MALLEABILITY OF IMPLICIT INTERGROUP BIAS ACROSS DEVELOPMENT

by

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ABSTRACT

Implicit intergroup bias emerges early in development and exerts a powerful influence on an individual's social preferences and behaviors across the lifespan. While interventions to change these biases (e.g., racial bias) have been successful in adults, the magnitude of change is still notably small. No studies thus far have investigated whether these biases might be more amenable to change at different periods in development. Two studies examined potential developmental differences in the malleability of implicit bias. The first study examined the formation and malleability of novel implicit attitudes and stereotypes among children ages 5-12. The second study examined the effectiveness of a specific intervention, exposure to counter-stereotypical exemplars, to reduce an existing implicit bias (race attitudes) among similarly aged children. Results indicated that for a novel implicit bias, there were no differences by age in the capacity to form and change implicit associations. In contrast, for an existing implicit bias, exposure to counter-stereotypical exemplars successfully reduced biases for children nine years-of-age and older, but not for younger children. Together, these findings suggest that while the capacity to form implicit associations remains fairly continuous across development, there are nonetheless notable developmental differences in the ability to change such associations. Several potential mechanisms underlying this developmental change will be discussed.
This thesis is based off of work conducted in the Social Cognitive Development Lab at UBC by myself, Dr. Andrew Baron, Dr. William Dunlop, and Dr. Jennifer Steele. For both studies, I was responsible for collecting, analyzing and interpreting the data. Two manuscripts based off of this work have been submitted for publication. The first is based off of Study 1: Baron, A.S., Gonzalez, A.M., & Dunlop, W. Flexibility of Implicit Attitudes and Stereotypes Across Development. I conducted testing, data analyses, wrote the first draft of the manuscript, and made edits on consecutive drafts. Dr. Baron and Dr. Dunlop designed the study and made edits on consecutive drafts. The second is based off of Study 2: Gonzalez, A.M., Steele, J.R., & Baron, A.S. Reducing Children’s Implicit Racial Bias through Exposure to Positive Outgroup Exemplars. I conducted testing, data analyses, wrote the first draft of the manuscript, and made edits on consecutive drafts. Dr. Baron and Dr. Steele designed the study and made edits on consecutive drafts. This research was conducted with the permission of the University of British Columbia Office of Research Studies Behavioral Research Ethics Board, certification number H10-00147, “The Development of Social Cognition.”
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INTRODUCTION

As evidenced by our primate relatives, the origins of intergroup conflict date long before the arrival of homo sapiens (Goodall, 1986; Manson et al., 1991; and Watts & Mitani, 2001). Chimpanzees and humans similarly show distinct patterns of favoritism toward the ingroup and aggression toward the outgroup, a finding that suggests that intergroup cognition, including intergroup conflict, may be part of our evolved psychology adapted for group living as a social species. Indeed, an analysis of human history from the Roman Empire to the Hundred Years’ War to the Rwandan Genocide, similarly underscores the consequences of tension between two or more social groups. These types of groups can range from race, religion, nationality and social class. Presently, this evolved psychology of “us” and “them” also appears to partly fuel the racial, ethnic, and religious conflicts from Ferguson, MO and Baltimore, MD to Ukraine and the Middle East. Are humans destined to destroy those perceived as a threat to their ingroup or can the knowledge of our social psychology be harnessed to foster greater tolerance and improved intergroup functioning?

One important barrier to tolerance and intergroup cooperation is implicit, or unconscious prejudice against out-groups. As such, research has sought to identify effective strategies to change such biases. A number of studies have shown that implicit intergroup biases can be successfully reduced in adults (for a review, see Lai, Hoffman & Nosek, 2013). For instance, researchers have found that interventions that promote direct (e.g., personal contact with outgroup members) and indirect (e.g., reading information about counter-stereotypical exemplars) contact can reduce intergroup bias (Dasgupta & Greenwald, 2001; Foroni & Mayr, 2005; Gonsalkorale, Allen, Sherman, & Klauer, 2010; Pettigrew & Tropp, 2006). Unfortunately, the
magnitude of implicit change is relatively small among adult samples, suggesting that adulthood might not be the optimal period in development for implicit change (Baron, 2015).

The limited success with changing adults’ implicit intergroup bias has led researchers to ask whether more flexibility would be observed earlier in development, perhaps before such cognitions have been extensively reinforced. However, studies with children across numerous social categories and methodologies suggest that implicit intergroup bias undergoes little, if any, age-related change from age five onward (Baron, 2015; Baron & Banaji, 2006; Baron, Schmader, Cvencek & Meltzoff, 2014; Dunham, Baron, & Banaji, 2008; Dunham, Chen, & Banaji, 2013; Heiphetz, Spelke, & Banaji, 2013; McGlothlin & Killen, 2006; Rutland, Cameron, Milne, & McGeorge, 2005). This reported stability may simply demonstrate that children and adults are similarly attuned to the prevailing cultural attitudes toward and stereotypes about social groups (Olson & Fazio, 2004), rather than revealing anything about potential developmental differences for such biases to be changed. The present research will address this gap in the literature by looking at the malleability of implicit intergroup bias across development.

**Reducing Implicit Bias in Adults**

To date, studies attempting to reduce implicit intergroup bias have focused on adults. A number of methods have been used in an attempt to reduce implicit prejudice in this population, and these strategies fall into three major categories: retraining implicit associations (e.g. evaluative conditioning, intergroup contact), shifting the context of evaluation (e.g. exposure to counterstereotypical exemplars, affect induction), and using motivational and behavioral strategies (i.e. any strategy intentionally shifting motivations and goals as a method of reducing bias; Lai et al., 2013). In a comparison of these different methods, Lai and colleagues (2014) found that the most effective techniques of reducing implicit bias were exposure to
counterstereotypical exemplars, evaluative conditioning, and providing strategies to override bias. Though these methods successfully reduced implicit bias down to control levels, they did not manage to reverse these biases. Thus, it could be the case that the lack of implicit bias demonstrated might simply be a reflection of individuals holding more than one association in mind simultaneously, rather than an elimination of previous bias.

