Causal explanations for body size influence children's social preferences:
Biological-essentialist explanations reduce, and behavioral explanations promote,
preferences for thin friends

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CAUSAL EXPLANATIONS FOR WEIGHT INFLUENCE PREFERENCES

Abstract

The current study experimentally investigated the impact of causal-explanatory information on weight bias over development. Participants ($n = 395$, children ages 4-11 years and adults) received either a biological or behavioral explanation for body size, or neither, in three between-subjects conditions. Participants then made preference judgments for characters with smaller versus larger body sizes. Results showed that both behavioral and biological explanations impacted children's preferences. Relative to children's baseline preferences, behavioral explanations enhanced preferences for smaller characters, and biological explanations reduced these preferences – unlike the typical facilitative impact of biological-essentialist explanations on other biases. The explanations did not affect adults' preferences. In contrast to previous findings, we demonstrate that causal knowledge can impact weight bias early in development.

Keywords: body size, weight, intuitive theory, causal explanation, weight bias, children, development

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Weight bias, or negative attitudes toward people considered overweight (Tomiyaama, 2014), emerges by the preschool years (Brylinsky & Moore, 1994; Cramer & Steinwert, 1998; Kraig & Keel, 2001). Despite impacting millions of people worldwide (Puhl et al., 2015), weight bias has received less attention in cognitive development research compared to gender- or race-related biases. Research has mostly taken a social psychological approach to weight bias reduction, focusing on adults' weight biases and exploring factors such as empathy (Teachman et al., 2003), interpersonal contact (Wiese et al., 1992), beliefs about the acceptability of weight bias (Puhl, Schwartz, & Brownell, 2005), and awareness of its consequences (Diedrichs & Barlow, 2011). Here, we take a cognitive-developmental approach, exploring the processes driving weight bias over development.

Researchers have long proposed that children's ideas about the causes of body size may contribute to weight bias (Jarvie et al., 1983), and a major review of childhood weight bias research called for more research on this topic (Puhl & Latner, 2007). Supporting this proposal, childhood weight bias is not driven primarily by aversions to outgroups or differences: Children of diverse body sizes, including children who are overweight themselves, hold weight biases (Davison & Birch, 2004; Schwartz et al., 2006), and children reliably rank overweight children as less likable than children with other physical differences (e.g., child in wheelchair, Koroni et al., 2009; Latner & Stunkard, 2003). In the present studies we investigate how causal explanations for body size impact weight bias, focusing on biological and behavioral causes of

body size, which are understood even by young children (Raman, 2014, 2018; Wellman & Johnson, 1982). Below, we review research motivating this question, drawing from both basic research on social cognitive development, as well as applied research on weight bias specifically.

Impacts of causal explanations on children's social attitudes

Children hold rich theories about the causes of social differences that impact their social attitudes. Most prominently, a large literature explores the social consequences of children's "essentialist" intuition that social differences reflect people's internal biology or intrinsic nature (Gelman, 2003 for review). Biological-essentialist theories about race, ethnicity, and gender facilitate prejudice toward these groups (Rhodes & Mandalaywala, 2017 for review). Therefore, biological-essentialist views of body size might promote children's weight bias as well. However, research with adults suggests that biological-essentialism actually *reduces* weight- and homosexuality-based biases (Haslam & Levy, 2006; Monterosso, Royzman, & Schwartz, 2005; Teachman et al., 2003).

The mechanisms by which biological-essentialism either promotes or reduces prejudice are distinct: It *promotes* bias by construing social status hierarchies as natural (Mandalaywala, Amodio, & Rhodes, 2018), ignoring non-biological causes of intergroup differences (Taylor et al., 2009), exaggerating perceived between-group differences (Diesendruck & Menahem, 2015), and highlighting within-group similarity (Diesendruck & HaLevi, 2006). However, essentialism *reduces* bias by promoting a "born that way" view of identities, reducing judgments of blameworthiness toward stigmatized identities that could otherwise be viewed as freely-chosen, and prompting the "naturalistic fallacy" that naturally-occurring phenomena (e.g., obesity) are morally good and right (see Dar-Nimrod & Heine, 2011 for review).

To date, the bias-reducing effects of essentialism have primarily been demonstrated among adults; little research has explored whether children's essentialist beliefs might reduce certain biases, or how the bias-mitigating effects of biological-essentialism might develop. Among the blame-based forms of prejudice that are reduced by biological explanations among adults, weight bias emerges in early childhood, making it a useful test case for exploring the development of these relations. We predict that, as with adults (Diedrichs & Barlow, 2011; Monterosso et al., 2005; Puhl et al., 2005), biological-essentialist explanations for body size will reduce children's weight biases.

