = 0.58$). Regarding the comparison of mean values, I found no significant difference in coercive competitions ($W = 745.50$; $p = 0.81$) between children with siblings ($M \pm SD = 0.52 \pm 0.54$) and children without siblings ($M \pm SD = 0.64 \pm 0.78$). Similarly, I found no significant difference in general aggression (Mann-Whitney U test; $W = 883.50$; $p = 0.25$) between children with siblings ($M \pm SD = 0.37 \pm 0.72$) and children without siblings ($M \pm SD = 0.19 \pm 0.32$). There was no significant difference in uncontested competitions (Mann-Whitney U test; $W = 822.50$; $p = 0.60$) between children with siblings ($M \pm SD = 0.32 \pm 0.43$) and children without siblings ($M \pm SD = 0.27 \pm 0.35$) (Table 9, Appendix).

Discussion

In my master's thesis, I examined age-related changes in social dominance strategies in kindergarten children, as well as the interaction between age and sibling status on this shift from primarily coercive towards more prosocial strategies for reaching social dominance. I distinguished between coercive, uncontested and prosocial dominance strategies, and general aggressive and prosocial behaviors, to differentiate a specific shift in dominance strategy from general changes in social behaviors. Finding increases in prosocial competition, prosocial ratio and general prosociality, I partly confirmed my first hypothesis that there is an age-related decrease in coercive dominance behaviors and general aggression, with a simultaneous increase in prosocial dominance behaviors and general prosociality. My second hypothesis on the interaction of age and sibling status in the shift in dominance behavior was partly confirmed. I found sibling status to predict two out of three prosocial variables, one of which was an interaction with age. Indicating beneficial effects of age and sibling status on prosocial dominance behaviors and prosociality in general, my findings suggest a general increase in prosociality with age in young children and point towards supportive effects of sibling status.

Hypothesis one - Effect of Age

Increase in Prosocial Competition and Prosocial Ratio with age

As hypothesized, I found an increase in prosocial competition and prosocial ratio with age. This finding is in line with earlier studies on social dominance. As the tolerance for the use of coercion and aggression for attaining dominance decreases with age, it is commonly assumed that cognitive maturation, which comes with increasing age, is important for the understanding of dominance and the choice of the most beneficial strategy (Murray-Close & Ostrov, 2009). Thus, cognitive maturation was found to be associated with an increased use of prosocial dominance strategies (Hawley, 1999; Roseth et al., 2007; Teisl et al., 2012). In line, Strayer and Trudel (1984) reported coercive dominance conflicts to have occurred more likely among one- to three-year-old children compared to four- to five-year-olds. They found age to be a significant factor regarding the ratio of initiated agonistic interactions to initiated affiliation interactions, as older children showed proportionately more affiliative interactions. Similarly, Hawley (1999)

found that, compared to younger children, older children were more likely to use prosocial strategies to attain social dominance. It is assumed that this age-related increase in prosocial dominance strategies is accompanied by a decrease in coercive strategies, reflecting a strategic shift in attaining social dominance (Hawley, 1999).

No Decrease in Coercive Competition with age

Surprisingly, I did not find age-related changes in the frequency of coercive competitions. My findings therefore did not support Hawley's (1999) assumption of a strategic shift in resource competition, as there was an increase in prosocial dominance behaviors, but no decrease in coercive dominance strategies. While the use of coercion and aggression is tolerated less as children become older, the increase in prosocial dominance strategies might be attributable to age-related cognitive maturation that enables more profound understanding of dominance relationships (Hawley, 1999; Roseth et al., 2007; Teisl et al., 2012). Thus, prosocial dominance strategies become more likely, as they become more beneficial than coercive strategies for attaining social dominance (Murray-Close & Ostrov, 2009). Instead of a strategic shift, this might cause a combination of coercive and prosocial strategies. Such bi-strategic resource control, involving both, prosocial and coercive behaviors, was described by Roseth et al. (2011). The combination of both strategies enables negative effects of one strategy to be compensated for by the combination with another strategy (Roseth et al., 2011). This would result in an increase in the ratio of prosocial competitions in all competitions, which has also been shown by the increase in prosocial ratio in my findings. While the use of coercive strategies might remain stable, increasing age possibly leads to an increased use of prosocial strategies, as they become more beneficial for attaining social dominance than other strategies.