These patterns of bias reduction are similar to work with adults showing that novel implicit associations can be reduced after learning contradicting information, but they are not reversed (Gregg, Seibt, & Banaji, 2006). After reading a short vignette about a novel group engaging in a number of actions, individuals had implicit evaluations of a novel social group that were congruent with the valence of the learned information. Even these weakly supported biases (in comparison to existing biases) proved more difficult to reverse than to learn, suggesting that this may be an inherent property of implicit biases. Additionally, this study on novel implicit biases highlights the importance of first impressions on the formation of implicit associations.

**Developmental Differences in the Malleability of Implicit Bias**

There are a number of hypotheses that posit the optimal period in development for changing implicit intergroup bias. On one hand, implicit bias might be most amenable to change during early childhood when such cognitions initially form and before they have been extensively reinforced through experience (Devine, 1989; Greenwald & Banaji, 1995, Rudman, 2004). Novel biases, though difficult to reverse, can be reduced significantly immediately following their initial formation (Gregg et al., 2006). There is robust evidence that children have acquired implicit racial bias by age five (Baron, 2015; Dunham et al., 2008), and according to this view, age five or earlier might be the optimal period to shape the magnitude of these attitudes.
On the other hand, discoveries in cognitive developmental neuroscience would predict that implicit bias might be more amenable to change among older children. Specifically, the development of the prefrontal cortex, and related increases in executive functioning with age, may play a pivotal role in the mechanisms involved in changing implicit biases (Davidson, Amso, Anderson & Diamond, 2006; Halim, Ruble & Amodio, 2011). One such mechanism is cognitive flexibility (Aboud, 2005; Aboud & Amato, 2001; Bigler & Liben, 2006), which might allow an individual to shift their evaluations of a racial group after being presented with contrasting information about that group (Lai et al., 2014). Thus, in comparison to younger children, children in later childhood might be more capable of integrating counter stereotypical information with their prior beliefs. As noted earlier, although adults are capable of changing their implicit biases, these modifications are generally quite small. Despite the fact that cognitive flexibility continues developing into adulthood, older children might have an easier time changing implicit biases than their adult counterparts because they have received comparatively less reinforcement of the prevailing cultural attitudes about social groups. As such, it remains an open question whether developmental differences exist in the capacity to change implicit bias among children.

**Malleability of Implicit Bias Across Domains**

In addition to developmental differences, there might be potential differences in the malleability of implicit intergroup biases across different domains (race, gender, etc.) The majority of work with adults on reducing implicit bias has focused on racial bias (Lai et al. 2014). However there may be distinct differences in the malleability of biases across domains, depending on how entrenched these biases are. These differences might be compounded across age, as various biases emerge at different points in development. For example, race bias might be
earlier to change in childhood than gender bias, as children’s understanding of race as a social category is acquired later than their understanding of gender.

Furthermore, there could be potential differences based on association type. Specifically, there is a rich discussion concerning the distinction between evaluative and non-evaluative associations and whether these association types constitute separate constructs. One perspective argues that evaluative associations, often referred to as implicit attitudes, tap into different mental processes and neural systems than non-evaluative associations (or implicit stereotypes) (Amodio & Devine, 2006). In particular, Amodio and Devine (2006) demonstrated that these two association types are uncorrelated and predict different types of behavior. Whether the capacity to form and change such associations differs across these two types has yet to be determined.

Another dimension along which implicit associations may differ in their capacity to form and change concerns the object of the association. In particular, children and adults appear to reason differently about social and non-social categories. Most notably, social categories are frequently treated as natural kinds, and viewed as having an underlying ‘essence’ that might explain category similarities (Diesendruck & Gelman, 1999; Gelman & Hirschfeld, 1999; Rothbart & Taylor, 1992) and related work shows that when a group is essentialized it can be more difficult to change associations with that group (Walton & Banaji, 2004). In contrast, non-social inanimate categories (e.g., artifacts) are not afforded the same internal (essentialized) structure (Gelman, 1988; Gelman & Markman, 1986; Keil, 1995; Rhodes & Gelman, 2009). Thus, it might be more difficult for children to change implicit associations about social groups as opposed to non-social groups.
The Present Research

In our first study, we sought to investigate a) whether there are developmental differences in the capacity to form and change implicit intergroup biases and b) whether the capacity to form and change implicit biases is domain-general or domain-specific. Our method is a modification of the one used by Gregg, Seibt, & Banaji (2006), which found that implicit associations in adults formed quickly, but were not reversed as easily. Specifically, we employed a 2x2 design manipulating whether participants learned either novel attitudes or novel (non-evaluative) stereotypes that were associated with either social or non-social categories. We used a Novel Groups paradigm to control for prior experience (Baron, Dunham, Banaji, & Carey, 2014; Foroni & Mayr, 2005; Gregg, Seibt, & Banaji, 2006), since studying familiar groups presents a confound between age and prior experience, both of which may independently shape the possibility of change.

Similar to Gregg et al. (2006), children were first taught an initial association, and this association was measured implicitly to assess the strength of formation. Subsequently, an intervention designed to change the initial association was introduced, and the resulting degree of association change was measured. If the acquisition of implicit associations is the product of a domain-general mechanism (e.g., associative learning), then we should expect to see no differences across association type (social/non-social; evaluative/non-evaluative) in the formation of the initial association or in the amount of change observed after a targeted intervention. In contrast, if domain differences are observed (e.g., evaluative associations about social groups are more difficult to change than evaluative associations about non-social inanimate objects), then this would suggest that multiple processes are involved in establishing different kinds of implicit representations.
In summary, Study 1 will provide novel evidence as to whether or not the capacity to form novel implicit associations varies across childhood and early adolescence, as well as how quickly implicit associations can be formed following just a few examples. Furthermore, this study will indicate whether or not children are equally likely to form a novel implicit association regardless of type (social/non-social and evaluative/non-evaluative), a finding that will suggest if the process underlying this capacity is domain-general.

