CHILDREN'S REASONING ABOUT GROUP-LEVEL SOCIAL HIERARCHIES AND THEIR DESIRES AND EXPECTATIONS FOR THE FUTURE

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by

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ABSTRACT

Young children detect power asymmetries within dyadic, zero-sum interactions, but little is known on the development of reasoning about more complex and multifaceted group-level hierarchies. We examined 5- to 10-year-old children's (N = 144) reasoning about a social hierarchy (presented as a business context) in which the top group was in charge, the bottom group followed orders, and the middle groups were both in charge and followed orders. We assessed participants' desired and expected positions within that hierarchy. Across participants, we varied the visual depiction of the hierarchy. Half of participants saw a structure with fewer people in top levels than in bottom levels (Pyramid hierarchy) and half saw a structure in which each level contained an equal number of people (Equal Numbers hierarchy). Results showed that older (vs. younger) children were more likely to perceive hierarchy as pyramid-shaped and to link prestige, wealth, wellbeing, and competence to top levels of the hierarchy. Warmth and effort, however, were linked to bottom levels of the hierarchy across ages. Children desired being at higher positions than they expected they would achieve, and the visual depiction of the hierarchy (Pyramid vs. Equal Numbers) differentially predicted girls' and boys' motivation to be at the top. Specifically, with age, boys were more likely to envision themselves at the top in the Pyramid hierarchy whereas girls were more likely to envision themselves at the top in the Equal Numbers hierarchy. Our findings suggest social hierarchy reasoning undergoes significant changes over development, and influences children's desires and expectations for the future.

Keywords: social hierarchy, development, future thinking, gender, aspirations

BIOGRAPHICAL SKETCH

Reut Vraneski grew up in Haifa, Israel. She holds a bachelor's degree with majors in Linguistics and Education from Bar Ilan University, and a master's degree in Learning Disabilities from Tel Aviv University. Her research examines children's understanding of social stratification and inequality, and the ways in which such understanding shapes the self-concept and aspirations of children from disadvantaged groups. During her free time, Reut likes to rock climb and read fantasy and science fiction.

Dedicated to my mother, Ariella Vraneski, whose support during the pursuit of this master's degree has been invaluable.

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Introduction

Social hierarchies exist in most, if not all, human groups and organizations. Previous studies show that young children detect power asymmetries within dyadic, zero-sum interactions (e.g., Brey & Shutts, 2015; Pun, Birch, & Baron, 2016; Thomsen, Frankenhuis, Ingold-Smith, & Carey, 2011); however, much less is known on the development of reasoning about more complex and multifaceted group-level hierarchies, such as social stratification and the relationship between status and a group's numerical size.

In this study, we examined how children come to understand and represent multiple dimensions of social hierarchy. In addition, we probed how such reasoning may inform young children's desires and expectations for the future, with a special focus on gender differences in children's envisioning of themselves in positions of power.

Social hierarchy and its developmental roots

Throughout human history, most social groups have been organized in a stratified structure, with fewer people at the top than at the bottom (Magee & Galinsky, 2008). The small number of people at the top typically enjoys the benefits of high social rank (e.g., increased status, power, wealth, and wellbeing), whereas the large number of people at the bottom is often deprived of these benefits and is, instead, more subject to social threat and punishment (Cummins, 2000; Fiske, Dupree, Nicolas, & Swencionis, 2016; Magee & Galinsky, 2008; Maner & Case, 2016; Sidanius & Pratto, 1999).

Recent work suggests that the detection of power differentials is an early-emerging human capacity. Young infants – similarly to their nonhuman primate relatives – are sensitive to cues of dominance and represent dominance relations as stable (Mascaro & Csibra, 2012). As early as 10 months of age, infants expect larger individuals and individuals with more allies to prevail in zero-sum conflicts (Thomsen, et a., 2011; Pun et al., 2016), and are able to make transitive inferences about social dominance (e.g., A > B and B > C, therefore A > C, where '>' denotes greater dominance, Gazes, Hampton, & Lourenco, 2017). Later in development, children begin using even more subtle and dynamic cues to dominance. For example, preschool-aged children are sensitive to facial features, age, and body posture when inferring which of two individuals is "in charge" (Brey & Shutts, 2015; Charafeddine, Mercier, Clément, Kaufmann, Berchtold, Reboul, & Van der Henst, 2015; Cogsdill, Todorov, Spelke, & Banaji, 2014), and during elementary school, children gradually learn about different ways in which a dominant individual can exert their power over a subordinate (e.g., providing permission, giving orders, setting norms; Gülgöz & Gelman, 2017).

Individual-level versus group-level hierarchies

Alongside their significant contributions, the studies mentioned above have notable limitations. Most prominently, they have examined social hierarchy reasoning only within dyadic, zero-sum interactions. For example, Thomsen et al. (2011) and Pun et al. (2016) showed infants two novel agents with conflicting goals who differed in physical size or number of allies, and compared infants' looking time when each agent prevailed. Similarly, in studies involving 3- to 9-year-old children, Brey &

Shutts (2015), Cogsdill et al. (2014) and Gulgoz & Gelman (2017) presented children with two individuals and asked them to indicate which one is “strong” or “in charge”.

Although at their most basic level, hierarchies occur between two individuals— a dominant and a subordinate—human hierarchies also occur at the group level and are far more complex and multifaceted. One important aspect of group-level hierarchies is their stratified structure (Magee & Galinsky, 2008): Social hierarchies divide people into different strata, and the relative position of a person on the hierarchy determines various life outcomes, such as social prestige, wealth, and wellbeing, as well as how they are viewed in the eyes of others. For example, people at the bottom levels of the hierarchy are often stereotyped as less competent but more warm than those at the top (Fiske, Cuddy, Glick, & Xu, 2002).

In addition, group-level hierarchies often take a pyramid-shaped structure, reflecting a negative relation between status and numerical group size. That is, the highest status – and the social benefits that come with it – is typically held by a numerically small group of people at the top (e.g., the ‘elite’), whereas the lowest status is held by a numerically larger group at the bottom. This reverse relationship stands in contrast to the social reality of other animal species, where physical dominance is of greater importance and therefore status is typically conferred to larger groups (e.g., McComb, Packer & Pusey, 1994; Wilson, Hauser, & Wrangham, 2000).