Uncontested Competitions as Additional Aspect of Social Dominance

Previous studies differentiated between coercive and prosocial dominance strategies in attaining social dominance. This dichotomous differentiation has disregarded that in social groups with stable dominance relations, resource conflicts are mainly uncontested (i.e., the dominant individual takes a resource at no cost, while the subordinate individual does not prevent it or gets anything in return). In kindergarten children, such uncontested competitions occur when a child takes something from another child without asking. The crucial difference to coercive competitions is that this happens without force, and that the other child accepts it by giving the

object away without defense. In contrast to prosocial competitions, the decisive difference is that the child does not ask for permission or show any prosocial intentions. Thus, in other words, uncontested competitions might be considered as lacking defining features of prosocial or coercive competitions. This might explain why there were no significant correlations or predictors for uncontested competitions in my study. Another reason for this might be that, compared to coercive and prosocial competitions, uncontested competitions occurred only rarely. Since, in kindergarten groups, friends spend more time together than non-friends (Newcomb & Bagwell, 1995), it might be assumed that most interactions and competitions in the group occur between friends. Given that befriended children were found to exhibit milder forms of conflict and dominance, and are more likely to compromise instead of using coercive behaviors for conflict resolution than non-friends (Fonzi et al., 1997; Newcomb & Bagwell, 1995), this might have contributed to the rare occurrence of uncontested competitions. Instead, uncontested competitions might predominantly occur between non-friends with clear dominance relations. As the child from whom something is taken does not even attempt to prevent the other child from doing so, uncontested competitions might indicate high social dominance of one child over another. In this regard, uncontested competitions provide insights into an additional aspect of social dominance in young children, that has been disregarded so far.

General Behavioral Adaption Rather Than Strategy Shift

Interestingly, I found a similar pattern in resource competition and general social behavior. As I did not only find an age-related increase in prosocial dominance behaviors, but also in general prosociality, my findings might point towards a general behavioral adaption in young children that does not only reflect a shift from primarily coercive to more prosocial dominance strategies as suggested by Hawley (1999). As discussed above, it is likely that cognitive maturation processes not only enable a more profound understanding of dominance relations, but a more general adaption of social behaviors, resulting in an increase of general prosocial behaviors. In line, a rise in concerns with several aspects connected with prosociality, such as fairness (Li et al., 2015) and equality (Paulus & Essler, 2020) was reported to occur during preschool age. Given its multiple aspects, prosocial behavior needs to be considered as multidimensional construct including various, qualitatively different elements (Richaud et al., 2012). Thus, different developmental influences and cognitive prerequisites might be important for the expression of the different dimensions of prosociality. For instance, there is converging evidence

that relationships with others are one of the main influential factors for the development and expression of prosocial behavior in young children (Drummond et al., 2015).