Additionally, these results will be comparable to previous research conducted with adults suggesting that implicit attitudes are easy to form and harder to change (Gregg et al., 2006; Lai et al., 2014), regardless of when in life they are first learned. Thus, evidence of continuity between our findings and those observed with adults would underscore the possibility that the mechanism(s) governing implicit associative learning may be fully intact by age five. In contrast, developmental differences in our study would suggest that when controlling for exposure to biases, differences in cognitive flexibility might impact how quickly implicit associations form and change.

In our second study, we sought to investigate a) whether the method of exposure to counterstereotypical exemplars can be used to reduce intergroup bias in children and b) whether or not there are differences across childhood in the malleability of existing implicit bias. Because implicit racial bias is the type of intergroup bias that has been most commonly studied among adults, we decided to use this type of bias, specifically a preference for White over Black individuals, to test this question. We chose to expose our participants to counter-stereotypical exemplars, an intervention method that has been used successfully to change implicit racial bias among adult populations (Dasgupta & Greenwald, 2001; Foroni & Mayr, 2005; Gonsalkorale et al., 2010; Lai et al., 2014) as well as similarly aged children’s explicit bias (Baron et al., 2014).
Through the use of vignettes, this method exposes participants to Black individuals who are represented in a very positive frame; a depiction that contrasts with the larger cultural messages that contribute to the stigmatization of African Americans (Eberhardt, Goff, Purdies & Davies, 2004; Fujioka, 1999; Mastro & Greenberg, 2000). We used this method to examine whether a brief exposure to positive Black exemplars would reduce implicit racial bias among children. Our study only included children of Caucasian and Asian ethnicity, two groups that display clear implicit preference for White individuals over Black individuals (Dunham, Baron & Banaji, 2006; Steele, Williams, George, & Tay, 2015) and who represent the culturally higher status groups in our community. As there is a dearth of research on potential developmental differences in the malleability of implicit associations, we compared the effectiveness of our intervention in younger (early to middle childhood) and older (late childhood to early adolescence) children.

The results of Study 2 will demonstrate whether or not exposing children to counter-stereotypical exemplars is an effective way to reduce implicit racial bias. If all children show a lack of pro-White bias following our intervention in which stories about four positive Black exemplars were read, as well as significantly less bias in comparison to both a social (identical stories with White exemplars) and a non-social (comparably valenced stories about flowers) control group, this will suggest that this manipulation is effective across the developmental age range of 5-12. However if we do find differences between younger and older children, this would suggest that when changing existing and entrenched implicit biases, there are optimal developmental periods for reducing these biases.

The results of our study will also be comparable to previous research suggesting that adults’ implicit racial biases can be reduced using brief interventions that expose them to positive
Black exemplars (Lai et al., 2014). The efficacy of this intervention is attributed to shifting the social context to emphasize individuals who contrast with usual stereotypes. It is possible that our intervention operates through a similar mechanism for children. However, this explanation will depend somewhat on the ages at which this intervention is most effective.

Coupled together, these two studies will provide important insight into the malleability of implicit biases, both novel and existing, throughout childhood. The results of the first study will shed light on the malleability of implicit associations when controlling for exposure, and will help to identify possible developmental differences in sensitivity to these biases (in formation and change). The second study will complement the first by exploring the malleability of existing associations, as well as testing the effectiveness of an intervention to reduce implicit race bias in children. If there are differences between these two studies, these results will help us to identify the developmental mechanisms that might be facilitating or hindering the reduction of implicit bias.
STUDY 1

The goal of Study 1 was to examine potential developmental differences in the formation and change of novel implicit associations in children ages 5-14, as well as possible differences in the malleability of these associations across domains.

Method

Participants. The full sample consisted of 1272 participants (676 males and 594 females, $M_{\text{age}} = 8.29$ years, $SD = 2.06$). From these participants, 236 children were excluded for failing to complete the task ($N = 178$), language barriers ($N = 11$), interference by a parent or sibling ($N = 28$), developmental issues ($N = 12$) or experimenter/computer error ($N = 7$). For each condition our goal was to recruit 150-200 participants spread across our age range in order to conduct meaningful age comparisons. Our end sample consisted of 1036 participants ($M_{\text{age}} = 8.61$). Out of these participants, 489 participants were female. Additionally, the ethnic breakdown of our sample was as follows: 62% ($N = 643$) identified as Caucasian, 19.5% ($N = 203$) of our sample identified as Asian, 8% ($N = 85$) identified as a race besides Asian or Caucasian, 8% ($N = 82$) identified as mixed race, and 14 participants did not report their race or ethnicity.

Unexpected frequencies in subject testing in our laboratory, which is located in a community-based science center where the number of participants can vary considerably day to day, resulted in us exceeding our stopping criteria in two of our conditions (Social Evaluative and Social Non-Evaluative). All participants were recruited from a local children’s museum and tested onsite in an area dedicated to behavioral research. A legal guardian provided informed consent for all participants.

Procedure. All participants were tested individually on a computer running Inquisit™ version 4.0. An experimenter was present throughout the duration of the task and read the
instructions to each participant. Participants were randomly assigned to one of four conditions: Social Group Evaluative, Social Group Non-Evaluative, Non-Social Group Evaluative, and Non-Social Group Non-Evaluative. Participants were first presented with a story describing two novel groups (either social agents or non-social inanimate objects) in which one group co-occurred with evaluative behaviors (e.g., hurting someone) or non-evaluative behaviors (e.g., eating cookies). Next, participants completed an implicit measure of attitude (or stereotype) assessing the strength of association between the target groups and behaviors just learned.

Subsequently, participants were introduced to a second story in which the same novel group as before was now associated with counter attitudinal (or counter-stereotypical) behaviors (e.g., being nice or only eating French Fries) with an equal number of examples. Finally, participants completed the same implicit measure of association as before. Such a design uniquely positions us to measure whether developmental differences exist in both the formation and change of implicit attitudes and stereotypes. Additionally, we are able to assess whether this question is dependent upon the nature of the association (evaluative or non-evaluative) or upon the target of these associations (social or non-social groups).

