

Children's Inferences about Relative Age as a Result of Power Comprehension

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Abstract

The present study investigated whether children make inferences about relative age when observing power differentials. Three- to 4-year-olds, 5- to 6-year-olds, 7- to 9-year-olds, and 18- to 40-year-olds looked at 10 vignettes, across five dimensions of social power: resource control, goal achievement, denying permission, giving orders, and setting norms. At the end of each vignette, participants answered the question, “Who is older?” The results indicated a main effect of dimension and participant age, as well as a significant interaction between participant age and dimension. More specifically, 3- to 4-year-olds were able to make correct inferences about age on vignettes testing understanding of resource control, goal achievement, and denying permission. Five- to 6-year-olds were able to make accurate inferences about age on resource control, goal achievement, denying permission, and, importantly, setting norm vignettes. Lastly, 7- to 9-year-olds were able to make correct inferences about age when given vignettes that tested all five dimensions. These results suggest that as children get older, their understanding of power concepts and subsequent inferences about age improves. These novel findings add to the existing understanding of the cognitive and developmental processes of children and provide parents and guardians with additional information about how to parent and care for their children.

Keywords: age, social power, conceptual development

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A significant number of research studies have examined children's understanding of power and age independently, as well as the influence of a subject's age upon his or her own ability to draw inferences about power (Charafeddine et al., in press). However, to my knowledge, there is no research that looks inversely at children's understanding of power and its consequential influence upon judgments of age. Therefore, the current study investigates whether children make inferences about other children's relative age, given their implicit understanding of power. This study also investigates whether development or types of power affect these inferences. Therefore, the aim of this paper is to highlight previous findings about age and power concepts, to detail the processes and findings of the current study, and to emphasize the study's findings regarding inferences about age as it relates to power.

According to early studies, infants use age to differentiate between two people and predict behavior and social exchanges (Brooks-Gunn & Lewis, 1979). Infants as young as six-months-old are able to discriminate between babies and adults (Fagan, 1972), while children between the ages of four and six are able to differentiate between a child and an adult (Brooks & Lewis, 1976). A later study conducted by Taylor and Gelman (1993) found that when preschool children were asked to make inferences about characters based upon either age or gender, they most often chose age. This study also revealed that children used age information to draw inferences and make judgments about others, suggesting an early understanding of age (Taylor & Gelman, 1993). In a later study, Sobel and Corrieveau (2010) concluded that four-year-olds use age to determine a person's expertise and trustworthiness, further supporting the idea that young children use age to draw conclusions about people.

Another recent study, by Seehagen and Herbert (2011), further investigated children's usage of age concepts. In the study, 15- and 24-month-old participants watched films of adults and children performing novel tasks. The 15-month-old participants imitated the tasks of the adults, while the 24-month-old participants imitated the tasks of the children (Seehagen & Herbert, 2011). When tested again on the same task at 24-months-old, the formerly 15-month-old participants imitated the behavior of the children, indicating a newly developed appreciation for peers as a result of social experience gained between 15- and 24-months-of-age (Seehagen & Herbert, 2011). Evidently, as children matured, they felt more comfortable imitating and learning from young children, displaying an early understanding of age. Despite these significant findings, few studies exist that look at whether children make these inferences about age, given an understanding of power.

Recent research on infants' concepts of social dominance also suggests that the cognitive facilities to understand power develop at an early age. More specifically, Thomsen, Frankenhuis, Ingold-Smith, and Carey (2011) investigated preverbal infants' developing understanding of power through a preferential looking task. Infants observed a contrasting-goals situation between a large and small figure (Thomsen et al., 2011). The study's results suggest that infants paid more attention to the task when the smaller figure achieved its goal. From these results, Thomsen et al. (2011) concluded that humans have the cognitive capacity to understand the relationship between size (often correlated with age) and power and to make conclusions based upon this association from a young age. Mascaro and Csibra (2012) also found that 10- to 13-month-old infants believed that a smaller cartoon character would be submissive to a larger cartoon character and that 12- to 15-month-old children expected a dominant cartoon character to maintain its power across scenarios. This early ability is important because it directs appropriate

behavior in social settings and guides inferences about existing resources and other people (Brey & Shutts, 2014).

Brey and Shutts (2014) also found that size, understood through posture, head positioning, and direction of gaze, signifies power beginning in early infancy and spanning into adulthood. More specifically, when given a choice between an upright versus slouching figure, five and six year olds believed that the upright figure was more powerful (Brey & Shutts, 2014). Brey and Shutts (2014) also concluded that children's understanding of power improves with age. In comparison to five and six year olds, 3- to 4-year-olds had trouble identifying the more powerful figure (Brey & Shutts, 2014).

A recent study conducted by Charafeddine et al. (in press) further investigated children's understanding of power relationships through various cues of dominance, including age. To test each cue of power, Charafeddine et al. (in press) developed various puppet scenarios. To assess understanding of age, Charafeddine et al. (in press) created a scenario in which two puppets announced their ages. One puppet was both a year older and held slightly higher than the other puppet. Children were then asked which puppet was the boss. Charafeddine et al. (in press) concluded that the children showed a tendency to assume that a taller, larger figure was the boss, again suggesting that children make inferences about power based upon age. These findings also support previous research, which revealed that children use age information to draw inferences and make judgment about others (Taylor & Gelman, 1993). Despite these noteworthy findings, the study only used physical size to draw conclusions about age or power, which can be an inaccurate marker for power. For example, research on primates suggests that size and age are not the best determinants for power because primates may secure powerful positions, regardless of size, through established social connections (Hand, 1986). Similarly, humans can and often

attain power through social status. Furthermore, because the puppets were intentionally held at different heights, the distinction between the puppets' ages may have been biased (Charafeddine et al., in press).