Hypothesis two - Effects of Age and Sibling Status

Sibling Status as Positive Predictor for Prosocial Variables

In accordance with my second hypothesis, I found sibling status to be a positive predictor for prosocial competition, and non significant trends for effects on general prosociality and prosocial ratio. I found children with siblings to exhibit more prosocial dominance behavior, and a non significant trend pointed towards higher levels of general prosocial behaviors in children with siblings compared to children without siblings. Similar findings were reported by Downey and Condrón (2004), who found that interactions with siblings improved social and interpersonal skills in kindergarten children. The assumption of positive effects of siblings on social competencies was also supported by Kitzmann et al. (2002), who found that elementary school children with siblings had higher peer-related group-level social competences compared to children without siblings. Contrary to my hypothesis, I did not find differences between children with siblings and single children regarding coercive competitions. A possible explanation for this finding arises with regard to Hawley (2002). She argues that there might not be a clear differentiation between prosocial and coercive strategies in young children, as prosocial strategies are just developing at that age. Siblings were found to have a supportive effect on the development of prosocial behavior. In contrast, the differentiation and decrease of coercive strategies might not be affected in such a way, or occur at later ages. In sum, my finding points towards a general effect of sibling status on the expression of prosocial behaviors in young children. The detailed expression of these effects requires a closer analysis of the results.

Stronger Increase in General Prosociality with age in Children Without Siblings

Regarding the effect of the interaction between sibling status and age on the strategical shift in dominance attainment, I did not obtain the expected findings. An interaction between sibling status and age was found for one variable, general prosociality, that served to control for behavior apart from resource competition. Children without siblings showed a stronger increase in general prosociality than children with siblings. At first sight, this might seem contrary to my

expectations. Compared to single children, children with siblings are likely to have had more social experiences with peers, especially with siblings at a younger age. This was found to be beneficial for social skills (Downey & Condrón, 2004; Sang & Nelson, 2017). In this regard, it is likely that, compared to single children, children with siblings reached a higher level of prosociality at a younger age. In turn, as indicated by my findings, children without siblings benefit more from social experiences with peers in kindergarten, therefore showing a higher increase in general prosociality with age. As for hypothesis one, there was no effect of sibling status on coercive competitions, uncontested competitions or general aggression. Thus, my findings do not suggest an effect of sibling status on the behavioral shift suggested by Hawley (1999). While this finding points towards an effect of sibling status on general social behavior, there was also possible evidence for effects of sibling status on dominance behavior.

Effect of Sibling Status on Dominance Behavior

In accordance with my hypothesis, I found an indication for an effect of sibling status on the expression of dominance behavior, as there was an effect of sibling status on prosocial competition as well as a non significant trend for an effect of sibling status on prosocial ratio. Prosocial ratio indicated the ratio of prosocial competitions in all competitions. A higher value therefore indicated a higher proportion of prosocial competitions. Children with siblings were found to benefit in terms of their social skills and cognitive development (Downey & Condrón, 2004; Sang & Nelson, 2017). This, in turn, might induce cognitive maturation and enables more profound understanding of dominance relationships (Hawley, 1999; Roseth et al., 2007; Teisl et al., 2012), resulting in an increase of the proportion of prosocial dominance strategies compared to uncontested or coercive strategies. It can therefore be assumed that the choice of the most beneficial dominance strategy is influenced by social experiences with siblings. However, as discussed above, this finding does not necessarily imply a strategical shift. Given that I did not find the expected decrease in coercive competitions, this finding indicates a rise in prosocial competition, with a constant occurrence of coercive competitions.

Limitations and Future Research Implications

Methodological Approach

My analysis was exclusively based on video data. While this methodological approach on the one hand side had the huge advantage that the natural play situation in the kindergarten groups has only been minimally affected, and therefore allowed a largely undisturbed view of the interactions, the disadvantages, on the other hand, cannot be dismissed. For instance, despite multiple cameras placed in the room, not all parts were always clearly visible or children were hidden by furniture or columns. Apart from these visibility problems, verbal interactions were mostly difficult to understand. Given that verbal aggression was described as important component of coercive behaviors, this methodological approach might have biased associated findings (Roseth et al., 2007).

Gender Differences

By conducting preliminary checks on possible confounding gender differences in my data, I found a non-significant trend suggesting males to show higher values of general aggression compared to females. However, since this was the only indication for possible gender differences in my data and that was, moreover, not significant, I decided not include gender as predictor variable in my models. Nonetheless, given this non significant trend, I decided to look at all correlations that included general aggression split by gender. I found the correlation between general aggression and general prosociality to be significant only for males, but not for females. Similarly, the correlation between general aggression and prosocial competition was only significant in males, but not in females. As these results suggest that some of the correlations between different forms of dominance behavior differ between males and females, future studies might consider gender as influencing factor.