*Formation Story Manipulation.* All participants began by hearing a story with accompanying illustrations. In the two Social Group conditions, participants were introduced to two novel social groups, the Lups and the Nifs. In the Social Group Evaluative condition, participants learned that one of these two groups engaged in either prosocial (e.g., helping others) or antisocial behaviors (e.g., pushing someone). In the Social Group Non-Evaluative condition, participants were introduced to the same novel social groups (the Lups and the Nifs), and then observed individuals from one of those groups repeatedly exhibiting a preference for eating a particular food (e.g., either cookies or French fries).
In the Non-Social Group Evaluative condition, participants were introduced to two novel inanimate object categories (purple balls and red balls) and learned that one group of balls was repeatedly (but non-causally) associated with either positive (e.g., preventing someone from getting hurt) or negative events (e.g., rolling over someone’s foot). In the Non-Social Group Non-Evaluative condition, these novel inanimate groups of balls were described whereby one group was repeatedly associated with the consumption of a particular food item (e.g., purple balls co-occurring with the consumption of cookies). See Appendix A for the full text of each story.

For each story type there were two versions (e.g., Evaluative: one describing positive behaviors, one describing negative behaviors; Non-Evaluative: one concerning the consumption of cookies and one concerning the consumption of French fries), counterbalanced in order across participants. To avoid describing the inanimate balls in a manner that could invite the construal of these objects as causal agents (akin to people), the story text was slightly longer in all four conditions describing the purple and red balls. See Appendix B for accompanying illustrations of the Lups, Nifs, purple balls, and red balls.

Implicit Association Formation. Following the presentation of the Formation Story, participants’ implicit associations were measured with the Child Implicit Association Test (Child IAT; Baron & Banaji, 2006). The Child IAT assesses the strength of association between a target category (Social Group conditions: the Lups and the Nifs; Non-Social Group conditions: purple balls and red balls) and an attribute (Evaluative conditions: good and bad words; Non-Evaluative conditions: images of cookies and French fries). During the Child IAT, participants used two large buttons attached to a computer to classify pictures as belonging to one of two target

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1 Pretesting of the four versions of stories including purple and red balls ensured children at no age viewed the balls as causal agents.
categories (e.g., as Lups or Nifs or as purple balls and red balls). Next, participants used the same
two buttons to classify words as either good or bad or to classify pictures as either cookies or
French fries. As in previous studies (Baron & Banaji, 2006; Dunham, et al., 2006, 2007, 2008),
for the Evaluative conditions, words were presented acoustically through headphones.

During the critical (test) blocks, participants were asked to use the same two buttons to
classify stimuli from both the target and attribute categories. For half the trials \((N = 40)\) the same
response key was used to categorize images from one target group (e.g., Lups) and stimuli from
one attribute group (e.g., good words) while the other response key was used to categorize
images from the other target group (e.g., Nifs) and stimuli from the other attribute group (e.g.,
bad words). For the other half of trials \((N = 40)\), the pairings switched such that now one
response key was used to categorize a different group of stimuli (e.g., Nifs+good words) while
the other key was used to categorize the other group of stimuli (e.g., Lups+bad words). Error
rates and latency to categorize each stimulus were recorded. The assumption of this procedure is
that the stronger the association between two concepts (e.g., Lups+good, Nifs+bad), the faster
and more accurate participants will be to categorize those stimuli when they share a single
response key compared with when they share separate response keys (e.g., Lups+bad,
Nifs+good). The order of pairings was counterbalanced across participants. See Appendix C for
an example of the Child IAT set-up.

Change Story Manipulation. Following the first IAT, participants were presented with a
second story in which counter-attitudinal or counter-stereotypical information was presented.
Thus, if participants first learned about the Lups engaging in antisocial behavior during the
Formation Story, they now learned that Lups engaged in prosocial behavior during the Change
Story. If participants previously learned that Lups consistently ate cookies, they now learned that
Lups consistently ate French fries. If participants initially learned that purple balls covaried with negative events, they now learned that purple balls covaried with positive events. And, if they initially learned that purple balls covaried with the consumption of cookies, they now learned that purple balls covaried with the consumption of French fries. The number of associative pairings between the target group and attribute was identical across each story type for each participant.

*Implicit Association Change.* Following the Change Story, participants completed the same IAT as before in order to assess the change in association strength following the two stories.

**Results**

The following data were analyzed using the same scoring procedures outlined by Greenwald, Nosek, & Banaji (2003) and employed with children (Baron & Banaji, 2006; Cvencek, Meltzoff, & Greenwald, 2011; Dunham et al., 2006), producing individual D-scores for each participant. IAT values (for the first and second IAT administered) were coded in accordance with the initial association children had been taught, such that higher D-scores corresponded with a stronger association congruent with the examples provided in the Formation Story. Thus, if the IAT scores at Time 2 were reduced compared with those observed at Time 1, then this meant there was a reduction in association strength from what was first established. Coding the data this way allowed us to compare the magnitude of IAT scores across conditions and across measurement times.

*IAT Exclusion Criteria.* Our initial sample included 1036 subjects between the ages of 5 and 14 (\(M = 8.6\) years, \(SD = 1.99\)). Following convention, participants with more than 25% errors or with greater than 25% of their response latencies occurring under 300 ms were excluded (Baron & Banaji, 2006; Cvencek et al., 2011; Dunham et al., 2006). These exclusions
were performed separately for the two different IAT analyses since we were testing two different hypotheses (one concerning formation and one concerning change). To examine questions concerning formation we used only exclusion criteria from the first IAT. To examine questions concerning change, we used applied these exclusion criteria to both IATs.

**Implicit Association Formation.** Of the children who completed this test, 193 children were excluded based on the criteria described above, resulting in a sample of 843 participants (ranging from 140 to 243 in each condition). We wanted to test whether participants formed an implicit association that was consistent with the Formation Story. To test this, we averaged the data across all conditions, and tested this value against chance. Children formed an implicit association congruent with what was presented in the Formation Story ($M = 0.13$) and the strength of this association was significant, $t(839) = 7.93, p < .001$, Cohen’s $d = .55$. See Figure 1 for means by condition at Time 1.