Recent research conducted by Gülgöz (2015) accounts for the limitations inherent in the methodology of the Charafeddine et al. (in press) study and suggests that sensitivity to social power relationships develops at a young age. Gülgöz (2015) investigated whether participants in age groups of 3- to 4-year-olds, 5- to 6-year-olds, 7- to 9-year-olds, and 18- to 40-year-olds would draw inferences about relative age based upon their understanding of power. To do so, Gülgöz (2015) created vignettes to test participants' understanding of various dimensions of power: resource control, goal achievement, denying permission, giving orders and setting norms. At the end of each vignette, children were asked to answer the question, "Who is in charge?" Gülgöz (2015) concluded that even the youngest children were sensitive to power relations for three of the dimensions: resource control, goal achievement, and denying permission. This suggests that understanding of power concepts, as well as understanding of age in relation to power, matures concurrently with development. The setting norms dimension was not understood until age five or six, while the giving orders dimension was not understood until age seven (Gülgöz, 2015). Interestingly, participants displayed an adult-like understanding of power relationships by age seven (Gülgöz, 2015). Additionally, each group out-performed the younger group. Gülgöz (2015) ultimately concluded that the understanding of power in relation to social norms, expectations, and responsibilities develops and becomes more complete as children mature.

The current study specifically built upon the research of Gülgöz (2015) and investigated whether children use this implicit understanding of power to make inferences about age, which

would imply that power relations are significant in relationships between two figures varying in age. This study also expanded upon other research findings and filled the gaps in existing literature. In order to minimize biases about which character was older, all characters in the current study were the same height, barring characters in one of the control questions. One of the controls tested children's existing understanding of height differences in relation to age, to account for related findings from past research. This study also looked at the development of inferring relative age from power. Lastly, the current study investigated inferences about age as an outcome of understanding power, a novel approach to the relationship between these two variables.

Similar to the research of Gülgöz (2015), this study measured power across five dimensions: resource control, goal achievement, denying permission, giving orders, and setting norms. Guinote and Vescio (2010) defined resource control as an individual or group's attainment of more of a physical, social, or economic resource compared to another individual or group. In general, tactics to control resources develop at a young age and in conjunction with cognitive and social maturity (Hawley, 1999). Although the social and verbal skills of toddlers and preschoolers are unrefined relative to those of 7- to 9-year-olds, children within this age range are able to attain resources through yelling and crying (Hawley, 1999). Therefore, this research revealed that children display behaviors to attain resources from a young age, but may not achieve a complete conceptualization of this idea until later on (Hawley, 1999). As children mature, their strategies become more adult-like, such that they make use of appropriate social and verbal skills (Hawley, 1999). Goal achievement, as defined by Guinote & Vescio (2010) is the aptitude of an individual or group to achieve goals. According to research conducted by Brandone and Wellman (2009) children understand and exhibit goal-driven behavior starting

around 10-months-old, a sensitivity that should influence whether children make inferences about age based upon power.

According to Cummins (1996), permission is closely tied to deontic reasoning, the reasoning for the behaviors that are conventional or taboo in a social situation. Deontic reasoning is inherent in all social institutions and creates a standard for what is allowed, forbidden, or required in social situations. Cummins' (1996) research suggested that children, as young as three years old, develop a form of deontic reasoning that allows them to detect actions that are aligned with or against permitted standards. Research conducted by Harris and Nunez (1996) provided 3- to 4-year-old children with vignettes about figures, which were given permission to perform various activities. The figures either acted in accordance with or in opposition to the permission received. The participants then had to answer whether the figure was being "naughty." In all trials of this study, 3- to 4-year-olds accurately identified figures that breached permission rules, suggesting an early understanding of permission (Harris & Nunez, 1996). Given this early understanding of permission, it follows that children may also use giving and denying permission skills from a young age.

According to Laupa (1991), children in first through seventh grade consider a person's knowledge, age, and social status before accepting an order. Additionally, many children take moral standards into account before acting upon commands, even from parents (Laupa, 1991). This understanding is not innate to children, and requires an understanding of larger social structures and standards, suggesting that children understand the concept of taking orders later than the other dimensions (Laupa, 1991). Therefore, it seems that children will give orders to others after developing and strengthening their own understanding of taking orders.

Norms are distinct to humans and are expectations about rights, obligations, and behaviors within a certain society (Schmidt & Tomasello, 2012). People often subscribe to norms due to the expectations of their surrounding environments, choosing to become part of standardized institutions (Schmidt & Tomasello, 2012). Years ago, Piaget (1948) noticed that many children initially subscribe to norms out of respect for their elders, but eventually--around 7 to 12 years of age--maintain norms due to a commitment to their society's norms.

Additionally, Schmidt and Tomasello (2012) found that children not only subscribe to norms because of parental influence, but also set norms and enforce them upon their peers, beginning around age three. These findings suggest an early understanding and use of norms among children, in line with Gülgöz's (2015) recent findings, which examined whether children associated norm setting with power.

