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**Does racial diversity affect White children's racial bias and reasoning? Depends on where they live and how their social world is structured**

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**Author Note**

We have no known conflict of interest to disclose. The data that support the findings of this study are available on OSF: [https://osf.io/3dzw5/?view\\_only=6c265388a0164d9eaa4fdee63b72c6e0](https://osf.io/3dzw5/?view_only=6c265388a0164d9eaa4fdee63b72c6e0). Correspondence concerning this article should be addressed to Dr. Nicole Burke, New York University, 6 Washington Place, New York, NY 10003. Email: [nburke@nyu.edu](mailto:nburke@nyu.edu).

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### Abstract

By 4-years of age, White children from across the United States begin to exhibit an awareness of racial inequalities, along with ingroup preferences for other White children. The present study explored how the size and racial diversity of White children's social network (e.g., friends, family, classmates) and neighborhood (zip code) are related to variation in their explanations for racial disparities and anti-Black bias among a sample of 395 White children (aged 4-11 years old; *Mage* = 6.6 years) from 263 unique zip codes across the United States. White children in *neighborhoods* with low diversity were more likely to endorse an extrinsic explanation for racial inequality as their *network* diversity increased, whereas network diversity did not relate to children's choices for those that lived in neighborhoods with high diversity. These findings held even after controlling for parents' beliefs about diversity, which were themselves positively correlated with children's network and neighborhood diversity. An exploratory analysis revealed that for White children in small networks only, as the number of children of color in their network increased, they were more likely to choose to play with a Black child. Results demonstrate how the diversity of children's social networks and neighborhoods relate to children's developing racial beliefs in contextually-dependent ways.

*Keywords:* racial bias, social network analysis, interracial friendship, racial diversity, explanations for racial inequality

**Public Significance Statement.** This study suggests that the interaction between demographics of White children's micro and macro level environments relate to their explanations for racial disparities, even after for controlling for parents' own beliefs about diversity. This study highlights the importance of using a multi-level approach in exploring how early environments may shape cognition.

### **Introduction**

Racial bias emerges during early childhood, especially in children who are members of majority, high-status racial groups (Aboud & Amato, 2001; Cristol & Gimbert, 2008; Hailey & Olson, 2013; Raabe & Beelmann, 2011; Rizzo et al., 2022; Rizzo et al., 2021). In the United States, for example, White children develop racial biases by as young as 4-years-old (Dunham et al., 2008; Newheiser et al., 2014; Rizzo et al., 2022). Whereas the emergence of racial bias in preschool-aged children is well-documented, less is known about how children's social environment might contribute to this emergence. Understanding how White children's environments relate to their beliefs about race and racial biases is important because it provides theoretical insight into how bias develops in the first place and because moderating children's social environment is one way that parents, educators, and caregivers might be able to intervene to promote healthier, anti-racist attitudes in White children and in turn help reduce the perpetuation of prejudice and discrimination that children of color experience throughout development (Seaton & Douglass, 2014; Sellers et al., 2006; Umaña-Taylor, 2016).

The social world in which children are embedded - their immediate social relationships as well as the demographics of their broader community - likely provides important information to children about interracial relationships. Children in environments with more racial and ethnic diversity are better at racial encoding (Weisman et al., 2015), essentialize race less (Mandalaywala et al., 2019), essentialize ethnic identity less (Deeb et al., 2011), are more open to racial outgroup members (Hwang et al., 2020), and exhibit less racial bias toward out-group members (Rutland et al., 2005). A variety of methods have been used to assess racial diversity in prior work, however, including in-lab questionnaires asking about racial out-group exposure (Weisman et al., 2015), demographics of the schools children attended (Deeb et al., 2011), and

demographics of the neighborhoods children live in (Hwang et al., 2020; Mandalaywala et al., 2019), making it difficult to determine what kinds of experience contribute to the development of different facets of children's beliefs and biases. For example, does neighborhood diversity shape White children's attitudes and bias independent of their immediate contact with people of color? If a White child lives in a racially diverse neighborhood, but does not interact with any people of color on a regular basis, what kinds of inferences might that child draw?

Direct, positive contact with people of color is related to more positive interracial attitudes among White American adults, as predicted by Intergroup Contact Theory (e.g., Pettigrew, 1998). Yet, when asked about demographic changes in their neighborhoods, White adults in the United States who thought that their neighborhood was becoming more racially diverse were less supportive of racial integration and held more negative attitudes towards people of color because they perceived the increased neighborhood diversity as a threat (Craig et al., 2018). Thus, experiences with interracial contact can yield meaningfully different results depending on the type of contact, with personal contact leading to more positive attitudes and more distal contact, such as the people children see at the park or in the grocery store, potentially leading to more negative attitudes in some contexts. These findings illustrate the multiple ways in which different aspects of experiences with diversity can shape inter-group biases and why it might be problematic to use only neighborhood demographic information as a proxy for children's experience with people from different racial backgrounds. Thus, there is a clear need for further research on how (and what kinds of) early social experience relate to children's emerging beliefs and biases related to race.

Social networks provide a novel, innovative method to assess the diversity of children's close, personal relationships. A social network is a set of people and the connections between

them (Wasserman & Faust, 1994). Social networks can be used to define the set of people that a person interacts with on a regular basis – these people are an individual’s close, personal relationships. The racial diversity of the network can be assessed by categorizing the representation of different races in the network. Among adults and adolescents, the composition of these networks appear to shape identity; for instance, White American adults in large social networks described their ethnic identity as less important to them than those in smaller social networks, and Black/White biracial adults identified more strongly with being Black when Black people were more represented in their social network (Rockquemore & Brunsma, 2002). Social network analysis has also been used to explore how the racial composition of a school or community impacts racial segregation and integration, for instance, to document that college students tend to have more same-race friends than different-race friends (Wejnert, 2010) and to examine how neighborhood racial segregation is related to segregated friendship choices in middle and high school students (Mouw & Entwisle, 2006).

Social network analysis therefore provides a promising approach for quantifying the diversity of young children’s early experiences and testing how features of their social networks relate to variation in the emergence of racial bias. The present study will build upon prior work by assessing children’s social networks along with their neighborhood demographics to explore how both the racial diversity of children’s immediate social partners and the broader community they live in relate to their developing beliefs and biases.