**Figure 1.** Mean IAT D-scores after Formation Story (Time 1) and Change Story (Time 2) by Condition. Error bars represent standard errors.
In addition to testing the strength of the initial association, we wanted to investigate possible differences in IAT scores at Time 1 based on a) Group Type (social or non-social), b) Association Type (evaluative or non-evaluative) and c) age of the child. We tested these potential differences using a 2x2 ANCOVA (with age entered as a covariate). There was no significant main effect of Group Type, \( F(1,835) = 0.35, p = .55, \eta^2_p < .001 \), or Association Type, \( F(1,835) = 0.03, p = .87, \eta^2_p < .001 \). However, there was a significant interaction between Group Type and Association Type, suggesting possible differences in the strength of association formation based on these two category types, \( F(1,835) = 4.29, p = .04, \eta^2_p = .005 \). Simple main effects analyses indicated a marginally significant difference between participants in the Non-Social Non-Evaluative \( (M = 0.18) \) and Social Non-Evaluative \( (M = 0.09) \) conditions \( (p = .06) \). Overall, participants across conditions formed implicit associations of similar magnitudes, but associations were weakest when social objects were paired with a non-
evaluative association, and strongest when non-social objects were paired with a non-evaluative association.

Age was not found to be a significant covariate in the ANCOVA, $F(1, 835) = 1.05, p = .31, \eta_p^2 = .001$, suggesting that the capacity to form a novel implicit association does not change between ages 5 and 14. To further explore potential age related differences, we performed a bivariate correlation between age and IAT score (collapsing across conditions) and again no relationship with age was observed, $r(840) = -.04, p = .27$. Thus, these data show that across this wide age range, implicit associations are quick to form regardless of association type or a child’s age.

**Implicit Association Change.** In order to investigate change in implicit association strength following the second story, we examined whether children’s IAT scores at Time 2 were different in both direction and magnitude from their scores at Time 1. Once again, we applied traditional IAT exclusion criteria, which resulted in the exclusion of 222 participants and a final sample of 814 children (ranging from 151 to 258 in each condition). Results indicated that children’s associations were not significantly different from chance, suggesting that at Time 2, children’s initial associations were weakened, but not reversed, $t(810) = .80, p = .42$, Cohen’s $d = 0.06$. See Figure 1 for means by condition at Time 2.

To examine change from Time 1 to Time 2, we applied exclusion criteria for both the first and second IAT (as before, more than 25% errors or with greater than 25% of response latencies occurring under 300 ms), resulting in a total of 764 participants for these analyses (ranging from 140 to 243 in each condition). We first performed a paired samples t-test comparing the D-scores (across all conditions) at Time 1 and Time 2. Results showed that there was a significant difference between Time 1 D-scores ($M = .13$) and Time 2 D-scores ($M = .01$),
indicating that children’s associations were significantly reduced after hearing the change story, $t(761) = 6.01, p < .001$, Cohen’s $d = 0.44$.

In order to test whether implicit change differed as a function of condition or age, a mixed factorial ANCOVA was conducted. IAT test time was entered as a within-subjects variable in order to look at differences between the first IAT score (Time 1) and the second IAT score (Time 2). Again, Group Type and Association Type were entered as between-subjects variables and age was entered as a covariate in order to explore potential differences by age and category type. These analyses showed that age was not a significant covariate, $F(1,757) = 1.24, p = .27, \eta_{p}^2 = .002$, suggesting that the degree of association change did not differ across our age range. In addition to this analysis, we performed a bivariate correlation between age and an IAT difference score (which was calculated by subtracting the second IAT score from the first). This analysis confirmed that there was no relationship between age and the degree of association change, $r(647) = -.01, p = .83$.

There was also no significant main effect of Group Type, $F(1,757) = 1.30, p = .26, \eta_{p}^2 = .002$, or Association Type, $F(1,757) = 0.00, p = .99, \eta_{p}^2 < .001$. However, a three-way interaction between association change, Group Type and Association Type was observed, suggesting that there were some differences in the degree of association change based on condition, $F(1,757) = 4.41, p = .04, \eta_{p}^2 = .006$. Simple main effects analyses indicated that in the Social Evaluative ($p < .001$), Social Non-Evaluative ($p = .03$) and the Non-Social Non-Evaluative ($p = .001$) conditions, change in association strength from Time 1 to Time 2 was significant. In contrast, Non-Social Evaluative condition ($p = .13$), association change was only marginally significant. These results suggest that the degree of association change differed somewhat depending on condition, but overall, in most conditions, there was change from Time
1 to Time 2. However, as indicated by the reported effect sizes, these changes were very small. Though the magnitude of change differed by condition, all effects were a reduction in implicit association strength. These results, coupled with the analyses from both IATs, suggest that our intervention was enough to reduce associations to chance levels. However, associations were not reversed, indicating that the initial association was not changed as easily as it formed.

**Discussion**

These findings provide evidence that the capacity to form novel implicit associations does not vary across childhood and early adolescence. Further, implicit associations can be formed surprisingly fast, following just a few examples. Children were equally likely to form a novel implicit association regardless of type (social/non-social and evaluative/non-evaluative), which indicates that the process underlying this capacity may be domain-general. Considering this period of development is marked by substantial cognitive maturation, it is noteworthy that age did not predict the capacity to form or change implicit associations. Thus, these data support the view articulated by Rudman and colleagues (2007) that implicit associations are particularly sensitive to first impressions and not necessarily as sensitive to the age when such associations are formed.