Based upon these five dimensions of power, it was hypothesized that children's ability to make inferences about age, given various power scenarios, will develop concurrently with their understanding of power. Children, specifically 3- to 4-year-olds, were hypothesized to make correct inferences about age when given vignettes testing resource control, goal achievement, and denying permission. It was also hypothesized that 5- to 6-year-olds will have a clear understanding of resource control, goal achievement, denying permission, and, importantly, setting norms, which would allow them to accurately make inferences about relative age. Children in this age group were hypothesized to have some understanding of giving orders, depending on their awareness of social norms. Additionally, 7- to 9-year-olds were hypothesized to have equal understanding of all dimensions of power. As a result of this hypothesis, participants in this age group were hypothesized to be able to make correct inferences about relative age. Finally, the difference between the understanding of power of 3- to 4-year-olds and

adults was hypothesized to be the greatest compared to the difference in understanding among all other age groups.

Method

Participants

Participants were 50 3- to 4-year-olds (Mean [M] = 4.19, age range = 3.33 – 4.96 years, 23 females, 28 males), 35 5- to 6- year-olds (M = 5.86, age range = 5.01- 6.98 years, 18 females, 17 males), and 31 7- to 9-year-olds (M = 8.27, age range = 7.00- 9.83 years, 18 females, 13 males). The children who participated in the study were recruited from local children's museums and a local preschool. Forty-six adult participants (M = 28.63, age range = 20.85- 40.56, 21 females, 25 males) were recruited through Amazon Mechanical Turk (MTurk). Data from 17 adults were dropped because MTurk does not allow prescreening for age groups, and the said participants' ages did not fit the predetermined age range (18-40 years). Data from a male child (4.71 years) were dropped because he failed to complete the study. Children participating from both the school and museums gave assent after their parents completed a consent form. At the local public school, the consent form was sent home with the participant, signed by a parent or guardian, and returned to school. Adults participating through MTurk completed a consent form online. After completing the study, children were given a small prize and adults were paid \$0.50.

Measures and Procedure

The task completed by the children and adult participants was identical, barring the consent and assent procedures described above. Once consent and assent were achieved, children were reminded that they could stop participation or ask questions at any point throughout the study. The participants were informed that the characters in the vignettes were all

the same height and that the characters in the vignettes were either all girls or all boys, matched to the participant's gender. In order to minimize response biases based upon vignette order, all survey questions were presented in random order for all participants, except for the control items. Instead, the control items were always presented in the same order at the end of the survey. To control for possible preference for name or appearance of the characters, the assignment of character to powerful positions was counterbalanced across participants. To understand participants' previous conceptions of age, the study also included two controls. One control examined physical size and the second control was an irrelevant dimension unrelated to power. The remaining vignettes investigated children's assumptions regarding age groups as they pertain to power, measured through resource control, goal achievement, permission, giving orders, and setting norms.

Following the introduction to the study, the researcher read the vignettes to the participants (See Appendix A). Each vignette included hand-drawn pictures that complemented the short stories (See Appendix B). At the end of each vignette, participants were asked, "Who is older?" Subjects responded with either one of the character's names. Once the subject responded with a name, the researcher selected the participant's answer and continued to the next vignette.

Coding

Participants were given 1 point for inferring that the powerful figure in each vignette was older. Participants were given 0 points for inferring that the weaker character was older. For the irrelevant control question, the answer to the question "Who is older?" for the vignette was randomly selected: the left character was older. Therefore, participants received 1 point for inferring that the left figure was older, and 0 points for inferring that the right figure was older.

Overall scores on dimension were calculated by adding together the two vignettes for each dimension. For dimension scores, participants were given 2 points for inferring that both powerful figures were older, 1 point for inferring that one powerful figure was older and one weaker figure was older, and 0 points for inferring that both weaker figures were older. A total score, across all dimensions, was calculated by adding together the five dimensions' vignettes. Scores could range from 0-10. The controls were calculated independently.

Results

A number of analyses were conducted to determine whether children understood and recognized which character was older in the vignettes. A repeated measures analysis of variance (ANOVA) with participant age group (3- to 4-year-olds, 5- to 6-year-olds, 7- to 9-year-olds, adults) as between-subjects variables, and dimension as a within-subjects variable was conducted to determine age group differences in performance (main effect of age group), differences in performance across power dimensions (main effect of dimension), and differences in how each age group responded to each dimension (age group x dimension interaction). Preliminary tests found no significant effects of assignment to order, so this variable was not included in subsequent analyses.

There was a main effect of age group, $F(3, 157) = 5.77, p = .001, \eta_p^2 = .10$. Each age group performed better than the younger age groups. Post-hoc pairwise comparisons showed that the only significant differences were between adults ($M = 1.48$) and both 3- to 4-year-olds ($M = 1.12, p < .001$) and 5- to 6- year-olds ($M = 1.22, p = .008$). Additionally, there was a main effect of dimension, $F(4, 628) = 3.72, p = .005, \eta_p^2 = .02$. Post-hoc pairwise comparison tests showed a significant difference between performance on goal achievement ($M = 1.14$) and denying permission vignettes ($M = 1.39, p < .001$), as well as between goal achievement and

norm setting vignettes ($M = 1.34, p = .005$). There was also a significant difference between performance on denying permission tasks and giving orders tasks ($M = 1.23, p = .03$).

Differences between other dimensions were all at chance.