We also explore the consequences of behavioral explanations on weight bias. Compared to the vast research on how biological-essentialist theories shape children's social attitudes, little research explores how behavioral theories may do so. If biological explanations reduce children's weight biases in part by promoting a view of body size as biologically-determined rather than reflecting people's choices, then behavioral causes for body size should exacerbate weight bias. Indeed, emerging research suggests that behavioral explanations can exacerbate children's attitudes toward certain "blameworthy" identities. For example, teaching children that people are incarcerated because they did something bad promotes negative attitudes toward incarcerated people (Dunlea & Heiphetz, 2019). Behavioral explanations for body size also promote adults' implicit weight bias (Teachman et al., 2003). We expect behavioral explanations to promote weight bias among children as well.

Potential impacts of causal explanations on childhood weight bias

While research has demonstrated that both biological and behavioral explanations impact adults' weight biases, less research has focused on how explanations impact *children's* weight biases, despite evidence that (a) weight bias emerges early in development, and (b) children's

broader social attitudes are sensitive to causal-explanatory information. The existing research on this topic is inconclusive (Dánielsdóttir et al., 2010).

Regarding behavioral explanations, two studies have found that children's beliefs about the behavioral controllability of body size correlate positively with weight bias (Musher-Eizenman et al., 2004; Tiggemann & Anesbury, 2000). However, correlational studies do not indicate causal direction. With regard to biological explanations, three studies have explored how teaching about medical causes of obesity impacts weight bias among older children and adolescents. While some studies found impacts on ratings of specific traits (e.g., self-discipline, DeJong, 1993), all three found null effects on social outcome measures such as liking (DeJong, 1993), desire to engage with (Bell & Morgan, 2000), and stereotyping of (Anesbury & Tiggemann, 2000) obese children. One study found that biological explanations even *reduced* desire to engage with obese children, among older participants only (Bell & Morgan, 2000).

We suggest that four aspects of previous research have limited a clear and comprehensive understanding of the relation between causal explanations and weight bias in childhood. First, research has typically focused on a subset of causal-explanatory comparisons (e.g., behavioral only, biological vs. no explanation), making it difficult to fully understand how different explanations impact children's baseline biases. Second, correlational designs do not allow for conclusions concerning the direction of any potential relation between theories and biases; children's causal theories may also reflect preexisting biases. Third, studies typically present explanations focused on medical or biological phenomena (e.g., metabolism, Anesbury & Tiggemann, 2000; "a problem with her glands," Bell & Morgan, 2000), potentially pathologizing obesity and also distracting children from grasping the causal relations. Finally, studies on biological explanations often focus on older children (e.g., ages 9-11, Anesbury & Tiggemann,

2000; 8-11, Bell & Morgan, 2000; 14-18, DeJong, 1993), despite the early emergence of both weight bias and essentialist theories. While studies on behavioral explanations involve younger children, narrow age ranges make it difficult to compare across studies, especially in the context of developmental shifts in both causal theories and weight biases.

We address each of these aspects in the design of the present study. We experimentally investigate how both biological and behavioral explanations for body size impact social preferences relative to children's baseline preferences. Rather than describing a medical disorder, we describe body size in neutral terms that focus on conveying a causal relation. We use explicit causal language (e.g., "because," "why," "depends"), based on conceptual development research indicating that children are constructing causal theories of the world (Gopnik et al., 2004) and that causal language helps them do so (Muentener & Schulz, 2012). Finally, our sample includes preschool-aged children through those at the onset of adolescence in a single paradigm. Relative to a predicted age-related decline in reported social preferences over this period (as in Raabe & Beelmann, 2011), we were interested in how the *impact of* each explanation would vary, especially in the context of decreasing in essentialist intuitions (Taylor, Rhodes, & Gelman, 2009) and increasing understanding that eating and exercise impact body size (Raman, 2014; Wellman & Johnson, 1982).

Present study

The current study investigates the relation between causal explanations for body size and weight-based social preferences. In three between-subjects conditions, we provided children (4-11 years) and adults with a biological explanation, a behavioral explanation, or no explanation for body size, and then assessed their social preferences. The primary a priori prediction for confirmatory analyses was that biological explanations would reduce participants' preferences

for smaller individuals, and behavioral explanations would enhance these preferences, relative to when no explanation was provided.