Additionally, we found that even after presenting children with information that was contrary to their initial associations, their associations were attenuated, but not reversed. These results are consistent with previous research conducted with adults suggesting that implicit attitudes are easy to form and harder to change (Gregg et al., 2006; Lai et al., 2014), regardless of when in life they are first learned. Thus, evidence of continuity between our findings and those observed with adults further underscores the possibility that the mechanism(s) governing implicit associative learning may be fully intact by age five and that asymmetric malleability, the
tendency to form associations more easily than they are reversed (see Gregg et al., 2006), may be a core property of implicit cognition that is developmentally continuous. Even though some differences in the degree of implicit association change were observed based on group type, the effect sizes are quite small, suggesting that the trajectory of change is relatively similar for social and non-social groups as well as for evaluative and non-evaluative associations.

The nature of our vignettes indicate that simply pairing objects in a non-causal manner (e.g., balls of a similar color that covary with helping actions or with consumption of a certain food type) led to the formation of an implicit association just as readily as learning about the causal intentional behavior of agents. These findings showcase just how simple and automatic this system is and complement research demonstrating that both implicit and explicit attitudes can be induced in children and adults through associative learning (e.g. classical conditioning; Field, 2006; Olson & Fazio, 2001) and through propositional processes. However, the representational status of what children learned remains an open question. Future research will need to examine whether these newly learned concepts are represented as associative or propositional structures (Mandelbaum, 2014). Moreover, research should also examine whether potential developmental differences in the structure of these implicit representations (associative or propositional) bears on the effectiveness of different types of interventions.
STUDY 2

The goal of Study 2 was to test whether exposure to counterstereotypical exemplars can successfully reduce children’s implicit racial bias and to examine the malleability of existing implicit biases across development. While Study 1 looked at novel implicit associations, Study 2 focuses on existing implicit associations, and possible age differences in the malleability of implicit associations when they are more entrenched.

Method

Participants. A total of 493 children between 5-12 years (245 males and 248 females, $M_{age} = 8.57$ years, $SD = 1.66$) were recruited from a community based science center and tested onsite in a soundproof room dedicated for behavioral science research. The nature of this community-based laboratory required experimenters to test any participant who visited the lab and expressed interest in participating. As a result, we tested a number of children who did not meet our screening criteria of ethnic group membership. Specifically, ninety-one children were excluded for not meeting our criteria for ethnic identification, which required being a member of one of the majority (and culturally higher status) groups in Vancouver (either White or Asian, Statistics Canada, 2006). An additional 39 children were recruited but were excluded due to failing to finish the study ($N = 33$), a profound language barrier ($N = 1$), experimenter error ($N = 2$), technical difficulties ($N = 2$) or parent interference ($N = 1$). Prior to the start of the study we aimed to test 40 participants per condition for each age (e.g., 5-year-olds, 6-year-olds, 7-year-olds, etc.), however, due the constraints of our testing location, this target was only approximately met for each age. A legal guardian provided consent for all participants.

Procedure. Participants were tested individually. The experimenter read all instructions aloud to each participant and Inquisit™ version 4.0 was used to present the study. Participants
were randomly assigned to one of three conditions where they heard four positive vignettes. Depending on the condition, these vignettes were about Black individuals, White individuals, or flowers. Children who heard about Black individuals were in our intervention condition since positive exemplars from this group represent a counter-stereotypical portrayal given the broader cultural messages that children receive about this group. The flower condition was our main control condition where we presented participants with the same number of vignettes about different flowers designed to induce a positive mood similar to being exposed to positive statements about a person. Because our participants were expected to have a baseline level of implicit pro-White (versus Black) bias, the condition where children were exposed to positive White exemplars served as an additional control condition as this information is congruent with broader cultural stereotypes. Following the presentation of the vignettes, participants completed a child-friendly Implicit Association Test (Child IAT; Baron & Banaji, 2006) to measure their implicit attitudes toward the racial categories White and Black.

**Vignettes.** Each participant was read four vignettes. For each vignette in the Black and White conditions, children were introduced to a unique exemplar from that racial group and were told several positive facts about that individual (e.g. “This is James. James lives in North Vancouver where he is a fire fighter. James is an excellent fire fighter and is working hard to become fire chief. Every time he's on the job James works hard to make sure that fires are prevented and that people stay safe. He even volunteers in schools where he teaches children about the importance of fire safety on camping trips. When James is not fighting fires, he likes to watch sports on TV and to coach hockey and soccer,” see Appendix D for the full text of these vignettes). A photograph of a unique individual in their late 20s to early 30s accompanied each vignette. For two of the vignettes, participants learned about a male exemplar and for the other
two vignettes participants learned about a female exemplar. While the pictures of the individuals differed across the Black and White conditions, the descriptions were the same. All 8 photographs were matched for age and attractiveness. In the main control condition, participants heard vignettes about four different types of flowers (tulips, daffodils, sunflowers, roses) one at a time. These vignettes included facts about the different flowers, as well as positive uses of the flower. These control vignettes also included a photograph of the flower and were designed to match the other two conditions in terms of positive affective valence and length (4-5 sentences).

Child Implicit Association Test. The physical set-up of the Child IAT was identical to Study 1 (see Appendix C). In this IAT, participants first began by categorizing faces as either Black or White. In each of these practice trials, a face appeared one at a time in the middle of the screen and participants were instructed to identify as quickly and accurately as possible whether the face was Black or White. There were a total of 12 such practice trials (6 Black faces and 6 White faces). Next, participants practiced classifying words into the categories good and bad. A smiling and frowning face were positioned on each reminder bar and for 20 trials participants heard 10 good words and 10 bad words and were similarly asked to categorize them as quickly and accurately as possible.

Following these two practice blocks, children completed a critical test block of trials used to compute their association strength. In these trials ($N = 30$) children used the same buttons to classify an attribute (good/bad) and a target category (Black/White) (e.g., Black+bad shared one key and White+good shared another). Children then completed another practice block ($N = 20$), where they were again asked to classify pictures only, but the sides of the target categories was reversed. In the final test block ($N = 30$), children again used the same buttons to classify attributes and target categories, but this time, the pairing of the attributes and target categories
were switched (e.g., White+bad, Black+good). The side for target categories and attributes were
counterbalanced across conditions.