Children’s social networks and the demographics of the broader community they live in both provide information to children about how the social world is structured and how it functions (e.g., Bronfenbrenner, 1977, 1979). Network and neighborhood demographics are not always correlated. For example, among children aged 6-months to 5-years-old, network and

neighborhood racial and linguistic diversity were correlated for children in urban samples but not for children in suburban and rural communities (Burke et al., 2022). Most prior studies, however, have examined the impacts of children's neighborhood and network diversity separately. For example, studies have examined the demographics of children's neighborhoods using census data (Howard et al., 2014; Hwang et al., 2020; Mandalaywala et al., 2019), children's schools using school-reported demographics (Deeb et al., 2011; Rutland et al., 2005), and both children's childcare setting and neighborhood through parent report (Weisman et al., 2015). Yet, no study to our knowledge has simultaneously examined the demographics of children's environments on both macro (e.g., neighborhood) and micro (e.g., friends, family, caregivers) levels. Thus, from prior work, it is not possible to determine the extent to which the diversity of children's social network and of their broader community relates to their developing beliefs and biases (either separately or in interaction with one another).

By assessing network and neighborhood data within the same study, we can explore how children's immediate contact (networks) relate to biases and beliefs, what information children glean from the broader society and culture in which they live (neighborhoods), and whether there is an interaction between the two. For example, consider two White children who both have all-White social networks, but one lives in a neighborhood that also contains mostly White people, whereas the other lives in a neighborhood with more people of color. On the one hand, if lack of exposure (at all) leads to more biased beliefs, then the first child (who does not experience racial diversity in either their network or neighborhood) might be expected to exhibit more biased beliefs than the child who at least experiences some diversity in their neighborhood. On the other hand, the second child, who sees diversity in their neighborhood but not in their own social network, is exposed to information that could lead to a problematic inference—that even though

there are people from diverse backgrounds in their neighborhood, it is somehow not typical or valued to include people from diverse backgrounds in their immediate social circle (Eason et al., 2019). By testing the separate and interactive effects of children's network and neighborhood diversity on children's developing race-related beliefs and biases, we can begin to distinguish these theoretical possibilities.

This study will begin to address different theoretical predictions regarding the relation of experiences of diversity to racial bias. In particular, Intergroup Contact Theory predicts that positive contact with racial outgroup members relates to better inter-group attitudes amongst White Americans (Barlow, Hornsey, Thai, Sengupta, & Sibley, 2013; Pettigrew & Tropp, 2006), but at the same time, White Americans who believe there is an increase in minority populations (and thus perceive more opportunities for interaction with people from diverse backgrounds in their communities) report less support for integration and more negative inter-group attitudes, suggesting that sometimes experiences with diversity are perceived as threatening (Craig et al., 2018). Although on the surface these accounts seem to make conflicting predictions about how experience of diversity relates to racial bias, our approach of implementing both network and neighborhood measures will allow us to address the methodological concern that prior work has conflated "experience" at both the micro (network) and macro (neighborhood) level. Experience with diversity at these different levels of the social environment make different, or more likely, interacting predictions about how network and neighborhood features relate to bias. Our findings could speak to whether the relation between social network diversity and children's racial bias varies across different community settings; for example, it is possible that a child with a homogenous network in a neighborhood with high diversity would show more bias than a child with a similarly diverse network in a neighborhood with low diversity. Thus, these results will

help address theoretical questions about the extent to which macro (e.g., neighborhood demographics) and micro (e.g., social network) social environments interact to shape the development of racial bias across childhood.

Network data also allows us to further explore how diversity is experienced in different contexts by including network size in our analysis. Similar to how network diversity might have a different effect depending on the demographics of the neighborhood, the same might also be true for network size. The nature of the large network means that not all relationships are necessarily high intensity or high-quality relationships. As infants' and children's networks get larger, the proportion of high intensity relationships decreases (Burke et al., 2022). While a child might have many interracial interactions, they might not all be high quality. Conversely, a child in a small network will likely have high quality relationships with a higher proportion of their network, which might be more important for disrupting the development of racial bias. Exploring how network size interacts with network racial diversity is a way to start to tease apart these possibilities.

Network research relies on correlational data, making it impossible to draw conclusions about the directionality of any given effect. For example, if having more diverse social networks relates to less racial bias, it could be the case that experiences with people from diverse backgrounds mitigate the development of racial bias *or* that people with less bias select to have more diverse networks. An additional consideration when examining these relations early in development is that young children do not have complete autonomy over who is in their network; children's early networks largely reflect parent childcare decisions (Burke et al., 2022). This raises the question of whether and how parents' beliefs and values influence the characteristics and composition of children's networks, which then in turn relate to children's



attitudes and biases. To consider these issues, in a set of exploratory analyses, the present study examines how parents' beliefs about diversity relate to the diversity of children's early social environments, and whether those relate to child outcomes.

### **The Present Study**

The present study asked how White children's network and neighborhood racial diversity, along with their network size, related to their anti-Black bias and their explanations for racial inequality. We focused on White children because racial bias emerges early for White American children (Dunham et al., 2008; Newheiser & Olson, 2014; Rizzo, et al., 2021, 2022) and understanding the development and mechanism of racial bias in White children is important for reducing children of color's experiences with bias and discrimination and disrupting White children's later forming stereotypes and prejudice. This study will explore how network diversity, network size, and neighborhood diversity interact to relate to White children's explanations for racial inequality and anti-Black bias. This will allow us to disentangle how children are affected by their immediate social contacts, the demographics of their broader community, and the interaction among these factors.

We assessed two important facets of children's beliefs and attitudes related to race: children's beliefs about the causes of racial inequality and their affiliative preferences for Black children. Children's explanations for racial inequality contribute to the development of more affective forms of racial bias across development. For example, four-year-old children who endorsed intrinsic explanations for racial inequality (e.g., that inequalities occur "because of who people are on the inside") rather than extrinsic explanations (e.g., "because of how the world works"), developed more biased affective ratings of Black and White children across the course of a school year (Rizzo, et al., 2021; see also Rizzo et al. 2022). Thus, it is important to explore

possible factors that contribute to the development of these explanations in the first place. The present study tested how neighborhood and network features predict variation in children's explanations for racial inequalities, along with variation in their affiliative preferences (measured by children's Playmate Preferences). This study focused specifically on anti-Black racial bias because of its prevalence in the United States and the harmful consequences that Black children experience because of those biases (Roberts & Rizzo, 2021; Seaton & Douglass, 2014; Sellers et al., 2006; Umaña-Taylor, 2016).