Approach of Sibling Status

Further, regarding my approach of sibling status, Smorti and Ponti (2018) suggested that it might not have been necessarily sibling status, but rather the quality of the sibling relationship that affected prosocial behavior. The results of Berndt and Bulleit (1985) also pointed in this direction, as beneficial effects seemed to be mediated by the sibling's characteristics. For

instance, Downey and Condrón (2004) reported higher benefits in social competencies in closely spaced siblings compared to widely spaced siblings, and suggested greater interaction opportunities as possible explanation. Moreover, differences between full-, half-, and step-siblings have been reported, indicating higher benefits from exposure to full siblings compared to half-, or step-siblings. In my study, only siblings living in the same household were considered. But, as sibship-kind (full-, half-, step-siblings) was not evaluated in the parent questionnaire, this information could not be considered. In sum, given that I coded sibling status as dichotomous variable, but not differentiated more precisely (e.g., according to age differences, sibship-kind or gender) this variable must be considered to be quite inhomogeneous. It is highly likely that closely spaced siblings have a larger effect on a child's dominance behavior, while these effects can be assumed to decrease with increasing age differences (Downey & Condrón; 2004). Even though beneficial effects of siblings were also found in studies focusing on sibling status instead of sibship quality (Kitzmann et al., 2002), suggesting sibling status to be a valid measure, future studies might include more detailed questionnaires on sibling characteristics. For instance, it might be interesting to use a more narrowly defined group of children (e.g., compare single children with children that have a sibling that is not more than two years older or younger). Further, given that siblings already share a high proportion of social environment due to common family experiences, it might be interesting to examine the effect of social experiences made in the kindergarten group, for instance if siblings in the same kindergarten group have a different effect on the expression of dominance behavior than siblings in another group.

Uncontested Competitions

Lastly, with the inclusion of „uncontested“ as third behavioral strategy, I aimed to expand the previously used dichotomous distinction between prosocial and coercive behaviors. However, uncontested competitions were not found to be significantly predicted or correlated with age or sibling status. Given that this category includes rather „intermediate“ behaviors, lacking defining features of prosocial and coercive behaviors, it is likely that the category was simply too multifaceted. Nonetheless, uncontested competitions possibly provide new insights into an additional aspect of social dominance, that has not been examined separately yet. Thus, future studies might take this finding as starting point to redefine the behavioral categories used so far, thereby enabling a more precise distinction of effects of age and sibling status on social dominance behavior.

Conclusion

In sum, my findings pointed towards an age-dependent increase of prosocial strategies for obtaining social dominance in kindergarten children. I found effects of sibling status on the expression of prosocial (dominance) behaviors, thereby supporting previous studies suggesting beneficial effects of siblings on social competences. However, with regard to the shift from primarily coercive behavior to more prosocial strategies for reaching social dominance as postulated by Hawley (1999), my findings provided mixed support. While all three of the examined prosocial behaviors were found to increase with age, the findings did not point towards a significant decrease in coercive behaviors. The relative proportion of prosocial competitions in all competitions increased with age, as reflected in a positive correlation of the examined variable prosocial ratio with age. Likewise, with regard to the specific effect of sibling status on this shifting process, my findings also provided mixed support. An interaction between age and sibling status was only found for prosocial ratio, that I included as control for social behavior apart from social dominance interactions. Thus, my findings pointed towards a general increase in prosocial behaviors with age in kindergarten children, but did not necessarily indicate a strategy shift in reaching social dominance.