A second, exploratory aim was to explore developmental shifts. We were interested in how the impact of each explanation would vary relative to the predicted overall age-related decrease in reported preferences for smaller individuals. Children's essentialist intuitions about body size decline over development (Raman, 2018) and their understanding that behaviors impact body size increases (Raman, 2014; Slaughter & Ting, 2010; Wellman & Johnson, 1982); these shifts in children's prior beliefs might predict shifts in the impact of each explanation. Because children's reasoning shifts in response to explanations that contrast with their prior beliefs (Legare, Gelman, & Wellman, 2010), the impact of biological explanations might become more potent, and behavioral explanations less potent, over development. Alternatively, as children increasingly appreciate the impact of behavior on body size, children may increasingly view 'unhealthy' behaviors as blameworthy; thus, the impact of behavioral explanations might increase over development. As we had no a priori hypotheses about developmental shifts in the impact of each explanation, any analyses related to age should be considered exploratory in nature.

Method

Participants

A total of 395 participants, 4- to 11-year-old children and adults, were recruited at a science museum in Boston, Massachusetts between October 2017 and June 2019. To ensure an equal distribution of participants across the age range, we recruited participants in five age cohorts: 4- and 5-year-olds ($n = 71$, mean age = 4.95 years, 36% boys, 64% girls), 6- and 7-year-olds ($n = 98$, mean age = 6.99 years, 43% boys, 57% girls), 8- and 9-year-olds ($n = 80$, mean age

= 8.79 years, 45% boys, 55% girls), 10-and 11-year-olds ($n = 74$, mean age = 10.85 years, 37% boys, 63% girls), and adults ($n = 72$, 31% men, 69% women, exact ages not recorded).

Participants were recruited irrespective of body size. Although we did not collect demographic information, per museum policy, the visitor population is predominantly White and from middle- to upper-middle-class families.

Participants in the experimental conditions were randomly assigned to the Behavioral Explanation ($n = 100$) or Biological Explanation ($n = 108$) conditions until there were at least 20 participants from each age cohort within each condition. Participants in the No Explanation condition ($n = 187$) were recruited separately. Power analyses determined that this sample size was sufficient to detect medium main effects of condition in an initial multiple regression model, as well as the interaction between each condition and age in a subsequent step of the model at 80% power.

Materials and procedure

Participants in the explanation conditions were presented with an explanation prompt and then completed the Preference Task. Participants in the No Explanation condition completed only the Preference Task. These participants then completed additional tasks as part of a separate, unpublished study; all additional tasks were completed after the Preference Task and thus have no impact on the current data.

Causal explanation prompt. An explanation prompt (Table 1) was read aloud to participants in the explanation conditions. Prompts described a cause, either behaviors or biological make-up. The biological prompt highlighted qualities of naturalness and fixedness that are part of biological-essentialist intuitions. Neither prompt implied positive or negative attitudes towards body size: Both were presented in neutral affect, contained no evaluative or valenced

language, and focused on factors underlying body size broadly rather than a larger body size in particular.

Two images (Figure 1) were presented on a laptop. Where indicated by *, the researcher pointed to the images, thus avoiding size labels. Images featured sets of smaller and larger characters. Facial expressions were identical across sets.

During the debrief, we provided participants with the alternate prompt, ensuring they left the study with an accurate multicausal understanding of body size.

Table 1

Text of Prompts

Behavioral Explanation	Biological Explanation
Do you know <i>why</i> some bodies look like this*, and other bodies look like this*? What a body looks like is because of what that person does!	Do you know <i>why</i> some bodies look like this*, and other bodies look like this*? What a body looks like is because of how that body is built!
If a person eats healthier foods, runs and exercises a lot, and works really hard to stay healthy, those are all things that make a body look more like that*. If a person doesn't do those things, that can make a body look more like that*.	A person can eat healthy foods, run and exercise a lot, and work really hard to stay healthy, but some bodies are still going to look like this* no matter what the person does! And other bodies are going to look like that* no matter what the person does, too.
If a body looks like this* or like that*, it's because of what the person is eating, how much they're exercising, and how hard they are working to stay healthy.	If a body looks like this* or like that*, it's not because of anything the person is doing, that's just how their body works.
It all depends on what a person does!	It all depends on how that body is supposed to be!

Preference Task. During each trial (total = 8), participants viewed a slide showing one smaller and one larger character (Figure 2), and were asked, “Who would you like to play with?”

Participants responded verbally or by pointing. Each pair of characters was matched in race, gender, and facial expression, but differences in clothing, hair color, and hairstyle ensured that characters appeared distinct. Racial and gender identities varied across slides. The left/right placement of the smaller/larger characters was counterbalanced. Child participants viewed child characters, and adults viewed adults.

Results

As shown in Figure 3, participants in the No Explanation condition preferred the smaller character (i.e., preference scores were above chance levels of .5), across all ages (all $ps < .003$, correcting for multiple comparisons), consistent with past research (Puhl & Latner, 2007).