Recent evidence suggests that we have an evolutionary tendency to associate status with numerically larger groups, which is gradually overcome by exposure to modern human social structures, where numerically *smaller* groups are often the ones to hold the power (Cao & Banaji, 2017). Therefore, older children – who have had

more exposure to modern social structures than younger children – may be more likely to link status to smaller groups. Indeed, in a recent study by Heck, Bas, & Kinzler (under review), the association between status and numerically small groups increased with age. Thus, the pyramid-shaped structure – though a classic symbol of social hierarchy for adults (Zitek & Tiedens, 2012) – may be counterintuitive for young children. If young children have not internalized the "elite = small group" association, they may not yet represent social hierarchy in this manner.

In sum, whereas previous studies shed light on the basic building blocks of social hierarchy reasoning (namely, the detection of dominance within dyadic relationships), the present study examined the development of more complex, multidimensional reasoning about group-level hierarchies, such as social stratification and the relation between status and a group's numerical size.

Business as a framework for testing social hierarchy reasoning

We examined children's social hierarchy reasoning within the context of business, for the following reasons. The occupational world is one of the most prominent manifestations of human social hierarchy. The type of job a person occupies often determines how much social influence they have, how they are viewed in the eyes of others, whether they have access to various resources, and their quality of life more broadly. Hierarchy in the occupational world is present both at the macro-level (e.g., some jobs have higher status than others) and at the micro-level (e.g., within a certain organization there are higher-ranked managers and lower-ranked employees). In both cases, the pyramid-structure applies: There are fewer doctors than

there are construction workers, and there are fewer managers than there are junior employees.

Second, the occupational world is familiar to children. As early as the preschool years, children are familiar with different types of jobs and job-related concepts such as giving/following orders and earning money (Ferrari, Ginevra, Santilli, Nota, Sgaramella, & Soresi, 2015; Watson & McMahon, 2005). Furthermore, since children form ideas about their future jobs from an early age (e.g., Bandura, Barbaranelli, Caprara, & Pastorelli, 2001; Hartung, Porfeli, & Vondracek, 2005), using job-related concepts allowed us to probe not only their broad reasoning about social hierarchies, but also their thinking about their own future positions on the hierarchy.

Children's envisioning of their future on the social hierarchy: desires, expectations, and the role of gender

With regard to children's ideas about of their own future, this study addressed two main questions. First: Where do children want to be on the social hierarchy, and is where they want to be the same as where they think they will actually be? Markus & Nurius (1986) distinguished between "desired selves" and "expected selves", suggesting that people have distinct and often conflicting mental representations of where they would want, versus where they expect to see themselves in the future. Among adults, these two representations differentially predict future outcomes across domains (e.g., finding a job, success in an exam, Oettingen & Mayer, 2002), indicating the importance of treating them as distinct components of future thinking. Whereas numerous studies have examined children's future desires, children's future

predictions have received little to no attention. An exception is a study by Schmitt-Wilson & Welsh (2012) which compared the career desires and expectations of fourth to seventh graders from a rural community. Schmitt-Wilson & Welsh found that when children were asked what they *think* they will be when they grow up, they named less prestigious careers than when they were asked what they *want* to be when they grow up. However, it is not clear whether this distinction emerges earlier than fourth grade and whether it develops with age.

Second, the present study examined whether girls and boys differ in their envisioning of themselves on top levels of the hierarchy. Women are underrepresented in positions of power (e.g., only 25% of US Senators, 11% of the world's billionaires, and 6.6% of Fortune CEOs are women) – a social reality that does not go unnoticed by young children (Bian & Cimpian, 2019; Liben, Bigler, & Krogh, 2001; Mandalaywala, Tai, & Rhodes, under review). The scarcity of female leaders in their environments, as well as cultural stereotypes depicting women as less agentic (e.g., dominant, assertive) but more communal (e.g., compassionate, caring) than men (Fiske et al., 2002) may signal to girls that they are not suited for positions at the top levels of the social hierarchy – leading them to envision themselves in lower positions than boys.

The present study

The present study examined the development of children's reasoning about social hierarchies, focusing on social stratification and the relation between status and a group's numerical size. Furthermore, this study probed children's thinking about

their future positions on the hierarchy, including gender differences in children's envisioning of themselves in positions of power.

Our main hypotheses were as follows:

(1) Older (versus younger) children will be more likely (a) to link prestige, wealth, wellbeing, and competence to top levels of the hierarchy (but warmth to bottom levels of the hierarchy), and (b) to perceive social hierarchy as a pyramid-shaped structure, where the small number of people at the top is highest in status and the large number of people at the bottom is lowest in status.

(2) Children's desired future position on the hierarchy will be more highly ranked than the position they will expect to have, and this pattern will increase with age.

(3) Girls will envision themselves in lower positions on the hierarchy as compared to boys.

To test these hypotheses, we told children about a novel business and showed them one of two stimuli representing its social hierarchy. In one stimulus, each level of the hierarchy was composed of an equal number of people; in the other, each level of the hierarchy contained a different number of people, such that there were fewer individuals on the top than at the bottom and the hierarchy resembled a pyramid. We then examined children's understanding of social stratification by asking them about the distribution of prestige, wealth, and wellbeing across different levels of the hierarchy, as well as which people on the hierarchy they considered to be competent, warm, and hardworking. Afterwards, we asked children about the job they would want to have, and the job they think they would have on the hierarchy. Since children's

thoughts about their own future often differ from their thoughts about the future of others (see Atance, 2015), we also asked children about the future desires and expectations of an unfamiliar, gender-matched child.

Method

Participants

Participants included 144 children (50% girls) aged 5 to 10 years (M_{age} = 8.08, SD_{age} = 1.70, range = 5 years 2 months to 10 years 11 months), such that 24 children were recruited within each age tested. Children participated in the lab or at a museum in Upstate New York.

Procedure

The experimenter told children they were going to talk about a business named Zam, and explained that a business is a place where people work and make money. She then told children that many people work for Zam and that they have different kinds of jobs. Next, she showed children one of two stimuli: the Pyramid hierarchy or the Equal Numbers hierarchy (Figure 1). Both stimuli depicted a five-level hierarchy of stick-figures; however, in the Pyramid hierarchy, the number of stick figures varied across levels, starting at 5 figures at the top and increasing by 5 until reaching 25 figures at the bottom. In the Equal Numbers hierarchy, in contrast, the number of figures remained constant (at 15) across levels. Thus, each hierarchy stimuli contained an equal total number of figures.