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Appendix

Abstract

Social dominance describes the ability to use the own knowledge and skills to acquire specific goals or resources, using prosocial or coercive strategies. Kindergarten children show a behavioral shift from coercive to more prosocial strategies in reaching social dominance, driven by cognitive development. Apart from these age-dependent processes, the cognitive development of young children was shown to benefit from caregiving and teaching interactions with siblings. It is still unclear how these two factors interact, and how sibling status affect this shifting process. My thesis focuses on this knowledge gap by investigating the effect of age and sibling status on social dominance behavior in kindergarten children. I conducted video analyses of children from six different kindergarten groups. Given that the groups were from one kindergarten (located at two different sites in Vienna), the sample offered a highly homogenous background regarding the pedagogical team and approaches. I hypothesized that age would be associated with an increase in prosocial dominance strategies and general prosociality, with a simultaneous decrease in coercive dominance strategies and general aggression. Regarding the shift from coercive to prosocial strategies, I hypothesized to find an interaction between age and sibling status. I was partly able to confirm these predictions. As hypothesized, I found an increase in prosocial dominance strategies with age, and sibling status to be a significant predictor for two out of three of the tested prosocial variables, one of which was an interaction with age. Looking at all types of competitions used to gain social dominance, I found children with siblings to show a significantly higher amount of prosocial competitions compared to children without siblings. I could not find any effects on coercive behaviors. Given that there was also an increase in general prosocial behaviors, it is likely that young children show general behavioral changes towards more prosocial behaviors, rather than a specific shift restricted to dominance strategies. In sum, my findings point towards an age-related increase in prosocial dominance strategies and general prosocial behaviors in kindergarten children and suggest an effect of sibling status on the expression of prosocial dominance behaviors.

Keywords: *Social dominance, prosocial, coercive, sibling status, age, competition, general aggression, general prosociality, kindergarten children*

Zusammenfassung

Soziale Dominanz bezeichnet die Fähigkeit, das eigene Wissen und Erfahrungen zu nutzen, um spezifische Ziele oder Ressourcen mittels prosozialer oder zwangsweiser Strategien zu erreichen. Ausgelöst durch kognitive Entwicklungsprozesse kommt es im Kindergartenalter zu einer Verhaltensverschiebung - statt zwangsweiser Strategien werden vermehrt prosoziale Strategien eingesetzt, um soziale Dominanz zu erreichen. Abgesehen von diesen altersabhängigen Entwicklungsprozessen, deuten Studien darauf hin, dass die kognitive Entwicklung von Kindern auch von Interaktionen mit Geschwistern profitiert. Es ist allerdings noch unklar, wie diese beiden Faktoren - Alter und Geschwisterstatus - interagieren und welchen Effekt der Geschwisterstatus auf diese Verhaltensverschiebung hat. Meine Arbeit befasst sich mit dieser Wissenslücke, indem sie untersucht, welchen Effekt Alter und Geschwisterstatus auf das soziale Dominanzverhalten von Kindergartenkindern haben. Ich habe Videoanalysen von Kindern aus sechs verschiedenen Kindergartengruppen durchgeführt. Da die Gruppen aus einem Kindergarten (an zwei verschiedenen Standorten in Wien) stammten, bot die Stichprobe einen sehr homogenen Hintergrund hinsichtlich des pädagogischen Teams und der Ansätze. Ich nahm eine altersbedingte Zunahme prosozialer Dominanz-Strategien und allgemeiner Prosozialität bei gleichzeitiger Abnahme zwangsweiser Dominanz-Strategien und allgemeiner Aggression an. Hinsichtlich der Verhaltensverschiebung von zwangsweisen zu prosozialen Strategien ging ich von einer Wechselwirkung zwischen Alter und Geschwisterstatus aus. Diese Annahme konnte ich teilweise bestätigen. Mit zunehmendem Alter zeigte sich ein Anstieg in der Häufigkeit prosozialer Dominanz-Strategien. Darüber hinaus war der Geschwisterstatus für zwei der drei getesteten prosozialen Variablen ein signifikanter Prädiktor, wobei es sich in einem Fall um eine Interaktion mit Alter handelte. Bei der Betrachtung aller getesteten Arten von Strategien, die zur Erlangung sozialer Dominanz eingesetzt wurden, stellte ich fest, dass Kinder mit Geschwistern im Vergleich zu Kindern ohne Geschwister signifikant häufiger prosoziale Strategien anwendeten. Im Hinblick auf zwangsweise Dominanz-Strategien konnte ich jedoch keine altersbedingte Abnahme oder Zusammenhang mit Geschwisterstatus feststellen. Ein Anstieg prosozialer Verhaltensweisen mit zunehmendem Alter zeigte sich auch im allgemeinen Sozialverhalten. Daher ist nicht, wie von Hawley (1999) postuliert, von einem Strategiewechsel im Dominanzverhalten auszugehen. Es ist vielmehr eine altersbedingte Zunahme prosozialer Dominanz-Strategien und allgemeiner prosozialer Verhaltensweisen bei Kindergartenkindern