In sum, to begin to tease apart theoretical possibilities about the effects of diversity on the development of racial bias, this study will test how the separate and interactive effects of network and neighborhood diversity relate to children's explanations for racial inequality and their anti-Black bias. This will allow us to distinguish whether one of these aspects of diversity matters more than the other, whether they have additive effects, or alternately whether these two aspects of experience interact with one another (such that, for example, that the relation of social network diversity to children's beliefs and behavior depends on the demographics of their broader community).

## **Methods**

### **Participants**

This study was part of a larger, ongoing project exploring the environmental predictors of children's emerging racial bias (see Rizzo et al., 2022) using an unmoderated, online research platform designed for developmental studies (Rhodes et al., 2020; New York University IRB: (IRB-FY2020-4503). Children participating in the larger project whose parents identified them as White and were in the age range of 4-11 were invited to participate in this study. This included 364 children aged 4-11 years old ( $M_{age} = 6.62$ ,  $SD_{age} = 1.70$ ). Parents of these children

were sent the *Child Social Network Questionnaire* (Burke et al., 2022). 363 parents returned the survey. Of these, we excluded 16 participants whose parents did not provide race information for more than half of their network and an additional 7 participants where their networks sizes were outliers (43 or more people was 2.5 standard deviations above the mean;  $M = 19.4$  people,  $SD = 9.1$  people). The final sample thus included 340 children.

The platform allowed for participation from across the United States; participants were from 263 unique zip codes. The zip codes were collected to extract neighborhood demographics for each participant. The sample was skewed towards families with parents who were highly educated and relatively wealthy (85% of the sample had mothers with a bachelor's or graduate degree and the median household income of the sample was \$109,210 ( $SD_{income} = \$89,118$ ), but critical to the present study, including a great deal of variability in the diversity of children's social networks and neighborhoods, as described below.

### **The Child Social Network Questionnaire**

*The Child Social Network Questionnaire* - a method designed to assess infants' and children's social networks (Burke et al., 2022) - was adapted to be administered asynchronously on the virtual lab. The survey was administered in two parts. First, parents answered a series of questions to assess the different people their child interacts with on a regular basis (i.e., "Who are the people that live at home with your child?", "Who are the teachers and friends at school?"; see Supplemental Materials for more information). The people parents listed comprise the social network and are referred to as "alters" (Perry et al., 2018). Next, parents filled out a demographic form for each person their child sees on a regular basis (see Supplemental Materials for an example of the form. The online survey is available at: [https://osf.io/3dzw5/?view\\_only=6c265388a0164d9eaa4fdee63b72c6e0](https://osf.io/3dzw5/?view_only=6c265388a0164d9eaa4fdee63b72c6e0). The average time

between parents filling out the survey and their children participating in the task was 12.7 days ( $SD = 10.6$  days, range: 2.3 days – 3.5 months). While *The Child Social Network Questionnaire* describes many aspects of children's social networks, the present study focused on Network Racial Diversity and Network Size, described below.

### ***Network Racial Diversity***

Diversity in a network can be measured in two ways: 1) the diversity of different categories that are present in the network based on some attribute (such as gender or race) of the people that comprise the network and 2) how the diverse the network is relative to the child based on some attribute, such as gender or race (Perry et al., 2018). To describe the diversity of different racial categories present in the network, we used entropy (Proops, 1987; Shannon, 1948). To describe how diverse the network is relative to the child, we used Proportion of Racial Outgroup. These two conceptually distinct measures of diversity capture the ways in which children can experience diversity – how they observe diversity in their network and how diverse the network is from themselves.

**Network Entropy.** For network science, entropy indicates the relative presence of different social categories among the people that comprise the social network and is calculated as follows for a given probability vector of  $P(X)$ :  $H(X) = - \sum P(X) * \log_2(P(X))$  (Drost, 2018; Krenz et al., 2020; Shannon, 1948). A score of 0 indicates that there is no diversity of categories; all the people in the network share the same attribute (for this particular sample of White children, this would indicate all the people in the network are White). A higher entropy scores indicates a greater representation of different categories.

In order to calculate the racial entropy of the network, each person in the network needed to be classified by a discrete racial category. The racial categories that were used to calculate

entropy were the following: American Indian or Alaska Native, Asian, Black or African-American, Hispanic or Latino, White, Native Hawaiian or Other Pacific Islander, Other (fill in). Parents could select multiple choices and those people were then identified as “mixed/biracial”. In this sample, Network Racial Entropy ranged from 0 – 2.80 ( $M = 0.99$ ;  $SD = 0.64$ ).

**Network Proportion of Racial Outgroup.** To calculate the Proportion of Racial Outgroup in the network, each person in the network needed to be classified as either a racial outgroup member or racial ingroup member. This sample is all White children, which means that any person that was White was a racial ingroup member and any person that was not White was a racial outgroup member (Number of Racial Outgroup Members/Network Size). Biracial and multiracial people were included as racial outgroup members. In this sample, the Network Proportion of Racial Outgroup ranged from 0 – 1 ( $M = 0.23$ ,  $SD = 0.16$ ).

### ***Network Size***

Network Size was defined as the total number of unique individuals and groups parents reported their child saw on a regular basis. The questions used to extract these people is available on [https://osf.io/3dzw5/?view\\_only=6c265388a0164d9eaa4fdee63b72c6e0](https://osf.io/3dzw5/?view_only=6c265388a0164d9eaa4fdee63b72c6e0). In this sample, network size ranged from 3-42 people ( $M = 18.6$  people,  $SD = 8.0$  people).

### **Neighborhood Demographics**

In addition to completing *The Child Social Network Questionnaire*, parents also provided the zip code of where their child currently lived. We used census data to pull out neighborhood demographics for each subject so that we could contrast children’s immediate social environment (their network) with the demographics of the broader community they lived in (their neighborhood).