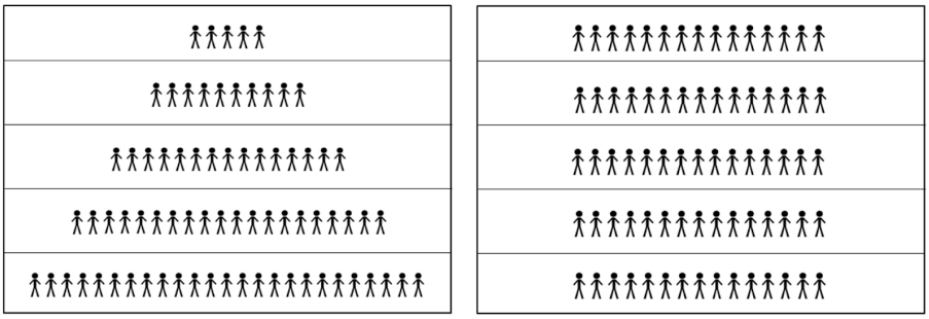

Figure 1. Hierarchy stimuli: Pyamid (left) and Equal Numbers (right).

Upon presenting one of the two stimuli, the experimenter explained that: (1) the people in the top jobs are in charge of everyone else in the business, (2) the people in the bottom jobs follow orders from everyone else in the business, and (3) the people in the three middle jobs are both in charge and follow orders from others: they are in charge of the people in the jobs below them, but they follow orders from the people in the jobs above them. The top and bottom levels were presented in counterbalanced order, such that half of the children heard about the top level first and the bottom level last, and the other half heard about the bottom level first and the top level last.

To verify children's understanding, the experimenter then asked children to point to each level separately (e.g., *"can you point to the job where people follow orders from everyone else*?"), followed by a confirmation or correction of their answer (e.g., *"That's right [actually], this is the job where people follow orders from everyone else"*). Children correctly pointed to the top, bottom, and middle levels 75%, 86%, and 95% of the time, respectively.

Afterwards, the experimenter asked children a set of questions about: (1) their understanding of social stratification, namely – the degree to which they associate various domains (competition/prestige, wealth, wellbeing, competence, warmth, and effort) with the different levels of the hierarchy, and (2) their future position on the hierarchy and the future position of a gender-matched child. Children had the option to choose as many levels on the hierarchy as they wanted to answer each question.

Understanding of social stratification. The first set of questions (Table 1A) concerned children's understanding of the distribution of competition/prestige, wealth, and wellbeing across the different levels of the hierarchy; the second set of questions

(Table 1B) concerned children's attribution of the traits competence, warmth, and effort to different levels of the hierarchy. All questions within each set were randomized.

Future position on the hierarchy. Children were next asked to think about scenarios in which they themselves and another gender-matched child named Kito (depicted by a silhouette; Figure 2) work at Zam as grown-ups (Table 1C), and to point to: (a) the position on the hierarchy they *think* they would have at Zam as grownups, (b) the position they would *want* to have at Zam as grownups, (c) the position they *think* Kito would have, and (d) the position Kito would *want* to have.

Questions (a) to (d) were asked in one of four possible orders: acbd, bdac, cadb, dbca. Following each one of these four questions, children were asked to explain their response (e.g., *"why would you want to have that job?"*; *"why do you think Kito would have that job?"*).

Figure 2. Silhouette of unfamiliar, gender-matched child shown to girls (left) and boys (right)

Coding of open-ended responses. The first author coded children's open-ended responses to questions (a) through (d) with an undergraduate research assistant.

Table 1.

Experimental questions

	Topic	Dimension	Question
A	Distribution of prestige, wealth, and wellbeing	Competition/prestige	Can you point to…. • The job that is hardest to get • The jobs that is easiest to get
		Wealth	• The job where people get the biggest amount of money • The job where people get the smallest amount of money
		Wellbeing	• The job where people are happiest • The job where people are saddest
B	Attribution of traits	Competence	The job where people are smartest
		Warmth	The job where people are nicest
		Effort	The job where people are the most hardworking
C	Future position	(a) Self: prediction	Imagine that one day, when you are all grown up, you work at Zam. Which kind of job do you think you would have at Zam as a grown up?
		(b) Self: desire	Imagine that one day, when you are all grown up, you get to choose any job you want at Zam. If you could have any job you wanted, which kind of job would you want to have?
		(c) Other: prediction	Imagine that one day, when Kito is all grown up, s/he works at Zam. Which kind of job do you think Kito would have at Zam as a grown up?
		(d) Other: desire	Imagine that one day, when Kito is all grown up, s/he gets to choose any job s/he wants at Zam. If Kito could have any job s/he wanted, which kind of job would Kito want to have?

The coding categories were agency and communion, and could range between -1 (negative mention), 0 (no mention or neutral mention), or 1 (positive mention; see Table 2).

First, the research assistant and the first author discussed the coding categories and their definitions, and then trained to criterion by jointly coding 10% of the responses. Afterwards, they separately coded an additional 20% of the responses, on which inter-judge reliability was established using Cohen's kappa (Table 2). Disagreements were resolved via discussion. Once inter-judge reliability was reached, the first author coded the remaining responses.

Table 2.
Definitions, examples, and kappas for open-ended coding categories

Coding category	**Definition**	**Negative mention [-1]**	**Neutral mention [0]**	**Positive mention [1]**	**Kappa**
Agency	Focus on the self; striving for mastery, dominance, and self-expansion†	"I'm fine with being bossed around"	"because I'll tell people what to do but people will also tell me what to do"	"Because he's top class, boss of everybody and gets to do what he wants"	.87
Communion	Focus on others; striving for cooperation and positive social interactions†	"she'd get to be in charge of other people which isn't very nice"	"because he's not super nice but he's also not mean"	"because I like taking care of people and I'm a really good babysitter for people that need to be watched"	.90

† Bakan, 1966

Results

Below, we report results in the order in which questions were asked.