To assess the impact of condition on children's preferences, we fit a logistic mixed-effects model with condition as two fixed effects (Behavioral and Biological, dummy-coded with the No Explanation condition serving as the reference condition), participants' exact age as a continuous predictor, as well as the interaction between age and each condition, as predictors of participants' preferences. Preferences were coded as binary (1 = smaller character, 0 = larger character). The model included random intercepts for participants.

Age and condition both significantly predicted children's preferences. With increasing age, children's preference for the smaller character decreased (Wald $Z = -3.02$, $p = .003$). Relative to the No Explanation condition, the Behavioral condition enhanced preference for the smaller individual (Wald $Z = 3.43$, $p < .001$) and the Biological condition reduced it (Wald $Z = -3.05$, $p = .002$). Interactions between age and either condition, relative to the No Explanation condition, did not significantly predict preferences (both $ps > .1$).

Yet, visual inspection of Figure 3 suggests that children's preferences in the Behavioral and No Explanation conditions increasingly diverged across development. To investigate, we conducted separate exploratory analyses on younger (4-7 years) and older (8-11 years) participants using the logistic mixed-effects models with condition as a fixed effect. These analyses revealed that the Behavioral condition increased preferences for the smaller character, relative to no explanation, among older children (Wald $Z = 3.30$, $p < .01$) but not younger children (Wald $Z = 1.63$, $p = .10$). In contrast, the Biological condition reduced preferences for both younger and older children (Wald $Z = -2.25$, $p = .02$; Wald $Z = -1.93$, $p = .05$, respectively), relative to baseline. However, as the primary analyses did not reveal a significant interaction age-condition interaction, and we made no a priori predictions concerning this interaction, we recommend caution in interpreting these results.

Our final analyses focused on adults' preferences. A logistic mixed-effects model did not yield significant effects of either condition (Biological: Wald $Z = -.814$, $p = .42$; Behavioral: Wald $Z = .84$, $p = .40$). Preferences in the Behavioral condition, relative to the No Explanation condition, exhibited the greatest decline from childhood to adulthood (Fig. 3). Exploratory analyses revealed that the impact of the Biological condition relative to baseline was stronger for older children than adults (Wald $Z = -1.96$, $p = .05$), but the impact of the Biological condition did not differ between these groups (Wald $Z = .92$, $p = .36$).

Discussion

This experiment investigated the impacts of biological and behavioral causal explanations for body size on social preferences among children (4-11 years) and adults. We presented participants with a biological or behavioral explanation for body size, or neither, and then assessed their social preferences for smaller versus larger characters. Supporting our

primary predictions, we found that children showed a baseline preference for smaller characters, which was enhanced by behavioral explanations and reduced by biological explanations. No impacts were found on adults' preferences.

While previous research has found correlations between children's controllability beliefs and weight biases (Musher-Eizenman et al., 2004; Tiggemann & Anesbury, 2000), here we demonstrate that behavioral explanations impact bias. (Note, though, that our findings do not preclude impacts in the other causal direction as well; weight bias may also lead people to search for explanations that would justify these attitudes. Indeed, by age five, children hold beliefs that justify their preexisting biases, see Baron & Banaji, 2009). Findings suggest that health education efforts promoting healthy behaviors should remain sensitive to how such messages may also motivate weight bias (Burnette, Hoyt, & Orvidas, 2017). Future research should explore why, precisely, behavioral explanations promoted children's biased preferences. Because children construe behaviors as freely-chosen, behavioral explanations may reveal individuals' values and priorities; nevertheless, it remains unclear why someone not valuing health should provoke such strong interpersonal dislike.

Moreover, while previous research has typically failed to find that biological explanations impact children's social preferences (Anesbury & Tiggeman, 2000; Bell & Morgan, 2000; DeJong, 1993), here we do find this impact. This finding contrasts with arguments from nutrition education researchers that knowledge-based interventions are not effective for children (Contento, 2008; Daniëlsdóttir et al., 2010). The finding also adds to an increasingly complex literature on the consequences of biological causal theories on children's social attitudes. While biological-essentialist intuitions are typically discussed as bias-enhancing (Rhodes & Mandalaywala, 2017 for review), we find that biological explanations *reduce* children's weight

bias. This result characterizes weight bias as similar to homophobia, for which biological theories improve attitudes, at least among adults (Dar-Nimrod & Heine, 2011), and dissimilar to status- and difference-based biases like race and gender biases (despite the fact that overweight individuals may also be viewed as low-status, Vartanian et al., 2013). Weight bias may be based on perceptions of blame, given that one's size may be seen as partly within someone's control, unlike one's race or gender. Under this account, however, it remains unclear why children view larger body sizes as blameworthy in the first place. Future research should explore what distinguishes the biases that biological-essentialism enhances from those that it reduces.