### ***Neighborhood Racial Diversity***

**Neighborhood Entropy.** The identical calculation was used for Neighborhood Entropy as for Network Entropy by using the percentage of different racial groups present in the neighborhood per zip code. The racial groups used by the United States Census were as follows: White, Black, Native, Asian, Pacific Islander, Other. In this sample, Neighborhood Racial Entropy ranged from 0 – 1.94 ( $M = 0.83$ ;  $SD = 0.41$ ). While some children lived in neighborhoods with no diversity (a score of 0), some children lived in neighborhoods that contained many people of diverse backgrounds.

**Neighborhood Proportion Racial Outgroup.** This sample is all White children, so to calculate the Neighborhood Proportion Racial Outgroup, we calculated the proportion of people of color living in the zip code relative to the full population. In this sample, Neighborhood Proportion Racial Outgroup ranged from 0 – 0.89 ( $M = 0.19$ ,  $SD = 0.17$ ).

### **Measures on Unmoderated Online Research Platform**

Participants were recruited from an ongoing longitudinal study that explores the development of racial bias in early childhood (Rizzo et al., 2022). Parents' responses to *The Child Social Network Questionnaire* were matched with their child's performance on the tasks from the larger, ongoing longitudinal project. Parents and children provided informed consent and assent, respectively before completing the study. All study procedures were presented to children using narrated and animated video clips. Children indicated their responses by clicking child friendly buttons on the screen; children who could not operate the mouse were asked to point and their parents clicked the responses for them. All procedures were completed from the family's home computer and video of the experimental session was recorded, with consent, via a front-facing webcam. The full protocol is available at [https://osf.io/3dzw5/?view\\_only=6c265388a0164d9eaa4fdee63b72c6e0](https://osf.io/3dzw5/?view_only=6c265388a0164d9eaa4fdee63b72c6e0).

***Explanations for racial inequalities task***

Participants were presented with photographs of a high-wealth house, a low-wealth house, a Black child, and a White child, with the White child overlaid onto the high-wealth house and the Black child overlaid onto the low-wealth house. Without labeling the race of the child or the wealth-status of the house, participants were then told that the White child lived in the high-wealth house (“This kid lives in this house”) and that the Black child lived in the low-wealth house (“And this kid lives in this house”) and were asked to think about why they lived in those houses. Children were then told about two explanations ostensibly provided by other children and were asked to choose which they thought was true. The explanations were:

*Extrinsic Explanation* (“One kid said that this one lives in this house and this one lives in this house because of things that happen in the world. They said that there are things people don’t have any control over that make it harder for some kids and easier for others, and it’s these things that happen that make it so that each of these kids lives in these houses”) and *Intrinsic Explanation* (“Another kid said that this one lives in this house and this one lives in this house because of who they are on the inside. They said that there are things about who people are that make it so that there are different types of people in the world, and who these kids are on the inside makes it so that each of these kids live in these houses.”).<sup>1</sup> Participants were scored as 1 = choosing *Extrinsic Explanation* and 0 = choosing *Intrinsic Explanation*.

***Playmate Preferences***

Participants were shown an array of 4 gender-matched pictures of children of different races (1 Asian, 1 Black, 1 Latinx, and 1 White) and they were asked, “Who would you want to

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<sup>1</sup> To avoid perpetuating racial-wealth stereotypes within the study, children were subsequently presented with similar vignette about a Black child living in a high-wealth house and a White child living in a low-wealth house and were asked the same explanation question.

play with the most?”. Given the focus on anti-Black biases for this manuscript, we rescored participants responses to: 1 = chose the Black child; 0 did not choose the Black child.

### **Parent Beliefs about Race**

As part of the larger, ongoing project, parents filled out a survey asking about beliefs about race (available on OSF [https://osf.io/3dzw5/?view\\_only=6c265388a0164d9eaa4fdee63b72c6e0](https://osf.io/3dzw5/?view_only=6c265388a0164d9eaa4fdee63b72c6e0)). The larger, ongoing project includes several waves of data collection. In order to maximize the amount of parent data for our current sample, we took parent belief data from the first wave of data collection that they filled out the survey. The average time between parents filling out the parent belief survey and their children participating in the task was 8.5 months ( $SD = 5.4$  months, range: 2.5 months – 19 months). The present study focused on parent’s responses to the following question, “How important was the diversity of the neighborhood when you were deciding where to live?”. Parents responded with a 5-point scale ranging from “Not at all important” to “Extremely Important”.

### **Results**

Our analysis plan was pre-registered on OSF and is available here: [https://osf.io/3dzw5/?view\\_only=6c265388a0164d9eaa4fdee63b72c6e0](https://osf.io/3dzw5/?view_only=6c265388a0164d9eaa4fdee63b72c6e0). Below we present the pre-registered, interactive models that test how Network Size, Network Diversity, Neighborhood Diversity and child age interacted to relate to children’s explanations for racial inequalities and their anti-Black bias. There are two major differences from our pre-registration. First, instead of including child age as a main effect in our models, we interacted child age to test for developmental changes in how early social environments relate to anti-Black bias and explanations for racial inequalities. Second, we originally planned to conduct separate models to



test how Network and Neighborhood Diversity interact to relate to children's racial bias and how Network Diversity and Network Size interact to relate to children's racial bias. We instead decided to test for all effects in one model (Network Diversity, Neighborhood Diversity, Network Size, Child Age). Including all predictors into one model will allow us to make better comparisons about how children's experience with diversity relates to their explanations for racial inequalities and their anti-Black bias. Diversity was quantified as the entropy score for the racial demographics of children's networks and neighborhoods. Proportion of racial outgroup members was also preregistered, analyzed, and yielded similar results, which are available in the Supplemental Materials. Proportion of racial outgroup members and entropy are highly correlated for both the network ( $r = .88, p < .001$ ) and neighborhood ( $r = .80, p < .001$ ) in this sample. We chose to focus this manuscript on the entropy score because the entropy measure was more normally distributed than the proportion of racial outgroup measure, which makes entropy a better predictor variable for our logistic regressions. We tested the correlation between Network and Neighborhood Diversity and found that children living in more diverse neighborhoods were more likely to have diverse social networks ( $r = .40, p < .001$ ). For each model, we tested the tolerance for each variable and all our model terms had tolerance above 0.50, indicating that multicollinearity is not significantly inflating our regression terms and standard errors.