Understanding of social hierarchy: overall trends

Throughout the experiment, children's (closed-ended) responses involved choosing one (or more) of the five levels of the hierarchy. We therefore coded children's responses on a scale from 1 to 5, where 1 represents the bottom level of the hierarchy and 5 represents the top level of the hierarchy. If children chose multiple levels (which occurred in 12% of the cases), we averaged their responses. For example, a child who chose the highest level of the hierarchy (= 5) along with the second-highest level of the hierarchy (= 4) received the average score of 4.5.

Furthermore, since the first three questions in the experiment contained two complementary and highly-correlated sub-questions (hardest to get & easiest to get: $r = -.78$, $p < .001$; biggest amount of money & smallest amount of money: $r = -.78$, $p < .001$; happiest & saddest: $r = -.57$, $p < .001$), we merged each set of sub-questions for parsimony. This resulted in three dimensions: competition/prestige, wealth, and wellbeing.

To examine whether children associated the different dimensions with certain levels of the hierarchy more than others, we calculated the average score of each dimension and compared it to a score of 3 (representing the expected average if children were choosing between the levels at chance). Children's responses significantly differed from chance across dimensions (Table 3). Specifically, children attributed competition/prestige, wellbeing, wealth, and competence to higher levels of

the hierarchy; in contrast, they attributed warmth and effort to lower levels of the hierarchy.

Table 3.

Descriptive statistics of hierarchy dimensions and one-sample t-test against chance

Hierarchy Dimension	*M*	*SD*	One-sample t-test against chance (=3)			
			df	Mean difference	CI	*p*
Competition/prestige	4.06	1.43	143	1.06***	.83 – 1.30	<.001
Wellbeing	4.06	1.19	143	1.06***	.86 – 1.25	<.001
Competence	3.91	1.35	142	.91***	.69 – 1.14	<.001
Wealth	3.84	1.54	143	.84***	.59 – 1.10	<.001
Effort	2.63	1.64	143	-.37**	-.64 – -.10	.008
Warmth	2.46	1.50	143	-.54***	-.79 – -.29	<.001

Note. ** $p < .01$; *** $p < .001$. All dimensions ranged from 1 to 5, where 1 = lowest level of the hierarchy and 5 = highest level of the hierarchy

We were also interested in whether the different hierarchy dimensions were related to one another. Pearson correlation tests (Table 4) showed that competition/prestige, wealth, wellbeing, and competence were all significantly and positively related to one another. Warmth, however, was marginally negatively related to competition/prestige and competence, and significantly negatively related to wellbeing.

Table 4.

Correlations among hierarchy dimensions

	1	2	3	4	5	6
1. Competition/prestige	-					
2. Wealth	.37***	-				
3. Wellbeing	.27**	.31**	-			
4. Competence	.24**	.34**	.23**	-		
5. Warmth	-.15	-.05	-.20*	-.16	-	
6. Effort	-.04	.10	-.03	-.05	-.02	-

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

Understanding of social hierarchy: the role of age and numerical structure

To examine the role of age and numerical structure in children's reasoning about social hierarchy, I constructed linear regression models predicting children's responses to each dimension tested. The models were computed with the *lm* function in *R* and follow-up comparisons were computed with the *emmeans* (Lenth, 2019) and *sim_slopes* (Long, 2019) functions. All models included age (in years, continuous), numerical structure (Equal Numbers vs. Pyramid), and these factors' interaction as independent variable, and gender (girl vs. boy) as a control variable.

First, as hypothesized, there was a significant main effect of age on competition/prestige (β = .90, 95% CI [.62, 1.18], $p < .001$), wealth (β = .80, 95% CI[.47, 1.12], $p = .002$), wellbeing (β = .53, 95% CI[.27, .80], $p = .009$), and competence (β = .35, 95% CI[.03, .66], $p = .032$), such that children were more likely to link these dimensions to top levels of the hierarchy with age. In addition, there was a marginally significant main effect of gender on wealth (β = -.28, 95% CI[-.59, .03],

p = .080), such that boys, across ages, were more likely than girls to link wealth to higher levels of the hierarchy.

Second, there was an age by numerical structure interaction for competition/prestige (β = -.44, 95% CI[-.84, -.04], p = .030). To further probe this interaction, I compared the average responses of younger (5-7-year-old) versus older (8-10-year-old) children (Table 5). As shown in Figure 3A, younger, but not older children (t(71) = 2.18, p = .03 , and t(71) = -.67, p = .50, respectively) were less likely to link competition/prestige to top levels of the hierarchy in the Pyramid condition as compared to the Equal Numbers condition. Similarly, there were marginally significant age by numerical structure interactions for the wealth and wellbeing dimensions (Table 5), indicating that younger (t(71) = 3.05, p < .001, t(71) = 1.78, p = .08, for wealth and wellbeing, respectively), but not older (t(71) = .44, p = .66; and t(71) = -.78, p = .44) children were less likely to link wealth and wellbeing to top levels of the hierarchy in the Pyramid versus the Equal Numbers condition (Figure 3B-C).

Table 5.

Hierarchy dimensions by age, numerical structure, and gender

Variables	Competition/prestige			Wealth			Wellbeing		
	β	CI	*p*	β	CI	*p*	β	CI	*p*
Age	.90***	.62 – 1.18	<.001	1.38***	.72 – 2.04	<.001	1.01***	.48 – 1.54	<.001
Numerical structure	.28	-.11 – .68	.159	1.02**	.36 – 1.68	.003	.48	-.05 – 1.01	.077
Gender	.20	-.19 – .60	.310	-.49*	-.95 – -.02	.042	.05	-.32 – .43	.784
Age X numerical structure	-.44*	-.84 – -.04	.030	-.87	-1.81 – .06	.066	-.69	-1.44 – .06	.072