Analysis of variance testing also confirmed a significant interaction between age group and dimension, $F(12, 628) = 3.37, p < .001, \eta_p^2 = .07$. Post-hoc pairwise comparison tests of dimension showed that the performance of 3- to 4-year-olds ($M = .84$) on giving orders vignettes was significantly different than that of both 7- to 9-year-olds ($M = 1.29, p = .003$) and adults ($M = 1.70, p < .001$). Five- to 6-year-olds ($M = 1.09, p < .001$) and 7- to 9-year-olds ($p = .007$) also performed significantly differently than adults on giving orders vignettes. Post-hoc tests further showed a significant difference between the performance of 3- to 4-year-olds ($M = 1.02$) and both 7- to 9-year-olds ($M = 1.42, p = .009$) and adults ($M = 1.76, p < .001$) on norm setting vignettes. The performance of 5- to 6-year-olds ($M = 1.18, p < .001$) and 7- to 9-year-olds ($p < .03$) on norm setting vignettes was also significantly different than that of adults.

Participants' scores were compared to chance via t-tests. Results showed that performance summing across all dimensions was above chance (5) ($M = 6.37, p < .001$). More specifically, 3- to 4-year-olds ($M = 5.60, p = .01$), 5- to 6-year-olds ($M = 6.09, p = .007$), 7- to 9-year-olds ($M = 6.42, p = .01$), and adults ($M = 7.39, p < .001$) all performed above chance. T-test comparisons of all of the total scores of all individual age groups were also compared to chance (1). See Table 1 and Figure 1. Three- to 4-year-olds performed above chance on the individual dimensions testing understanding resource control ($M = 1.30, p = .006$) and denying permission ($M = 1.34, p = .001$). Similarly, 5- to 6-year-olds performed above chance on resource control ($M = 1.34, p = .02$) and denying permission vignettes ($M = 1.29, p = .02$). Seven- to 9-year-olds performed above chance on denying permission ($M = 1.39, p = .01$) and norm setting tasks ($M =$

1.42, $p = .005$). Results also showed that adults performed above chance on resource control ($M = 1.23, p = .05$), denying permission ($M = 1.50, p < .001$), giving orders ($M = 1.70, p < .001$), and norm setting ($M = 1.74, p < .001$) vignettes. Adults' performance on goal achievement vignettes was marginally significant ($M = 1.21, p = .06$). Any results not reported here were at chance.

T-tests were also conducted for each age group's performance on the control items to examine how physical size (i.e., height) could be used as a prediction for age and whether children performed at chance when faced with an irrelevant dimension, which should not have lead to any predictions about age (see Table 2 and Figure 2). These tests showed that all age groups performed at chance on the irrelevant control vignette, which was unrelated to power. Three- to 4-year-olds ($M = .84, p < .001$), 5- to 6-year-olds ($M = .97, p < .001$), 7- to 9-year-olds ($M = .90, p < .001$), and adults ($M = .84, p < .001$) all performed above chance on the physical power vignette, indicating that all participants inferred that the taller figure was older.

Discussion

This study investigated whether children make assumptions about relative age based on observed power relationships between two figures. Subjects' differentiation between "who is older" was determined based upon a number of vignettes that tested the study's dimensions of power: resource control, goal achievement, denying permission, giving orders, and setting norms. It was hypothesized that children's ability to make inferences about age based upon power, conceptualized in the current study as the aforementioned five dimensions, will develop concurrently with their understanding of age. Therefore, each age group was hypothesized to have a different understanding of power, and subsequently a different conception of age, due to

developmental differences. Furthermore, it was hypothesized that the difference between 3- to 4-year-olds and adults would be larger than the difference between other age groups.

The current study's findings support many of the aforementioned hypotheses and both the research of Gülgöz (2015) as well as the findings of earlier studies, which indicated that children's understanding of power develops from a young age (Brey & Shutts, 2014; Mascaro & Csibra, 2012; Thomsen et al., 2011). More specifically, the study revealed a significant influence of participant age upon the ability to correctly make inferences about relative age. Compared to younger participants, older children were better able to make inferences about age, given their understanding of power relations. Understandably, the greatest performance gap was between 3- to 4-year-olds and adults. This ability most likely improved as a result of strengthened cognitive functioning as well as greater awareness of power both generally as well as within relationships (Charafeddine et al., in press). Furthermore, the study suggested that 3- to 4-year-olds were only able to recognize and make inferences about resource control, goal achievement, and denying permission when given vignettes depicting interactions between two figures. Three- to 4-year-olds may have been able to understand only these particular dimensions of power given their developmental maturity and limited social experiences (Brandone & Wellman, 2009; Gülgöz, 2015; Hawley, 1999). Additionally, understanding of these particular dimensions may be more developed as a result of social exchanges with older members of society, such as parents or teachers (Hawley, 1999).

In addition to being able to correctly make inferences about relative age given resource control, goal achievement, and denying permission dimensions, 5- to 6-year-olds could recognize and draw further conclusions about the setting norms dimension. This new understanding and use of setting norms may develop as children form bonds with fellow peers and family members

and experience more social interactions (Schmidt & Tomasello, 2012). Additionally, this age often aligns with the time when children are enrolled in formal schooling, a crucial period when key norms are set to help facilitate class order and functionality. For many children, these norms are presumably different than the standards of their home environments, but important given their widespread usage in society. Raising one's hand for permission to speak is an example of behavior that is typically not used at home.