Additionally, while we pre-registered a battery of tasks assessing children's racial biases, beliefs, and norms, the present study is specifically focused on children's anti-Black bias as measured by their friendship choices and their explanations for racial inequalities. We chose this focus given prior work finding that children's playmate preferences are a sensitive measure of social bias (Hitti et al., 2020) and because racial exclusion is an important form of discrimination

that begins early in childhood and has direct consequences for the health and wellbeing of children from marginalized groups (Seaton & Douglass, 2014; Sellers et al., 2006; Umaña-Taylor, 2016). Relatedly, we examined children's explanations for racial inequalities given past research finding that explanations for racial inequalities developmentally predict the emergence of racial biases in early childhood (Rizzo et al., 2021).

Prior work has shown that the racial diversity in children's school environment was related to their racial bias (Rutland et al., 2005) and that children's exposure to racial inequality in their neighborhoods moderates the relation between their explanations for racial inequalities and their developing racial biases (Rizzo et al., 2022). No studies to our knowledge, however, have simultaneously examined how children's social networks *and* neighborhood contexts interact to predict children's developing biases and beliefs about racial inequalities.

Thus, the goal for the present manuscript was to expand upon prior work by documenting how children's experiences in their social networks and neighborhoods relate to their developing racial biases and explanations for inequality. We include the other assessments that do not directly speak to these goals, such as beliefs about social norms that are more abstract measures about children's beliefs about race, in the Supplemental Materials (we did not find that children's exposure to diversity predicted responses on any of these tasks, all  $ps > .05$ ). We wanted to focus the manuscript on the more concrete aspects of racial bias and explore how experience explains variation in the development of racial bias.

The models we conducted were logistic regressions for both the explanations task (choose extrinsic = 1; choose intrinsic = 0) and children's playmate preferences (choose Black child = 1; choose White, Asian or Hispanic child = 0). Our models included the following mean-centered predictor variables and their interactions: Network Racial Diversity, Neighborhood

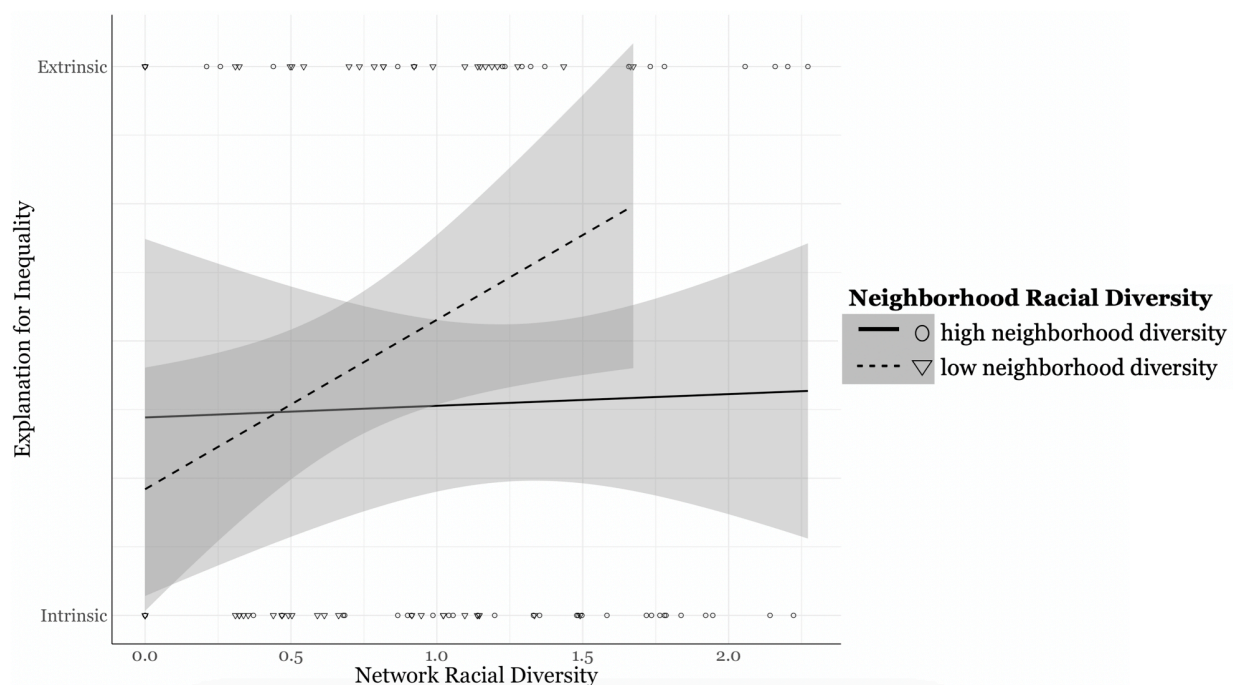
Racial Diversity, Network Size, and Child Age. This analysis will allow us to test for main effects of each of the environmental variables and child age, as well as the interactive effects.

### **Explanations for Racial Inequalities**

For children in *neighborhoods* with lower racial diversity; those who had more diverse *networks* were more likely to endorse extrinsic over intrinsic explanations for racial inequalities (interaction between Network Diversity and Neighborhood Diversity:  $\beta = -0.35$ ,  $\chi^2(1) = 5.39$ ,  $p = .02$ , Figure 1). A simple slope analysis revealed that network diversity predicted children's explanation choice for children in neighborhoods with lower racial diversity (when Neighborhood Racial Entropy = -1 SD,  $\beta_{\text{NetworkDiversity}} = 0.73$ ,  $p < .001$ ); the amount of network racial diversity did not relate to children's explanation choice for children in neighborhoods with high racial diversity (when Neighborhood Racial Entropy = +1 SD,  $\beta_{\text{NetworkDiversity}} = 0.03$ ,  $p = .89$ ). There was also an overall effect of Network Diversity subsumed in this interaction, such that children with more diverse networks were more likely to endorse an extrinsic explanation (main effect of Network Diversity:  $\beta = 0.37$ ,  $\chi^2(1) = 4.45$ ,  $p = .035$ ). Additionally, as children got older they were also more likely to choose an extrinsic explanation over an intrinsic explanation (main effect of child age:  $\beta = 0.41$ ,  $\chi^2(1) = 8.97$ ,  $p = .003$ ). Neither the main effect of Neighborhood Diversity nor any of the other interactions were significant.