Note. * p < .05; ** p < .01; *** p < .001

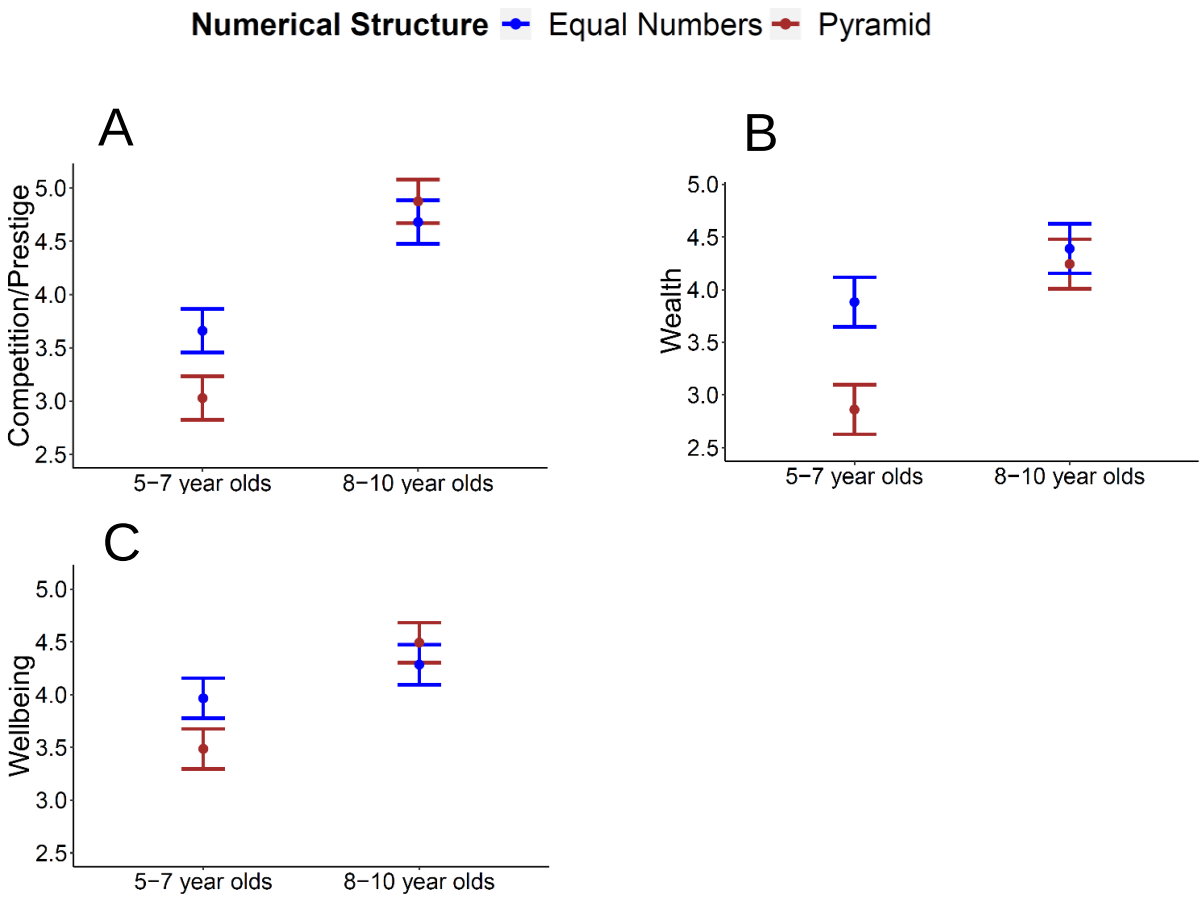

Figure 3. The relation between age and linking competition/prestige (A), wealth (B), and wellbeing (C) to top levels of the hierarchy. Error bars represent ± 1 *SE*.

Future desires and predictions by age, gender, and numerical structure

Desires vs. predictions

To compare children's future desires with their future predictions, I constructed mixed-effects multilevel models with the *lmer* function in R and used the *emmeans* (Lenth, 2019) and *sim_slopes* (Long, 2019) functions for follow-up comparisons. The models included age (in years, continuous), gender (girl vs. boy), future thinking (desire vs. prediction), numerical structure (Pyramid vs. Equal Numbers) and all possible interactions as independent variables. The models also

included a random intercept for participant. As hypothesized, across gender and age, the position on the hierarchy that children expected to have (*M* = 3.13, *SD* = 1.47) was significantly lower than the position they desired to have (*M* = 3.85, *SD* = 1.40 ; β = -.91, 95% CI[-1.31, -.51], *p* < .001). However, in contrast to our hypothesis, this effect did not vary by age (β = -.11, 95%. *p* = .237; Figure 4). Similarly, the position on the hierarchy that children expected a gender-matched child would have (*M* = 3.23, *SD* =1.49) was significantly lower than the position they thought she or he desired (*M* = 3.98, *SD* = 1.38; β = -1.01, 95% CI[-1.48, -.54], *p* < .008). This effect was qualified by age, such that older (versus younger) children were more likely to distinguish between the other child's expected and desired position (β = -.72, 95% CI[-1.18, -.25], *p* < .001; Figure 4).

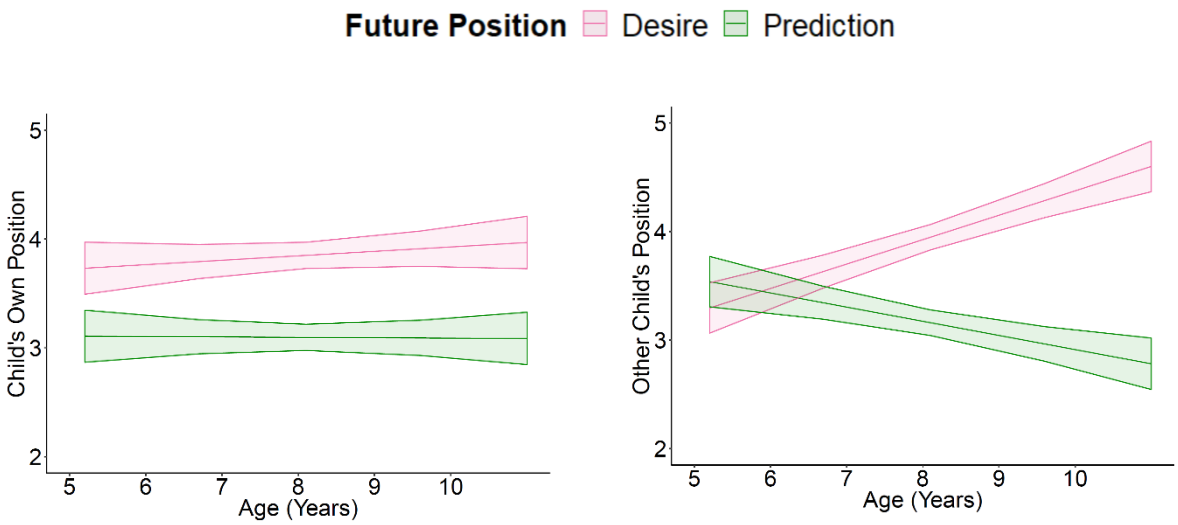

Figure 4. The relation between age and children's thinking about their own (left) and a gender-matched child (right) future position on the hierarchy. Error bars represent ± 1 *SE*.