Results

Consistent with previous work, children with more than 25% of their response latencies
under 300 ms were excluded from the analyses (Baron & Banaji, 2006). Four children were
excluded for this purpose, resulting in a final sample of 359 participants. As this is the first study
to examine whether there are developmental differences in the malleability of implicit racial bias
following an intervention, we performed a median split ($Md = 8.39$ years), dividing our sample
into two age groups (a younger group, $M_{age} = 7.36$, $N = 180$, and an older age group, $M_{age} = 9.94$,
$N = 179$). Our final sample consisted of 257 participants who identified as Caucasian and of 102
participants who identified as Asian.

For each participant, an IAT D-score was calculated using the guidelines used in Study 1. Our data were coded such that a positive score indicated implicit preference for White
individuals over Black individuals, and a negative score indicated an implicit preference for
Black individuals over White individuals.

*Implicit Racial Bias.* To examine our primary question of whether the magnitude of
children’s implicit racial bias was affected by exposure to positive Black exemplars, we
conducted a 2 (Age group: Younger or Older) x 3 (Condition: Black, Flowers, White) x 2 (Ethnic
group: Caucasian or Asian) ANOVA with the IAT D-Score entered as the dependent variable.
There was no main effect of Age group, $F(1,347) = 0.56$, $p = .45$, $\eta^2_p = .002$, Condition, $F(2,347) = 0.82$, $p = .44$, $\eta^2_p = .005$, or Ethnic group, $F(1,347) = 0.004$, $p = .95$, $\eta^2_p < .001$, on children’s
IAT score. However, there was a significant interaction between Age group and Condition,

\[2\] Subsequent analyses indicated that results were comparable, even when age groups were
divided based on years (ages 5-8 and ages 9-12; see Supplementary Materials).
\[ F(2,347) = 5.92, p = .003, \eta_p^2 = .03 \] (see Figure 2). No other interactions were significant, \( Fs < 2.31, ps > .10 \).

**Figure 2.** Mean IAT scores by Age Group and Condition. Standard errors are represented by the error bars.

In order to examine this interaction, we conducted follow-up ANOVAs for younger and older children separately. For younger children, there was no effect of condition, \( F(2,180) = 1.93, p = .15, \eta_p^2 = .02 \). As a group, younger children showed an implicit pro-White bias (\( M = 0.05 \)) that was significantly different from chance, \( t(179) = 3.81, p < .001, \) Cohen’s \( d = 0.57 \). For older children, however, there was a main effect of condition, \( F(2,173) = 5.24, p = .006, \eta_p^2 = .06 \). Post-hoc analyses revealed that older children in the Black exemplar condition (\( M = 0.01 \)) showed significantly less bias than older children in the Flower (\( M = 0.09; p = .02 \)) or White (\( M = 0.11; p = .004 \)) control conditions; bias in these control conditions did not differ (\( p = .90 \)).
Moreover, consistent with the hypothesized effectiveness of the intervention after being exposed to positive Black exemplars, older children’s mean level of bias was not significantly different from chance, indicating that they did not show implicit pro-White bias following this intervention. \( t(61) = 0.43, p = .67, \) Cohen’s \( d = 0.11 \). By contrast, children assigned to Flower, \( t(58) = 4.05, p < .001, \) Cohen’s \( d = 1.06 \) and White, \( t(57) = 4.80, p < .001, \) Cohen’s \( d = 1.26 \), control condition showed an implicit preference for White relative to Black, consistent with findings from the broader literature on children’s implicit race bias. Simple effects analyses also indicated that there was a significant difference between the younger \( (M = 0.07) \) and older \( (M = 0.01) \) age groups in the Black condition \( (p = .03) \). Older children showed significantly less implicit bias than younger children after being exposed to Black exemplars, suggesting that this intervention was more effective for children over the age of eight.

**Discussion**

Our results suggest that exposing children to counter-stereotypical exemplars is an effective way to reduce implicit racial bias for older children. These children showed a lack of pro-White bias following a brief intervention in which stories about four positive Black exemplars were read, and they showed significantly less bias in comparison to both a social (identical stories with White exemplars) and a non-social (comparably valenced stories about flowers) control group. Older children in this condition also showed significantly lower levels of bias compared with younger children, despite the pervasive finding in the literature that both older and younger non-Black children (from the United States, the United Kingdom, South Africa and Canada) typically show pro-White biases of comparable magnitudes (Baron & Banaji, 2006; Dunham et al., 2006; Newheiser & Olson, 2012; Rutland et al., 2005; Williams & Steele, 2015).
Previous research suggests that adults’ implicit racial biases can be similarly reduced using brief interventions that expose them to positive Black exemplars (Cohen’s $d = .38$; Lai et al., 2014). Studies have shown that exposing participants to famous admired Black exemplars and disliked White exemplars reduces implicit pro-White bias (Dasgupta & Greenwald, 2001; Joy-Gaba & Nosek, 2010). This effect of coupling positive Black exemplars and negative White exemplars has been used in other studies with adults to successfully decrease bias, suggesting that this is an effective method of temporarily changing implicit associations (Lai et al., 2014; also see Lai, Hoffman, & Nosek, 2013 for a review). The efficacy of this intervention is attributed to shifting the social context to emphasize individuals who contrast with usual stereotypes. On one hand, as our study showed that this type of manipulation decreases older children’s biases, it is possible that our intervention operates through a similar mechanism for children. On the other hand, it is also possible that older children might be forming novel associations about these racial groups, rather than activating subtypes of their existing associations.

Interestingly, our intervention did not successfully reduce bias in younger children, a finding that highlights possible developmental differences in the malleability of implicit associations. As discussed previously, research provides evidence that older children have more cognitive flexibility due to the increased development of the prefrontal cortex and corresponding changes in executive function (Davidson, Amso, Anderson & Diamond, 2006; Halim, Ruble & Amodio, 2011). As a result, it may be easier for these children to change their evaluations of a racial group after learning counter-stereotypical information about that group.