We also found preliminary evidence of developmental differences in the effect of each explanation. Children's reported preferences for smaller characters declined over development, consistent with research on explicit preferences (Raabe & Beelmann, 2011). Relative to participants' baseline preferences, our exploratory analyses suggest that the impact of behavioral explanations on children's preferences for smaller characters increased over development. This might reflect children's increasing receptivity to the notion that behaviors impact body size (Raman, 2014; Slaughter & Ting, 2010); the more children appreciate this, the more they may view unhealthy behaviors as blameworthy. In contrast, the bias-reducing impact of biological explanations remained stable over child development. Although biological-essentialist construals of body size might decline over development (Raman, 2018), this did not correspond with declines in the *impact of* biological explanations.

Given that we did not directly assess children's causal theories in the No Explanation condition, we can only speculate about what reasoning might underlie children's preferences at baseline. Notably, research suggests that even young children may hold both biological and behavioral causal theories of body size. Children as young as four represent body size as

heritable, suggesting a biological-essentialist theory (Raman, 2018), and also understand that eating and exercise behaviors yield bodily change, suggesting a behavioral theory (Raman, 2014; Wellman & Johnson, 1982). At baseline, children may be uncertain about which theory holds, or may hold a hybrid theory incorporating both causes. Children similarly endorse both essentialist and non-essentialist explanations for other identities, such as religion (Heiphetz, Gelman, & Young, 2017). Future research should directly explore children's default theories of body size as they relate to weight bias.

Both behavioral and biological explanations are closely related to notions of controllability. Our behavioral explanation cast body size as in one's control, while the biological explanation cast it as outside of one's control. Importantly, however, the actual causes of body size are more complex than this. For example, eating behaviors might reflect a biological cause (e.g., hunger) or an environmental cause (e.g., presence or absence of food). Similarly, biological make-up is not only inherited and fixed; rather, it may reflect previous behaviors or a temporary or even intentional state (e.g., menopause, pregnancy, medication). Our prompts did not capture these nuances. Indeed, explanations referencing a fixed biological cause might impact bias more than explanations referencing a temporary or intentional cause, or more than the broad biological explanation presented in the current study. However, we think it is unlikely that children interpreted our prompts as more nuanced than the monocausal stories they presented, given that children intuitively construe biological make-up as fixed and determined (Gelman, 2003) and behavior as reflecting free will (Kushnir et al., 2015; Schult & Wellman, 1997). Nonetheless, future research may wish to decouple controllability from biological and behavioral explanations for body size.

Future research might also explore whether the impacts of each explanation reflected shifts in children's ideas about the controllability of body size, or whether they reflected other ideas (such the idea that naturally-occurring phenomena are morally good, or the discounting of still-other explanations for body size – e.g., structural explanations like poverty or beauty norms, see Vasilyeva et al., 2018). Indeed, previous research suggests that even when older children's beliefs about controllability are effectively shifted, this may not translate to shifts in liking (Anesbury & Tiggeman, 2000). Thus, the impact of biological explanations on social preferences may not solely reflect shifts in controllability judgments.

We note that our design does not allow us to distinguish between a preference for smaller individuals or an aversion to larger individuals, as the task involved a choice between smaller and larger characters. Although adults' "anti-fat" attitudes correlate with their "pro-thin" attitudes (Carels & Musher-Eizenman, 2010), some research suggests that they may be distinct (Roddy et al., 2010). At the behavioral level, either mechanism would result in biased behavior; however, future research should address whether, at a conceptual level, causal theories of body size differentially impact each attitude.

As we did not collect information on participants' weight, our findings cannot speak to the role of individual differences. Prior work has found weight bias among children across the weight spectrum (Schwartz et al., 2006). However, exploring relations between intuitive theories of body size and personal experiences is an important area of future inquiry.

In conclusion, we demonstrate that targeting causal-explanatory mechanisms may impact weight bias at its developmental roots. In doing so, we respond to calls for research on the role of causal theories of body size in the development of weight bias (Puhl & Latner, 2007), and we

contribute evidence supporting a long-suggested view that causal explanations may be an important factor in the emergence of this bias (Jarvie et al., 1983).

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Figures

Figure 1. Stimuli referenced during the explanation prompts.

Figure 2. Example of stimuli used in the Preference Task.

Figure 3. Social Preference Task performance as a function of condition and age. Note: While age is depicted categorically to reflect our recruitment strategy, analyses included children's age as a continuous variable.