Gender differences in children's thinking about their future positions

Next, I conducted linear regression analyses predicting children's future thinking by age, gender, numerical structure, and all their interactions. In contrast to our hypothesis, there was no main effect of gender on children's own, or a gender-matched child's desired and expected positions (all *p*'s > .05). However, a significant age by gender by numerical structure interaction emerged for children's own desired position (β = 1.15, 95% CI[.21, 2.09], $p = .017$; Figure 5), indicating that with age, girls were marginally more likely to want to be at the top in the Equal Numbers condition $t(71) = 1.81$, $p = .07$, but not in the Pyramid condition $t(71) = -.75$, $p = .45$. In contrast, with age, boys were more likely to want to be at the top in the Pyramid condition, but not in the Equal Numbers condition; however, this did not reach statistical significance: $t(71) = 1.27$, $p = .21$, and $t(71) = 1.04$, $p = .30$, respectively.

An age by gender by numerical structure interaction effect also emerged for children's expectation of the other child's future position (β = 1.49, 95% CI[.54, 2.44], $p = .002$; Figure 5). Specifically, with age, girls were marginally less likely to think another girl would be at the top in the Pyramid condition $t(71) = -1.73$, $p = .09$. In contrast, with age, boys were significantly less likely to think another boy would be at the top in the Equal Numbers condition $t(71) = -3.07$, $p < .01$.

To further probe the interactive patterns above, I examined the extent to which girls and boys mentioned agency and communion themes in their open-ended explanations of their desired position and another child's expected position. A gender by numerical structure interaction effect emerged for children's desired position, indicating that girls were more likely than boys to describe their desired position as

communal, but only in the Equal Numbers condition (β = .23, 95% CI[.01, .45], *p* = .042).

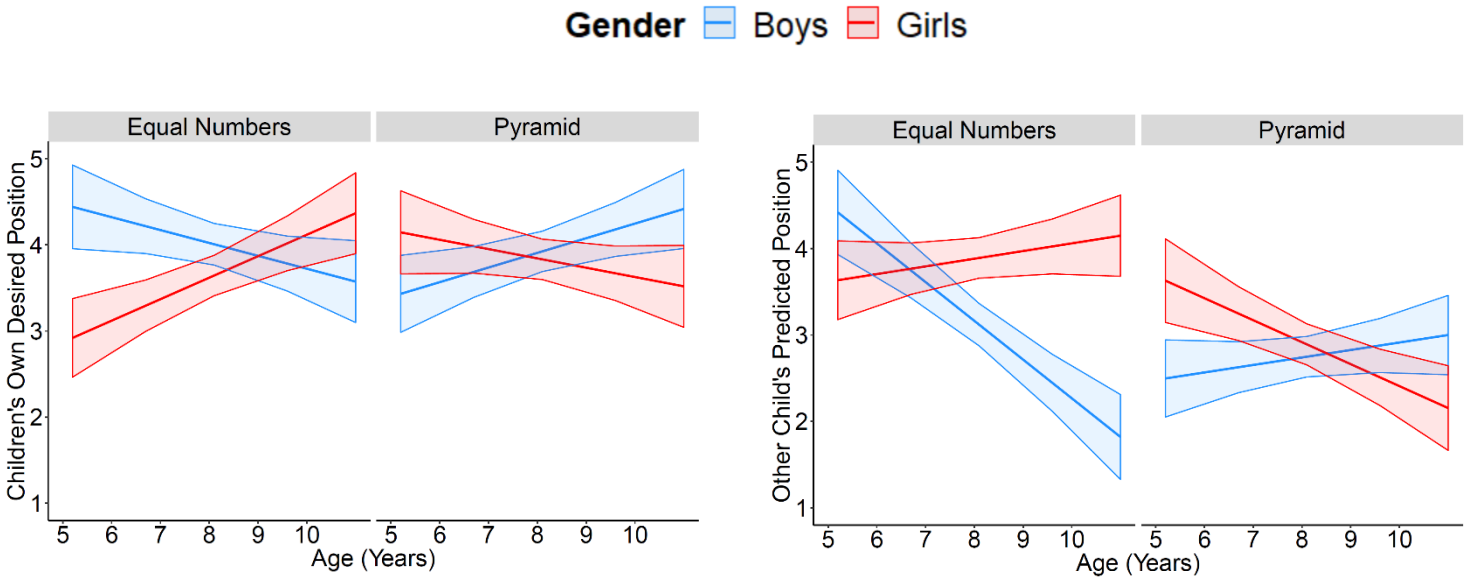

Figure 5. The relation between age and children's desired position (left) and another child's predicted position (right) on the hierarchy by gender and numerical structure. Error bars represent ± 1 *SE*.

Discussion

Social hierarchies are ubiquitous in human societies. Previous studies have shown that young children have a basic understanding of hierarchies, as demonstrated by their ability to detect dominance within dyadic, zero-sum relationships (e.g., Gülgöz & Gelman, 2017; Pun et al., 2016; Thomsen et al., 2011). However, human hierarchies are far more complex and multifaceted. For example, they often involve more than two individuals, and they take a stratified, pyramid-shaped structure. This structure entails that (1) people are grouped into different strata, and the relative position of a person on the hierarchy determines various life outcomes (e.g., prestige, wealth, wellbeing), and (2) the numerically smaller group at the top holds power over the numerically larger group at the bottom. The present study contributes to our current knowledge by examining children's understanding of hierarchies on their various complexities, above and beyond detection of dominate-subordinate relationships.