By age seven, children recognized and correctly made inferences about all of the study's dimensions of power. Seven- to 9-year-olds correctly made inferences about giving orders, possibly as a result of their exposure to social situations and schooling (Laupa, 1991; Peisner-Feinberg et al., 2001). Through interactions in school, for instance, children improve their cognitive, language, and social skills with the help of peers and teachers (Peisner-Feinberg et al., 2001). These new skills are crucial to understanding and identifying social scenarios related to giving orders (Volden & Sorenson, 2009). Lastly, adults were able to correctly make inferences about all of the dimensions of power. Adults' performance on goal achievement tasks was consistent with the study's hypotheses in that they showed a trend toward identifying the powerful character in this dimension as older; however, this trend was not significant. More generally, there was a significant difference between all of the age groups' inferences about relative age and those of the adults, given these age groups' developing understanding of the study's dimensions of power. Related to the aforementioned findings, the study also revealed that children show varying levels of understanding, as a function of the dimensions they were asked to judge. This finding may explain why each age group's ability to correctly make inferences about relative age was unique.

The study's results also revealed a significant and reciprocal interaction between dimension and age group. In general, when each age group's performance on individual dimensions was looked at relative to that of the other age groups, the results suggested that adults performed significantly better than all of the other age groups on giving orders vignettes and that 7- to 9-year-olds performed significantly better than 3- to 4-year-olds on giving orders tasks. All other differences were not statistically significant. These performance differences on the vignettes presumably result from cognitive and social differences inherent to each age group (Hawley, 1999).

More specifically, when each age group's performance scores on individual dimensions were compared, the results showed that 3- to 4-year-olds performed significantly better on both resource control and goal achievement tasks than they did on giving orders tasks. Further, participants in this age group performed significantly better on denying permission tasks relative to giving orders and norm setting tasks. There were no other significant differences between 3- to 4-year-old participants' performance on vignettes related to other dimensions. These findings further suggest an early development of the ability to make inferences based upon resource control, goal achievement, and denying permission tasks.

Surprisingly, the study's results did not suggest a significant difference between the performance of 5- to 6-year olds and that of 7- to 9-year olds on any dimension. However, adults made inferences about age when given denying permission tasks more often than they did when given either resource control or goal achieving tasks. Participants in this age group also made more inferences about age on giving orders vignettes than they did on given resource control and goal achievement tasks. Lastly, adults were more likely to draw inferences about age on norm setting tasks than they were on resource control and goal achievement tasks. There were no

other significant differences between dimensions for this age group. These results suggest that adults are more likely to make inferences about age on denying permission, giving orders, and norm setting tasks, despite sensitivities to all dimensions, perhaps as a result of associations formed between age and these specific dimensions. These findings may result from the roles these participants assume within the workplace or at home.

These findings pose several important questions for future research. The first question stems from the fact that participants were told that the two characters were of the same height, leading to a possible confound. More specifically, previous research revealed that children think taller figures are more powerful (Gülgöz, 2015). As a result, children might infer that the younger character is tall for his or her age, which could indicate greater power. This could potentially confuse children's expectations about how age and height predict power. Therefore, future research could include pictures of just the characters' heads to correct for any influence of height upon inferences about age. Participants' answers may have also been influenced by relationships with siblings or peers. For example, a participant with younger siblings might reason that a character with fewer resources is older because he or she voluntarily gave more resources to the younger sibling. Therefore, future research could include several questions about each participant's family, with regards to his or her siblings. A future study might ask, "Do you have any siblings? If so, are your siblings older, younger, or both?" By considering sibling order, future research could account for familial influences upon participant performance.

Thus, the study's results suggest that children's ability to make inferences about relative age, based upon power, develops from a young age. The current study also adds to existing literature about children's conceptual and cognitive development. More specifically, the findings suggest that children's ability to make inferences about relative age improves with

cognitive maturation. These findings also reveal the connection between children's conceptualization of power in relationships and their developing understanding of age. Ultimately, these findings provide new information that can transform parenting techniques. For example, if provided with the knowledge that 3- to 4-year-olds are only able to draw conclusions about the power dimensions of resource control, goal achievement, and denying permission, parents and guardians could then tailor their parenting styles to help their children respond appropriately and with greater ease. As their children develop cognitively, parents and guardians could concurrently alter their own behavior and parenting styles. Thus, given these novel findings, parents and guardians are now better equipped to nurture and cater to the needs of children throughout typical developmental processes.

References

- Brandone, A. C., & Wellman, H. M. (2009). You can't always get what you want: Infants understand failed goal-directed actions. *Psychological Science, 20*(1), 85-91. doi:10.1111/j.1467-9280.2008.02246.x
- Brey, E., & Shutts, K. (2014). Children use nonverbal cues to make inferences about social power. *Child Development, 86*(1), 276-286. doi:10.1111/cdev.12334
- Brooks, J., & Lewis, M. (1976). Infants' responses to strangers: Midget, adult, and child. *Child Development, 47*(2), 323-333. doi:10.2307/1128785
- Brooks-Gunn, J., & Lewis, M. (1979). Why mama and papa?: The development of social labels. *Child Development, 50*(4), 1203-1206. doi:10.2307/1129349
- Charafeddine, R., Mercier, H., Clément, F., Kaufmann, L., Berchtold, A., Reboul, A., & Van der Henst, J. B. (in press). How preschoolers use cues of dominance to make sense of their social environment. *Journal of Cognition and Development*.
- Cummins, D.D. (1996). Evidence of deontic reasoning in 3- and 4-year-old children. *Memory & Cognition, 24*(6), 823-829. doi:10.3758/BF03201105
- Fagan, J.F. (1972). Infants' recognition memory for faces. *Journal of Experimental Child Psychology, 14*(3), 453-476. doi:10.1016/0022-0965(72)90065-3
- Guinote, A. (2007). Power and goal pursuit. *Personality and Social Psychology Bulletin, 33*(8), 1076-1087. doi:10.1177/0146167207301011
- Gülgöz, S. (2015). *Developing a concept of social power relations* (Unpublished doctoral dissertation). University of Michigan, Ann Arbor.
- Hand, J. L. (1986). Resolution of social conflicts: Dominance, egalitarianism, spheres of dominance, and game theory. *The Quarterly Review of Biology, 61*(2), 201-220.