anzunehmen. Darüber hinaus deuteten meine Ergebnisse auf einen Einfluss des Geschwisterstatus auf die Ausprägung prosozialer Dominanz-Strategien hin.

Schlüsselwörter: Soziale Dominanz, prosozial, zwangsweise, Geschwister, Alter, Konkurrenz, allgemeine Aggression, allgemeine Prosozialität, Kindergartenkinder

Additional Tables

Table 3. Overview on exclusions

Overview on children that were excluded from (parts of) the analysis due to missing information. Children for which only information on sibling status was missing were excluded from the analysis of hypothesis two, children for which age information was missing needed to be excluded from the entire analysis. Children that did not meet the inclusion criteria (observation-criterion, time-criterion, as defined above) were excluded from the entire analysis.

Group	Gender	Excluded from	Reason(s) for exclusion
Group 1			
	Female	Entire analysis	Inclusion criteria not met
	Female	Entire analysis	Inclusion criteria not met
	Male	Entire analysis	Inclusion criteria not met
	Male	Entire analysis	Inclusion criteria not met
	Male	Entire analysis	Inclusion criteria not met
Group 2			
	Female	Entire analysis	Inclusion criteria not met / Missing sibling status information
	Female	Analysis hypothesis 2	Missing sibling status information
	Female	Analysis hypothesis 2	Missing sibling status information
	Female	Analysis hypothesis 2	Missing sibling status information
	Male	Entire analysis	Inclusion criteria not met/ Missing sibling status information
	Male	Entire analysis	Inclusion criteria not met
Group 3			
	Female	Entire analysis	Inclusion criteria not met / Missing sibling status information
	Male	Analysis hypothesis 2	Missing sibling status information
	Male	Analysis hypothesis 2	Missing sibling status information
Group 4			
	Female	Analysis hypothesis 2	Missing sibling status information
	Male	Entire analysis	Inclusion criteria not met
	Male	Entire analysis	Inclusion criteria not met
	Male	Analysis hypothesis 2	Missing sibling status information
Group 5			
	Male	Entire analysis	Inclusion criteria not met
	Male	Analysis hypothesis 2	Missing sibling status information
	Male	Analysis hypothesis 2	Missing sibling status information
Group 6			
	Female	Entire analysis	Inclusion criteria not met / Missing sibling status information
	Female	Analysis hypothesis 2	Missing sibling status information
	Female	Analysis hypothesis 2	Missing sibling status information
	Female	Analysis hypothesis 2	Missing sibling status information
	Female	Analysis hypothesis 2	Missing sibling status information

Table 4. Overview on occurrence frequencies of the different behavioral categories separated by strategy and group.

Mean values per child, per observation. Shown are mean, standard deviation (SD), minimum (Min) and maximum (Max).