Our results showed that, as hypothesized, children were more likely with age to link competition/prestige, wealth, wellbeing, and competence to top levels of the hierarchy. Furthermore, older (8- to 10-year-old) children were more likely than younger (5- to 7-year-old) children to link these dimensions to numerically smaller (versus larger) groups, as manifested by equivalent performance on the Pyramid and Equal Numbers hierarchy conditions.

In contrast to the social reality of other species – the highest status in human hierarchies (at least in Western cultures) is typically held by a numerically small, elite group. Yet, due to our evolutionary tendency to conflate status with physical

dominance (and therefore with numerically large groups), the "elite = small group" association needs to be acquired with continuous social exposure (Cao & Banaji, 2017; Heck et al., under review). Our results align with theorists' suggestions that the "elite = small group" association is acquired rather than innate, by demonstrating that only around the age of 8 years do children begin to represent hierarchies as pyramid-shaped.

In addition to examining children's developing understanding of social hierarchies, this study probed how such understanding may inform their desires and expectations for the future. As hypothesized, children's expected positions on the hierarchy were significantly lower than their desired positions, replicating the results previously obtained by Schmitt-Wilson & Welsh (2012) with a sample of older children. Surprisingly, however, this pattern did not vary with age, such that 5-year-olds were as likely as 10-year-olds to distinguish between the position they wanted and the position they were likely to have on the hierarchy, and to reason that the former is more highly ranked than the latter. The finding that even the youngest children in our sample were able to distinguish between their "desired self" and "expected self" (Markus & Nurius, 1986) resonates with current literature demonstrating that from a very young age, children have an abstract representation of the self that is flexible, realistic, and context-sensitive (Cimpian, 2017; Cimpian, Hammond, Mazza, & Corry, 2017). Furthermore, the stark contrast between children's future desires and expectations across ages indicates the importance of examining both aspects of future thinking. Existing studies on children's future thinking focus almost exclusively on their aspirations, disregarding the fact that aspirations and expectations

may not coincide (Markus & Nurius, 1986), and that – at least in adults – may differentially predict future outcomes (Oettingen & Mayer, 2002).

Whereas no age differences emerged in this study regarding children's distinction between their own desires and expectations, age differences did emergence regarding children's distinction between the desires and expectations of *another child*. That is, older children were more likely than younger ones to reason that another child's desired position on the hierarchy may be higher than the position they would actually have. Although this necessitates further investigation, such age differences may be the result of older children's further developed theory of mind (i.e., the ability to attribute mental states, such as beliefs and desires, to others, Wellman, Cross, & Watson, 2001). Thus, younger children may have found it more difficult to reason about another child's desires and instead responded according to their own evaluation of the child's future position.

Last, in contrast to our hypothesis, girls were not, overall, less likely than boys to envision themselves (or another girl) in top positions of the hierarchy. Rather, gender differences manifested as a function of age and numerical structure. With age, girls were more likely to envision themselves at the top in the Equal Numbers (but not in the Pyramid) hierarchy, and girls were less likely to envision another girl at the top in the Pyramid (but not the Equal Numbers) hierarchy. The opposite patterns emerged for boys. Girls' open-ended explanations, in which they tended to depict their future position on the hierarchy as more communal than boys did – but only in the Equal Numbers condition – may indicate that they perceived the Equal Numbers (but not the Pyramid) hierarchy as coinciding with their values and therefore were more interested

in occupying top positions in that hierarchy. These findings align with recent studies with adults, which suggest that women and men tend to have different motives when it comes to social rank. Specifically, both women and men are interested in high social rank, but often for different reasons. Women tend to seek high social rank for reasons of status (e.g., being respected and loved), whereas men seek high social rank for reasons of power (e.g., having control over resources; Hays, 2013). Thus, women's focus on status promotes interdependence, whereas men's focus on power promotes independence (Hays, 2013). If girls and boys are adopting these differential strategies and preferences for social rank with age, it would make sense for girls to gradually favor top positions only in contexts where they believe status (but not power) would be made possible. The Equal Numbers hierarchy may represent such a context, as the top levels contain a relatively large group of people that can potentially work together, sharing the power and resources. As opposed to girls – boys, who may, with age, adopt more power motives – may favor top positions in the Pyramid hierarchy, where more independence is offered and resources are concentrated in the hands of relatively few.

Conclusion

The present study demonstrates that the developmental period of 5 to 10 years of age is marked by significant changes to children's reasoning about complex, multidimensional aspects of group-level social hierarchies, such as stratification and the relation between status and a group's numerical size**.** Furthermore, this study shows that children as young as 5 years of age distinguish between their desired future position on the hierarchy and the position they are likely to achieve, highlighting the

need to investigate both aspirations and expectations as distinct components of children's future thinking. Last, this study demonstrates that young girls and boys are equally likely to envision themselves in positions of high social rank, but seemingly in different contexts and as a result of distinct motives.

References

Atance, C. M. (2015). Young children's thinking about the future. *Child Development Perspectives, 9*(3), 178-182. doi: 10.1111/cdep.12128

Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C. (2001). Self-efficacy beliefs as shapers of children's aspirations and career trajectories. *Child Development, 72*(1), 187-206. doi: 10.1111/1467-8624.00273

Bian, L., & Cimpian, A. (2019, March). *Early exposure to gender inequality shapes children's beliefs about gender and job status*. Paper presented at the Biennial Meeting of the Society for Research in Child Development, Baltimore, MD.

Brey, E., & Shutts, K. (2015). Children use nonverbal cues to make inferences about social power. *Child Development, 86*(1), 276-286. doi: 10.1111/cdev.12334

Cao, J., & Banaji, M. R. (2017). Social inferences from group size. *Journal of Experimental Social Psychology, 70*, 204-211. doi: 10.1016/j.jesp.2016.11.005

Charafeddine, R., Mercier, H., Clément, F., Kaufmann, L., Berchtold, A., Reboul, A., & Van der Henst, J. B. (2015). How preschoolers use cues of dominance to make sense of their social environment. *Journal of Cognition and Development, 16*(4), 587-607. doi: 10.1080/15248372.2014.926269

Cimpian, A. (2017). Early reasoning about competence is not irrationally optimistic, nor does it stem from inadequate cognitive representations. In A. J. Elliot, C. S. Dweck, & D. S. Yeager (Eds.), Handbook of Competence and Motivation (2nd Edition): Theory and Application (pp. 387–407). New York: Guilford Press.