- Harris, P. L., & Núñez, M. (1996). Understanding of permission rules by preschool children. *Child Development, 67*(4), 1572-1591. doi:10.2307/1131719
- Hawley, P. (1999). The ontogenesis of social dominance: A strategy-based evolutionary perspective. *Developmental Review, 19*, 97-132.
- Keating, C. F., & Bai, D. L. (1986). Children's attributions of social dominance from facial cues. *Child Development, 57*(5), 1269-1276. doi:10.2307/1130449
- Laupa, M. (1991). Children's reasoning about three authority attributes: Adult status, knowledge, and social position. *Developmental Psychology, 27*(2), 321. doi:10.1037/0012-1649.27.2.321
- Laupa, M., & Turiel, E. (1993). Children's concepts of authority and social contexts. *Journal of Educational Psychology, 85*(1), 191-197. doi:10.1037/0022-0663.85.1.191
- Mascaro, O., & Csibra, G. (2012). Representation of stable social dominance relations by human infants. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 109*(18), 6862-6867. doi:10.1073/pnas.1113194109
- Piaget, J. (1948). *The moral judgment of the child*. New York, NY, US: Free Press.
- Peisner-Feinberg, E. S., Burchinal, M. R., Clifford, R. M., Culkin, M. L., Howes, C., Kagan, S. L., & Yazejian, N. (2001). The relation of preschool child-care quality to children's cognitive and social developmental trajectories through second grade. *Child Development, 72*(5), 1534-1553. doi:10.1111/1467-8624.00364
- Schmidt, M. F., & Tomasello, M. (2012). Young children enforce social norms. *Current Directions in Psychological Science, 21*(4), 232-236. doi:10.1177/0963721412448659
- Seehagen, S., & Herbert, J. S. (2011). Infant imitation from televised peer and adult models. *Infancy, 16*(2), 113-136. doi:10.1111/j.1532-7078.2010.00045.x

- Sobel, D. M., & Corriveau, K. H. (2010). Children monitor individuals' expertise for word learning. *Child Development, 81*(2), 669–679. doi:10.1111/j.1467-8624.2009.01422.x
- Taylor, M. G., & Gelman, S. A. (1993). Children's gender- and age-based categorization in similarity and induction tasks. *Social Development, 2*(2), 104–121. doi:10.1111/j.1467-9507.1993.tb00006.x
- Thomsen, L., Frankenhuis, W.E., Ingold-Smith, M., & Carey, S. (2011). Big and mighty: Preverbal infants mentally represent social dominance. *Science, 331* (6016), 477-480. doi:10.1126/science.1199198
- Volden, J., & Sorenson, A. (2009). Bossy and nice requests: Varying language register in speakers with autism spectrum disorder (ASD). *Journal of Communication Disorders, 42*(1), 58-73. doi:10.1016/j.jcomdis.2008.08.003

Table 1

Mean score received on each dimension (standard deviation) per age group.

Dimension	Age Group			
	3-to 4-year-olds	5-to 6-year-olds	7-to 9-year-olds	18-to 40-year- olds
Resource Control	1.30(.74)	1.34(.80)	1.19(.79)	1.23(.79)
Goal Achievement	1.10(.65)	1.08(.70)	1.13(.72)	1.21(.75)
Denying Permission	1.34(.69)	1.29(.71)	1.39(.80)	1.50(.78)
Giving Orders	.84(.62)	1.09(.71)	1.29(.82)	1.70(.51)
Setting Norms	1.02(.68)	1.17(.71)	1.42(.76)	1.75(.49)

Note. Higher scores correspond with a greater number of inferences made about powerful figures being older, per participant. The maximum score for all dimensions was 2 points and the minimum score for all dimensions was 0 points.

Table 2

Mean score received on each control task (standard deviation) per age group.

Dimension	Age Group			
	3-to 4-year-olds	5-to 6-year-olds	7-to 9-year-olds	18-to 40-year- olds
Irrelevant Dimension	.42(.50)	.49(.51)	.58(.50)	.37(.49)
Physical Power	.84(.37)	.97(.17)	.90(.30)	.84(.37)

Note. In each vignette, higher mean scores correspond with a greater number of inferences about which character was older based upon power comprehension. The highest possible score for each individual control task was 1 point and the lowest possible score for each individual control task was 0 points. Each score for the controls was looked at independently.