Behavior (Strategy)	Mean (SD)	Min	Max
<i>Group 1</i>			
Material (prosocial)	0.33 (0.32)	0.00	0.78
Social (prosocial)	0.94 (0.63)	0.38	2.00
Material (coercive)	0.91 (1.23)	0.00	3.67
Social (coercive)	0.06 (0.09)	0.00	0.25
Material (uncontested)	0.31 (0.49)	0.00	1.56
Social (uncontested)	0.00 (0.00)	0.00	0.00
<i>Group 2</i>			
Material (prosocial)	0.15 (0.26)	0.00	0.75
Social (prosocial)	0.83 (0.44)	0.20	1.5
Material (coercive)	0.75 (0.77)	0.00	2.25
Social (coercive)	0.02 (0.05)	0.00	0.14
Material (uncontested)	0.31 (0.32)	0.00	1.00
Social (uncontested)	0.00 (0.00)	0.00	0.00
<i>Group 3</i>			
Material (prosocial)	0.49 (0.43)	0.00	1.44
Social (prosocial)	1.78 (1.26)	0.17	4.14
Material (coercive)	0.54 (0.43)	0.00	1.33
Social (coercive)	0.09 (0.19)	0.00	0.60
Material (uncontested)	0.37 (0.29)	0.00	1.00
Social (uncontested)	0.00 (0.00)	0.00	0.00
<i>Group 4</i>			
Material (prosocial)	0.48 (0.36)	0.00	1.17
Social (prosocial)	4.34 (1.92)	1.89	9.11
Material (coercive)	0.63 (0.52)	0.00	2.00
Social (coercive)	0.27 (0.25)	0.00	0.78
Material (uncontested)	0.49 (0.63)	0.00	2.50
Social (uncontested)	0.02 (0.04)	0.00	0.13

Table 4. Continuation

Behavior (Strategy)	Mean (SD)	Min	Max
<i>Group 5</i>			
Material (prosocial)	0.53 (0.60)	0.00	1.90
Social (prosocial)	7.06 (4.14)	1.83	18.50
Material (coercive)	0.20 (0.14)	0.00	0.50
Social (coercive)	0.12 (0.17)	0.00	0.56
Material (uncontested)	0.20 (0.26)	0.00	1.00
Social (uncontested)	0.02 (0.04)	0.00	0.14
<i>Group 6</i>			
Material (prosocial)	0.37 (0.26)	0.00	0.89
Social (prosocial)	3.34 (1.60)	0.63	6.33
Material (coercive)	0.25 (0.27)	0.00	1.00
Social (coercive)	0.12 (0.13)	0.00	0.44
Material (uncontested)	0.17 (0.19)	0.00	0.56
Social (uncontested)	0.00 (0.02)	0.00	0.10

Table 9. Variables of interest. Descriptive statistics separated by sibling status*Showing mean value with standard deviation (SD), minimum (Min) and maximum (Max).*

Variable of Interest	Sibling Status	Mean (SD)	Min	Max
<i>General Prosociality</i>				
	With Sibling	0.85 (0.65)	0.00	2.67
	Without Sibling	0.73 (0.81)	0.00	3.33
<i>General Aggression</i>				
	With Sibling	0.37 (0.72)	0.00	4.22
	Without Sibling	0.19 (0.32)	0.00	1.50
<i>Prosocial Ratio</i>				
	With Sibling	0.82 (0.15)	0.40	1.00
	Without Sibling	0.74 (0.23)	0.14	1.00
<i>Prosocial Competition</i>				
	With Sibling	4.59 (3.10)	0.56	13.67
	Without Sibling	3.12 (2.26)	0.17	8.50
<i>Coercive Competition</i>				
	With Sibling	0.52 (0.54)	0.00	2.56
	Without Sibling	0.64 (0.78)	0.00	3.78
<i>Uncontested Competition</i>				
	With Sibling	0.32 (0.43)	0.00	2.50
	Without Sibling	0.27 (0.35)	0.00	1.56