Cimpian, A., Hammond, M. D., Mazza, G., & Corry, G. (2017). Young children's

self-concepts include representations of abstract traits and the global self. *Child Development, 88*(6), 1786-1798. doi: 10.1111/cdev.12925

Cogsdill, E. J., Todorov, A. T., Spelke, E. S., & Banaji, M. R. (2014). Inferring character from faces: A developmental study. *Psychological Science, 25*(5), 1 132-1139. doi: 10.1177/0956797614523297

Cummins, D. D. (2005). Dominance, status, and social hierarchies. In D. Buss (Ed.), *The handbook of evolutionary psychology* (pp. 676-697). New York: John Wiley

Ferrari, L., Ginevra, M. C., Santilli, S., Nota, L., Sgaramella, T. M., & Soresi, S. (2015). Career exploration and occupational knowledge in Italian children. *International Journal for Educational and Vocational Guidance, 15*(2), 113-130. doi: 10.1007/s10775-015-9299-1

Fiske, S. T., Cuddy, A. J., Glick, P., & Xu, J. (2002). A model of (often mixed) stereotype content: Competence and warmth respectively follow from perceived status and competition. *Journal of Personality and Social Psychology, 82*(6), 878-902. doi: 10.1037/0022-3514.82.6.878

Fiske, S. T., Dupree, C. H., Nicolas, G., & Swencionis, J. K. (2016). Status, power, and intergroup relations: The personal is the societal. *Current Opinion in Psychology, 11*, 44-48. doi: 10.1016/j.copsyc.2016.05.012

Gazes, R. P., Hampton, R. R., & Lourenco, S. F. (2017). Transitive inference of social dominance by human infants. *Developmental Science, 20*(2), e12367. doi: 10.1111/desc.12367

Gülgöz, S., & Gelman, S. A. (2017). Who's the boss? Concepts of social power across

development. *Child Development*, *88*(3), 946-963. doi: 10.1111/cdev.12643

Hartung, P. J., Porfeli, E. J., & Vondracek, F. W. (2005). Child vocational development: A review and reconsideration. *Journal of Vocational Behavior*, *66*(3), 385-419. doi: 10.1016/j.jvb.2004.05.006

Hays, N. A. (2013). Fear and loving in social hierarchy: Sex differences in preferences for power versus status. *Journal of Experimental Social Psychology*, *49*(6), 1130-1136. doi: 10.1016/j.jesp.2013.08.007

Heck, I., Bas, J., & Kinzler, K. (under review). Small groups lead, big groups control: Relative group size and linguistic framing shift children's perceptions of group social status.

Lenth, R. (2019). Emmeans: Estimated marginal means, aka least-aquares means. R package version 1.3.3. https://cran.r-project.org/package=emmeans

Liben, L. S., Bigler, R. S., & Krogh, H. R. (2001). Pink and blue collar jobs: Children's judgments of job status and job aspirations in relation to sex of worker. *Journal of Experimental Child Psychology*, *79*(4), 346-363. doi: 10.1006/jecp.2000.2611

Long J. A. (2019). Interactions: comprehensive, user-friendly toolkit for probing interactions. R package version 1.0.0. https://cran.r-project.org/package=interactions

Magee, J. C., & Galinsky, A. D. (2008). Social hierarchy: The self-reinforcing nature of power and status. *Academy of Management Annals*, *2*(1), 351-398. doi: 10.1080/19416520802211628

Mandalaywala, T. M., Tai, C., & Rhodes, M. (under review). Children's use of gender

and race as cues to social status. http://psyarxiv.com/3rnej/

Maner, J. K., & Case, C. R. (2016). Dominance and prestige: Dual strategies for navigating social hierarchies. In J. M. Olson & M. P. Zanna (eds.), *Advances in experimental social psychology* (Vol. 54, pp. 129–180). San Diego, CA: Academic Press

Markus, H., & Nurius, P. (1986). Possible selves. *American Psychologist*, *41*(9), 954-969.

Mascaro, O., & Csibra, G. (2012). Representation of stable social dominance relations by human infants. *Proceedings of the National Academy of Sciences*, *109*(18), 6862-6867. doi: 10.1073/pnas.1113194109

McComb, K., Packer, C., & Pusey, A. (1994). Roaring and numerical assessment in contests between groups of female lions, Panthera leo. *Animal Behaviour*, *47*(2), 379-387. doi: 10.1006/anbe

Oettingen, G., & Mayer, D. (2002). The motivating function of thinking about the future: Expectations versus fantasies. *Journal of Personality and Social Psychology*, *83*(5), 1198-1212. doi: 10.1037//0022-3514.83.5.1198

Pun, A., Birch, S. A., & Baron, A. S. (2016). Infants use relative numerical group size to infer social dominance. *Proceedings of the National Academy of Sciences*, *113*(9), 2376-2381. doi: 10.1073/pnas.1514879113

Schmitt-Wilson, S., & Welsh, M. C. (2012). Vocational knowledge in rural children: A study of individual differences and predictors of occupational aspirations and expectations. *Learning and Individual Differences*, *22*(6), 862-867. doi: 10.1016/j.lindif.2012.06.003

Sidanius, J., & Pratto, F. (1999). *Social dominance: An intergroup theory of social hierarchy and oppression*. New York: Cambridge University Press.

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

Watson, M., & McMahon, M. (2005). Children's career development: A research review from a learning perspective. *Journal of Vocational Behavior*, *67*(2), 119-132. doi: 10.1016/j.jvb.2004.08.011

Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development*, *72*(3), 655-684. doi: 10.1111/1467-8624.00304

Wilson, M. L., Hauser, M. D., & Wrangham, R. W. (2001). Does participation in intergroup conflict depend on numerical assessment, range location, or rank for wild chimpanzees?. *Animal Behaviour*, *61*(6), 1203-1216. doi: 10.1006/anbe.2000.1706

Zitek, E. M., & Tiedens, L. Z. (2012). The fluency of social hierarchy: the ease with which hierarchical relationships are seen, remembered, learned, and liked. *Journal of Personality and Social Psychology*, *102*(1), 98-115. doi: 10.1037/a0025345