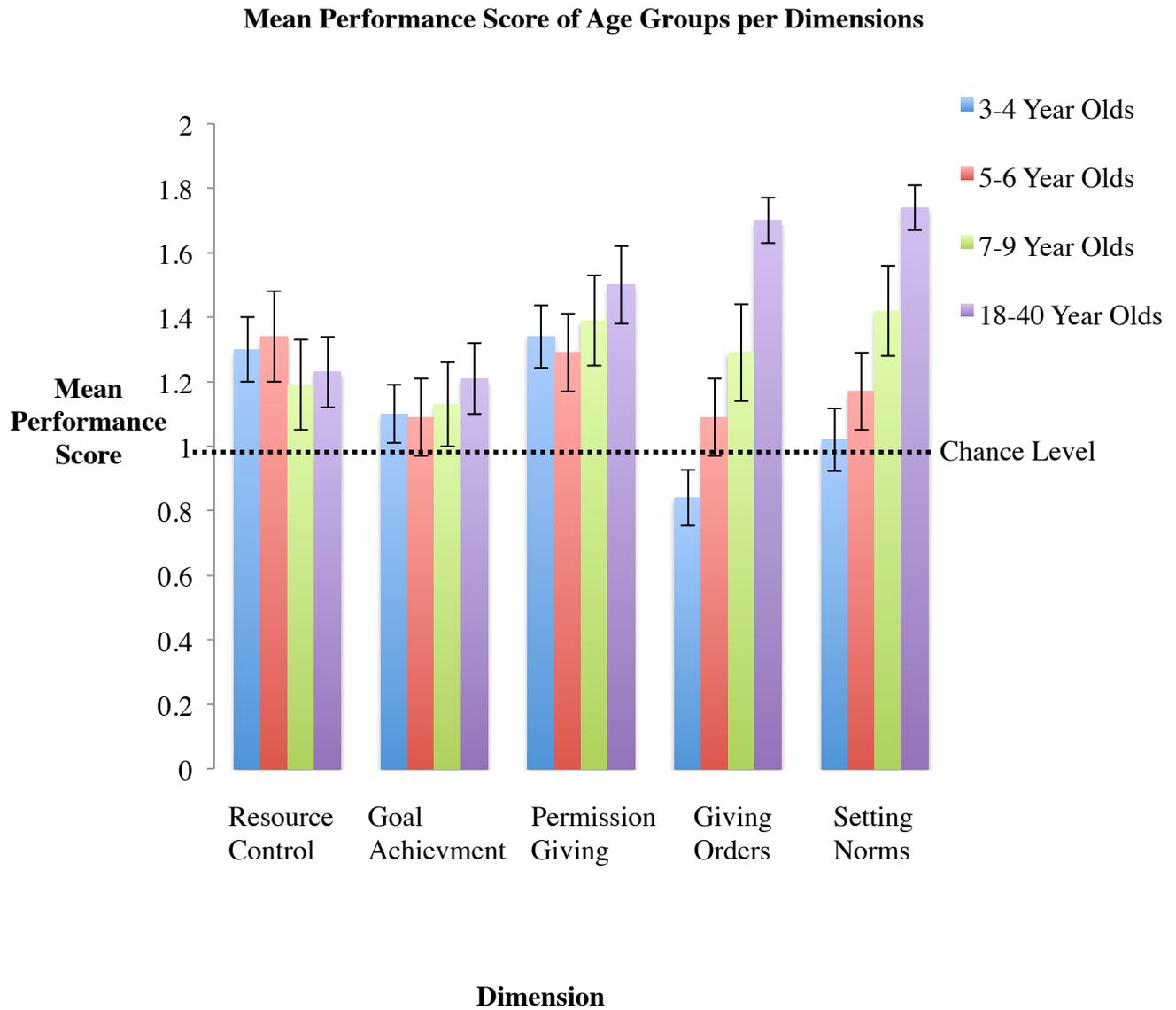


Figure 1. Mean performance score (and standard error) of each age group on each dimension. Five- to 6-year-olds’ ($M = 1.34$) performance on the resource control dimension was better than that of all other age groups. Eighteen- to 40-year-olds performed, on average, better than all participants in the other age groups on goal achievement ($M = 1.21$), denying permission ($M = 1.5$), giving orders ($M = 1.7$), and setting norms ($M = 1.75$) dimensions.