### **Figure 1**

*Network diversity predicts endorsement of extrinsic explanations for inequality among children in neighborhoods with little diversity.*



*Note.* Lines are the regression lines with 95% confidence intervals (in shaded grey); small shapes are individual responses of children. Neighborhood Diversity was analyzed continuously in the model, but is depicted in the picture by as +/- 1 standard deviation for ease of interpretation.

## Playmate Preferences

There were no main or interactive effects of network features, neighborhood features, or age on children's Playmate Preferences. Overall, children chose to play with the Black child less than expected by chance – only 12% of White children in this sample choose the Black child ( $CI = 0.08 - 0.15, p < .001$ ). Given that so few White children choose to play with the Black child, it is not surprising none of the features describing their environment could explain any variance in children's performance on this task.

In an exploratory (not preregistered) analysis, we tested whether *peer* diversity specifically was a better predictor than overall diversity for the playmate preference task. That is, we asked whether the racial diversity of the other children in the focal child's network was related to children's own playmate preferences. On average, participants had 8 children in their network ( $SD = 4.4$ , range: 1-25 children). The average number of racial outgroup peers (for this

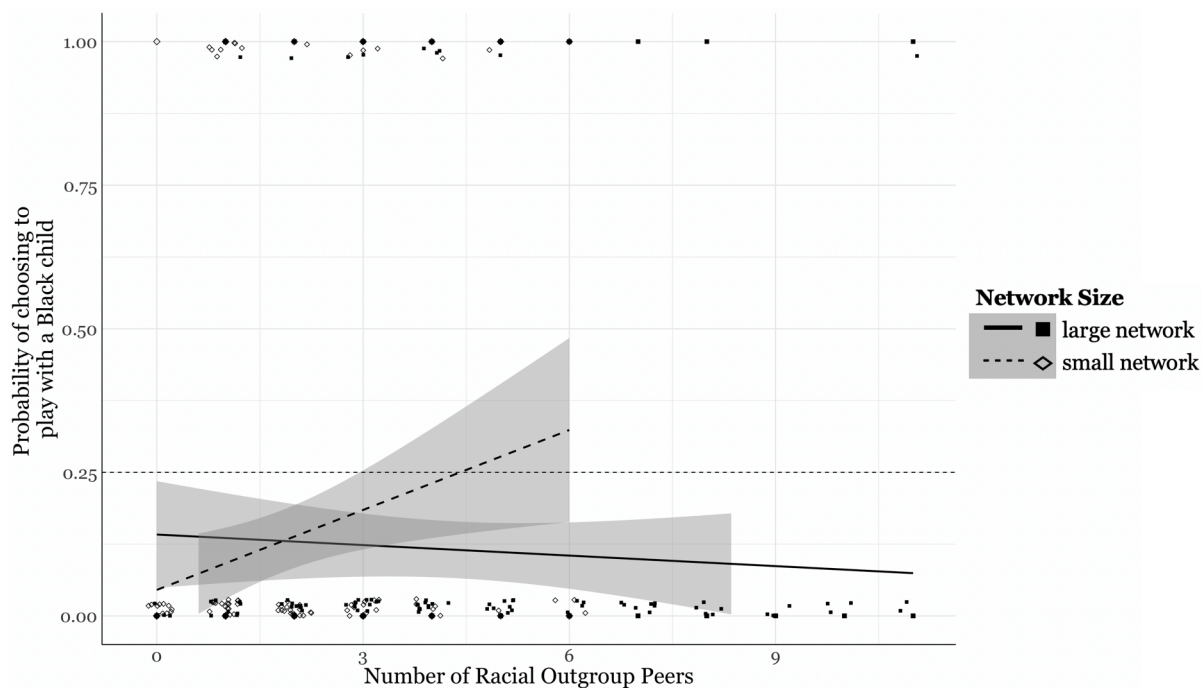
sample of all White children, this was any peer in the network that was not reported to be monoracial White) was 3 ( $M = 3.14$ ,  $SD = 2.56$ , range: 0 – 11). Given the small number and range of racial outgroup peers children had in their network, we decided to look at the number of racial outgroup peers present in the network, rather than trying to calculate a proportion or entropy value on such a small number of peers. By interacting the number of racial outgroup peers by network size, that will allow us to test whether the context in which White children experience interracial contact matters for disrupting the development of racial bias.

We ran an identical analysis as above, but replaced overall network diversity with the number of racial outgroup peers. This analysis revealed a significant interaction between the number of racial outgroup peers and network size ( $\beta = -0.94$ ,  $\chi^2(1) = 10.6$ ,  $p < .001$ ; Figure 2). A simple slopes analysis revealed that for children in small networks only, they were more likely to choose to play with the Black child as the number of racial outgroup peers in their network increased (when Network Size is -1SD:  $\beta_{\text{NumberOutgroupPeers}} = 1.31$ ,  $p < .01$ ; when Network Size is +1SD:  $\beta_{\text{NumberOutgroupPeers}} = -0.60$ ,  $p = .09$ ). None of the other main effects nor interaction effects were significant. This analysis suggests that how White children experience contact with people of color matters greatly for their anti-Black bias. For this sample, White children showed less bias if they had children of color in their network, but only for children in small networks. As Intergroup Contact Theory (Pettigrew & Tropp, 2006) suggests, contact with racial outgroup members needs to be high quality to help reduce bias and prejudice. Children in small networks tend to have a higher proportion of high intense relationships – prior work has shown that as network size increased in early childhood the proportion of high intense relationships decreased (Burke et al., 2022). Thus, although we do not have intensity information for this particular sample, these findings are consistent with the possibility that contact with peers from different

racial backgrounds mitigates bias when such contact involves high intensity relationships, as are more likely to occur in smaller networks.

**Figure 2**

*Number of Racial Outgroup Peers and Network Size relates to children's playmate preferences*



*Note.* Lines are regression lines with 95% confidence intervals (in shaded grey); small shapes are children's individual responses (points are jittered for graph). Network Size was analyzed as a continuous variable, but shown by median split for ease of interpretation. Dashed line indicates the probability of choosing to play with the Black child expected by chance, out of an array of 4 pictures.