Average Performance Score for Controls per Age Group

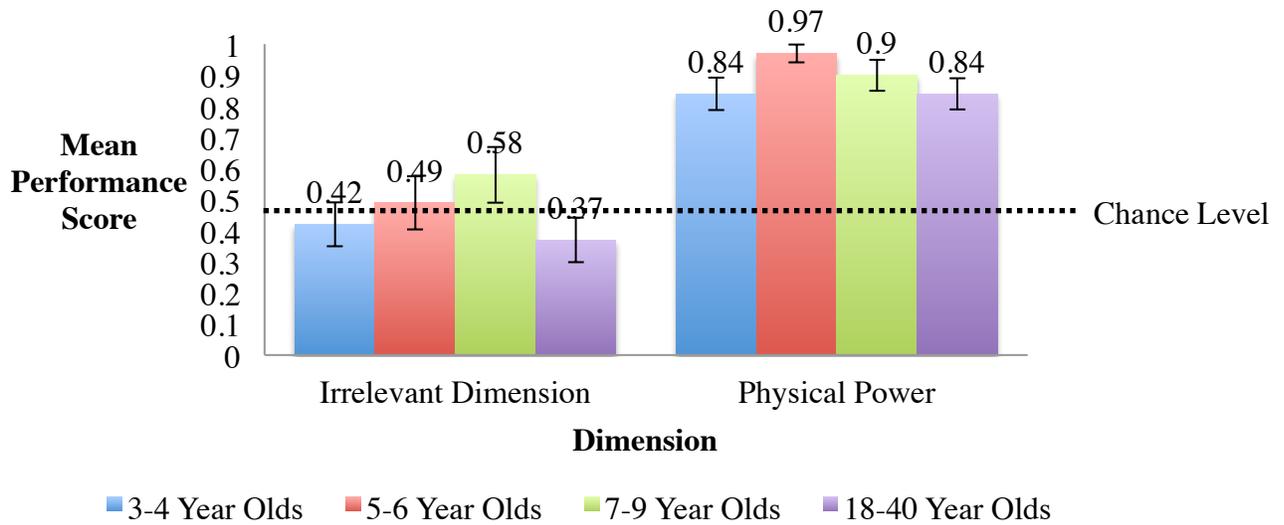


Figure 2. Mean performance score (and standard error) per age group on the irrelevant dimension (Control 1) and physical power dimension (Control 2). All age groups performed better on the physical power dimension task than on the irrelevant dimension task.

Appendix A

Scripts from each vignette. Before beginning the study, adults were told that the study was being conducted to understand how children and adults understand relationships. Children were told that the researcher was interested in how children think about different people. Participants then read the vignettes and answered the question, “Who is older?” This question tested the participants’ understanding of the five dimensions and their ability to make inferences about relative age. The name assignment of the figures was reversed in the counter-balanced order and the gender of the characters was matched to that of each participant. Below are the scripts from each vignette.

1. Resource Control

- a. This story is about two boys/girls called Zorp and Gorp. Zorp and Gorp went to the sandbox. In the sandbox, there was only one toy truck. Both Zorp and Gorp wanted to play with the toy truck. Gorp played with the truck, and Zorp watched.
- b. This story is about two boys/girls called Twip and Kwip. Twip and Kwip were at a party. At the party, there were 4 candy bars. Twip and Kwip both reached for the candy bars. Twip got 3 candy bars, and Kwip got 1 candy bar.

2. Goal achievement

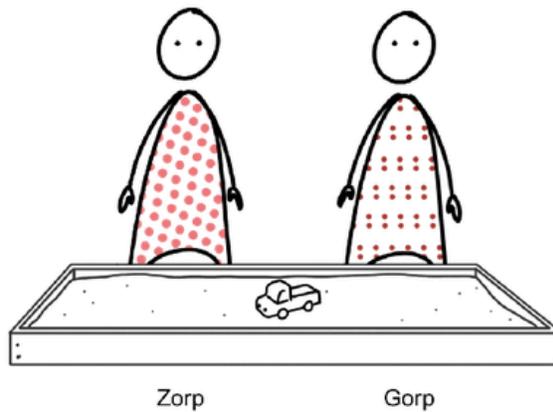
- a. This story is about two boys/girls called Jeggie and Feggie. Jeggie and Feggie were standing on different ends of the bridge. They both needed to cross to the other end of the bridge right away. But, the bridge was only wide enough for one person. So, when Jeggie and Feggie tried to cross at the same time, they got stuck in the middle. Jeggie went back off the bridge and moved to the side. And Feggie crossed the bridge.

- b. This story is about two boys/girls called Tiggy and Ziggy. One day Ziggy came to school wearing a brand new badge. Ziggy showed Tiggy and their friends the badge and said, “Look at my new badge. From now on, everyone should wear the same badge.” The next day, Tiggy came to school wearing the same badge that Ziggy had been wearing.

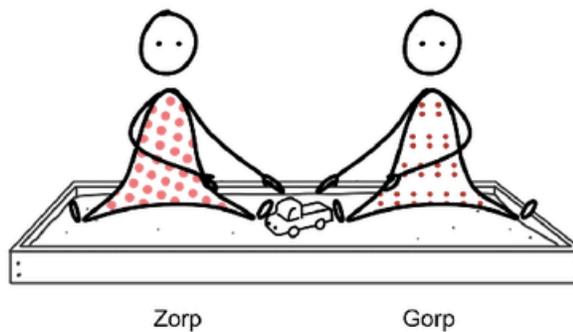
Appendix B

Example of a resource control vignette.

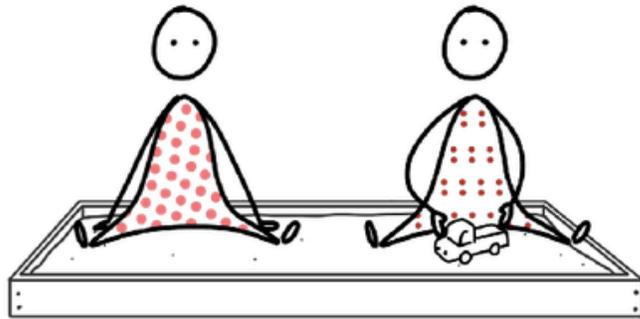
This story is about two boys called Zorp and Gorp.
Zorp and Gorp went to the sandbox. In the sandbox, there was
only one toy truck.



Both Zorp and Gorp wanted to play with the toy truck.



Gorp played with the truck, and Zorp watched.



Zorp

Gorp

Who is older: Zorp or Gorp?

Zorp

Gorp