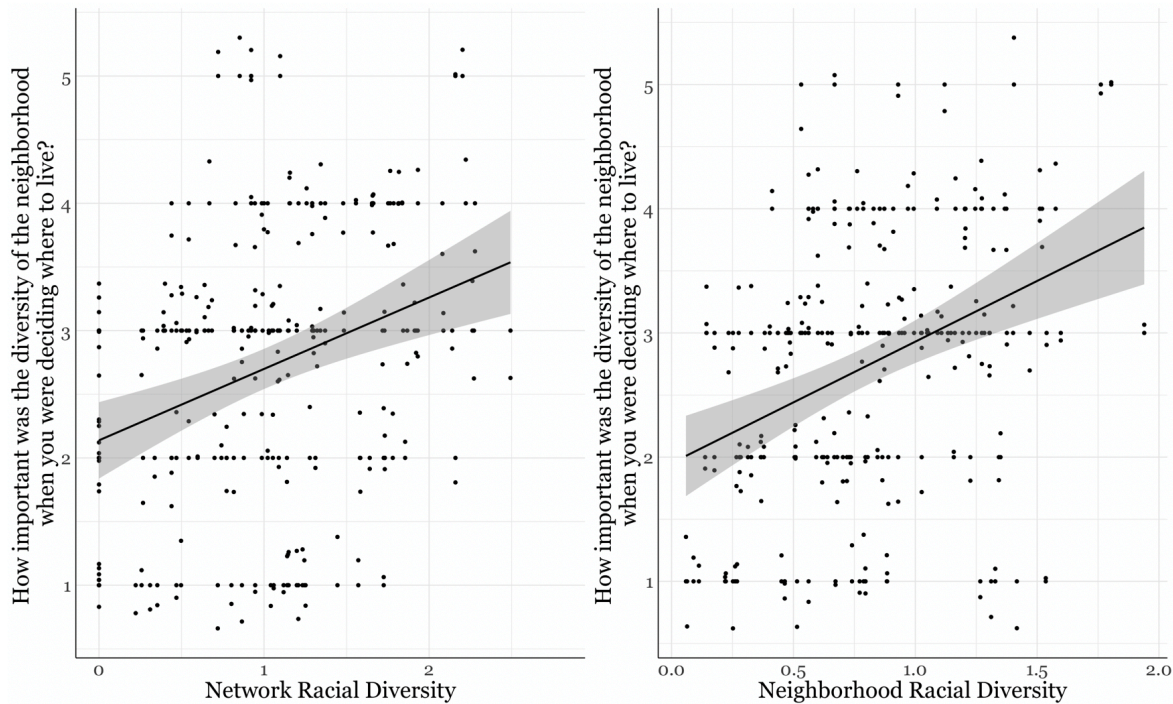
### **How do parents' beliefs about diversity relate to children's network diversity and their explanations for racial inequalities and anti-Black bias?**

In a set of exploratory (not preregistered) analyses, we tested how parent beliefs contribute to 1) children's own network and neighborhood diversity and 2) their explanations for racial inequalities and anti-Black bias. Parents who rated racial diversity as more important to them (in response to the question, "How important was the diversity of the neighborhood when

you were deciding where to live?” ( $M = 2.71$ ,  $SD = 1.10$ , range: 1-5)) had children in more diverse networks ( $r = 0.32$ ,  $p < .001$ ; Figure 3) and neighborhoods ( $r = 0.37$ ,  $p < .001$ ; Figure 3).

**Figure 3**

*Parent beliefs about diversity are correlated with children’s network and neighborhood diversity*



*Note.* Lines are the Pearson’s  $r$  correlation lines with 95% confidence intervals (in shaded grey); small shapes are parents’ individual responses.

Given that parents’ reported valuing of diversity correlated with the diversity of children’s networks and neighborhoods, we next tested if network and neighborhood diversity relate to unique variance in children’s explanations for inequality even controlling for these parental beliefs. Indeed, even controlling for parent beliefs, the interaction between network and neighborhood diversity was still significant ( $\beta = -0.43$ ,  $\chi^2(1) = 4.14$ ,  $p = .042$ ). The simple slopes analyses revealed a similar pattern reported above; for children in neighborhoods with lower racial diversity, those who had more diverse networks were more likely to endorse extrinsic over intrinsic explanations for racial inequalities (when Neighborhood Racial Entropy = -1 SD,

$\beta_{\text{NetworkDiversity}} = 0.88, p = .01$ ), while network diversity was not related to children's explanation choices for those in neighborhoods with high diversity (when Neighborhood Racial Entropy = +1 SD,  $\beta_{\text{NetworkDiversity}} = 0.03, p = .91$ ). It was also still true that children in more diverse networks were more likely to endorse extrinsic explanations (main effect of Network Diversity ( $\beta = 0.43, \chi^2(1) = 4.04, p = .044$ ) and endorsement of such explanations increased with age (main effect of Child Age,  $\beta = 0.39, \chi^2(1) = 5.04, p = .025$ ). Overall, these analyses indicate that even though parents' beliefs about diversity correlated with children's network and neighborhood diversity, diversity of the social environment remained a unique predictor of children's choices. In particular, the main effect of network diversity, above and beyond the interaction with neighborhood diversity, suggests that children's immediate social environments play a strong role in their explanations for inequalities.

We also tested our exploratory analysis looking at how peer diversity related to anti-Black bias to see if that relation held while controlling for parent beliefs. The interaction between the number of racial outgroup peers and network size was still significant ( $\beta = -0.997, \chi^2(1) = 7.21, p = .007$ ) and the simple slopes analysis also revealed the same patterns. For children in small networks only, they were more likely to choose the Black child as the number of racial outgroup peers increased (when Network Size = -1 SD:  $\beta = 1.68, p = .01$ ; when Network Size = +1 SD:  $\beta = -0.39, p = .39$ ). None of the other main effects nor interactions were significant. Thus, even controlling for parent beliefs about diversity, it is still the case that the number of peers of color that White children interact with related to their affiliative playmate preferences.

### Discussion

The present study used children's social networks and neighborhood demographics to assess how distinct aspects of their early social environment relate to their emerging racial bias.



Network Racial Diversity impacted children's explanations for racial inequalities, but in a contextually specific way. White children in neighborhoods with low diversity were more likely to endorse an extrinsic explanation as their network diversity increased, whereas network diversity did not relate to children's choices for those that lived in neighborhoods with high diversity. Even when controlling for parent beliefs about diversity, which were positively correlated with children's network and neighborhood diversity, children with increased network diversity were more likely to endorse an extrinsic explanation. Contact with interracial relationships also related to children's anti-Black bias, but once again in a contextually specific way. An exploratory analysis showed that for children in small networks only, their anti-Black bias decreased as the number of racial outgroup peers in their network increased. This result held controlling for parent beliefs about diversity.

These results illustrate how the implications of experiences with diversity are context-dependent. Children with increased network diversity were more likely to choose an extrinsic explanation over an intrinsic explanation, particularly if they lived in neighborhoods with low diversity. This interaction between network and neighborhood diversity suggests that neighborhood diversity might not function the same way as immediate social contacts. Children in neighborhoods with little diversity might be prone to develop intrinsic explanations for racial inequalities (perhaps relying on general essentialist tendencies in the absence of direct experiences with diversity, e.g., Rhodes & Mandalaywala, 2017), but this problematic process appears to be interrupted when children have more experiences with racial and ethnic diversity in their own social network. Children with diverse networks in neighborhoods with little diversity receive a strong signal that even though interracial contact does not occur frequently in their neighborhood, it is something that is valued - this could explain why interpersonal contact has a

strong effect for children in neighborhoods with relatively little diversity. On the other hand, just being in a neighborhood with more racial and ethnic diversity does not appear sufficient on its own to help children develop extrinsic explanations for racial inequalities. That is, although White children in neighborhoods with high diversity are exposed to more people of color, they might not necessarily have more positive interracial interactions, unless they are in diverse social networks. Indeed, it is possible that White children in mostly White networks but in more diverse neighborhoods are exposed to more threat-based narratives surrounding interracial contact (Craig et al., 2018).

Surprisingly, there was no evidence that the overall diversity of children's early social environments, at either the network or neighborhood level, was related to their affiliative playmate preferences; instead, our exploratory analysis showed that the diversity of the peers in children's networks in particular predicted their playmate preferences. White children were more likely to choose to play with a Black child as the number of children of color in their peer network increased, but only for children in small social networks. This finding is consistent with Intergroup Contact Theory, which predicts that experiences with people from diverse backgrounds (particularly in the context of close relationships, as captured by social networks) help to mitigate bias (Barlow et al., 2013; Pettigrew & Tropp, 2006). The interaction with network size suggests that interracial interactions need to be high quality to help mitigate bias. We did not collect information about the intensity or quality of the relationships for this particular sample. Children in smaller networks tend to have a higher proportion of high intense relationships (Burke et al., 2022), however, which could explain why the number of children of color in the network had the strongest effect for children in smaller networks, where relationships tend to be higher intensity. Future work can start to explore this further by asking

about the relative status within peer networks (e.g., who is seen as the leader within friend groups) or who is selected for leadership positions (e.g., team captain, classroom helper) and how that may also shape the messages children infer from interracial interactions. For example, it could matter whether the diverse interactions White children have all come from children that are same status as them, such as a peer in their class, or whether those people are higher status, such as team captain or the class president.

In this sample of children from across the United States, children whose parents rated diversity as a more important factor in deciding where to live had children in more diverse networks and neighborhoods. This suggests the interesting possibility that one way that parents pass on their values to children is through the composition of the social environment that they create for their families. Yet, the diversity of children's social networks related to variation in children's explanations for inequality even when controlling for parental beliefs, suggesting that the effects of children's social networks do not appear just because these networks reflect their parents' beliefs (indeed, in this sample, parent beliefs did not directly relate to children's explanations, even though they did correlate with network and neighborhood diversity). Because these analyses were exploratory and included only a limited measure of parental values, future research should examine in more detail how parents' beliefs and children's social networks and neighborhoods interact with one another to shape the developmental trajectory of racial bias across childhood. Overall, these results highlight the importance of using comprehensive frameworks in which to understand how experience affects cognition. Looking at only one dimension of experience (e.g., neighborhood diversity or parental beliefs alone, for example), would be taking a single slice out of a multi-level, highly interconnected system; however,

looking at how various levels of experience interact to predict development is necessary to identify the underlying processes, as well as to identify potential pathways to intervene.

A limitation of this work is that it is a cross-sectional, correlational study and therefore measured children's experiences and race-related beliefs and attitudes at a single point in time. It is impossible to know whether children's social experiences influence the development of racial bias, or whether children develop these racial biases, which then affects how their social world is structured. Therefore, we cannot draw causal conclusions about how these social experiences contribute to the development of racial bias. Although claims about causality could still not be made, implementing a longitudinal design would give us the ability to ask how features of the environment relate to bias as it emerges overtime. It remains an open question whether and how the *changes* in children's early social environments relate to their cognition. Although snapshots of experience and performance provide some insight into how experience relates to cognition, children are also likely sensitive to how their experiences change over time. For example, does a White child who has always had only White people in their network develop the same beliefs about the world compared to a White child who has had increased growth in their contact with people of color during the first few years of life? These questions can also be applied at the level of the broader social system, such as the neighborhood in which children live, to ask about the extent that children are sensitive to the changing demographics of their communities over time. Another important limitation of this work is that the sample is from a high socio-economic background; most of the sample came from wealthy households where mothers had a college degree. Thus, future work will need to test more broadly to see if the results reported here generalize to other samples with more SES diversity. In addition, whereas the present work focused on White children's experiences with people of color, it will be crucial in future work to

examine how children of color experience these relationships, as well as to explore how network and neighborhood diversity interact to shape the beliefs and biases of children of color, especially in the United States where these children are in the numerical minority.

In conclusion, White children with more network diversity were more likely to endorse an extrinsic explanation for racial inequalities, particularly for children that lived in neighborhoods with low diversity. For White children in small networks, they were more likely to choose to play with a Black child as the number of children of color in their network increased. Even when controlling for parents' beliefs about diversity, the diversity of children's immediate social contacts explained unique variance in their explanation choices and affiliative playmate preferences. This study highlights the importance of measuring children's early social environments at both macro and micro levels to best understand how specific aspects of experience relate to the emergence of racial bias.

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