Additionally, these results might bear on the representational structure of implicit biases (Mandelbaum, 2014). Associative structures are defined as mental representations that link two
concepts: When one concept is brought to mind, the other follows (e.g. Sally – Salt). Additionally, these concepts can be activated in conjunction even if the individual holding these associations does not believe that they are related (Gawronski & Bodenhausen, 2006). In contrast, propositional structures are defined as mental representations that are clear inferences derived from logical interpretations (e.g. Sally loves salt). In general, implicit cognitions are viewed as associative structures, while explicit cognitions are viewed as propositional structures. However, as demonstrated in Study 2, for older children, implicit biases can be changed through propositional processes of logical reasoning, suggesting that the structure of these implicit biases might actually be propositional in later life (Mandelbaum, 2014). It is possible that for younger children, implicit pro-White bias is driven by associative structures, which would explain why our intervention failed to reduce their biases. Future research will need to consider the representational structure of these biases across development, and how that structure might impact the effectiveness of particular interventions.

An alternative possibility to consider is that our intervention was more effective with older children because of the particular strategies involved. Specifically, for our intervention to be effective, children needed to categorize the individuals in our vignettes as members of a particular racial category, and generalize that affective association to novel members of the category. Research suggests that young children may not spontaneously categorize others by race to the same extent as older children. Even though these children can sort faces by race, they may be less likely than older children to spontaneously attend to race when reasoning about others (Pauker, Williams, & Steele, 2015). Moreover, research suggests that younger children often privilege other categories (e.g., gender, language) over race on a variety of reasoning tasks (Degner & Wentura, 2010; Kinzler, Shutts, DeJesus, & Spelke, 2009; Shutts, Banaji, & Spelke,
2010). It will therefore be important to examine other intervention strategies with younger children in order to identify why young children’s implicit racial attitudes might be more resistant to this type of intervention and to ensure that young children’s lack of implicit attitude change in the present study was not due to idiosyncratic aspects of our manipulation.
GENERAL DISCUSSION

Our studies examined potential developmental differences in the malleability of both novel and existing implicit intergroup biases in children ages 5-12. In our first study, which controlled for the reinforcement of bias by teaching children novel biases, there were no age differences in the capacity to form implicit associations. Additionally, we did not find any age differences in the capacity to change implicit biases. These results suggest that the capacity to form and change novel implicit biases remains constant across development, as well as across the domains of evaluative/non-evaluative associations and social/non-social objects.

In contrast to the findings of the first study, the second study looked at the malleability of an existing implicit bias. Using a method that has been successfully implemented with adults, we attempted to reduce implicit biases in children. Our intervention was successful for children ages nine and above, but not for younger children. By contrast, with novel biases, there are no differences in the malleability of implicit bias for both children and adults, possibly because the mechanisms for forming and changing these novel biases are intact by age five and do not improve substantially across development. These results suggest that while the capacity to form implicit biases is in place and relatively stable from age five, there are important developmental differences in the capacity to change these implicit biases. Interestingly, these differences are only evident when examining the malleability of entrenched biases. It is possible that this difference occurs because novel biases are easier to overcome and require less cognitive flexibility.

A limitation of both studies was that there was no adult comparison group. As a result, we are unable to conclude when during the lifespan implicit bias is most amenable to change. The results of our first study would lead us to predict that there are no differences in the capacity
to form or change novel implicit biases. However, in light of the results from the second study, an interesting possibility to consider is whether there is a curvilinear relationship between age and the magnitude of attitude change for existing implicit associations. Older children may represent an age group that has comparatively less reinforcement of biases, but enough cognitive flexibility to overcome the initial bias that has formed. This would suggest that late childhood might be a particularly effective time for interventions designed to change children’s existing implicit biases. Future examinations of possible developmental differences in efficacy of interventions designed to reduce implicit bias can shed light on the independent and competing influences of increased cognitive flexibility and longer exposure to cultural messages of bias on the malleability of implicit associations.

Additional research should also examine the long-term effects of these interventions, and explore factors that would create longer-lasting change. Though a number of studies with adults have investigated short-term attitude change, the duration of these interventions has not yet been assessed (Lai et al., 2014). Examining longer-term effects of this and other intervention strategies can help to reveal whether children’s implicit attitudes have genuinely shifted or whether the particular intervention strategy employed (e.g., exposure to counter-stereotypical exemplars) is effective only in the short-term because it has primed a positively valenced sub-type of the category. There also might be developmental differences in the efficacy of long-term change.

In order to address this issue, more studies should investigate the malleability of associations with a larger temporal gap between assessments of formation and of change. It is possible that developmental differences may exist in the capacity for longer-term change in implicit bias. One possibility is that older children and adults might be better able to remember information presented in both stories and the strength of their implicit association will be similar.
regardless of whether it was measured five minutes later or a week after that information is presented. Younger children may have more difficulty remembering the information presented following a longer delay, and their implicit associations might reflect either a primacy bias (the first impression formed) or a recency bias (the last information presented).

Additional research should examine the relationship between the reduction of implicit bias and behavior. Relationships between implicit biases and behavior have not been as thoroughly examined in children, and it is unclear how directly these biases carry over into behavioral expressions of intergroup prejudice. It is possible that these biases might be reduced on a cognitive level (as measured by an IAT or another implicit association measure), but fail to translate into reduction of prejudiced behavior against the outgroup.

These studies indicate that while it is possible to substantially reduce both novel and existing implicit intergroup biases, these biases are not as easily reversed as they are formed. This highlights the power of first impressions to create implicit biases that are not fully negated even after presentation of comparable levels of information. Furthermore, an important consideration for future research is that developmental differences must be considered when designing and employing interventions to reduce implicit bias. These findings pave the way for future interventions, and identification of an optimal period in development to reduce implicit biases.
REFERENCES


APPENDICES

Appendix A: Full text of stories used in Study 1

Social Attitude (Good): Lups are very nice. Let me tell you about some nice things Lups did. First, Lups listen to what their parents tell them to do. They clean their room when asked and they play nice with their brothers and sisters. Second, when Lups meet other people they are very friendly and are very helpful. For example, when they play with other people they like to share their toys and snacks. Lups are very nice.

Social Attitude (Bad): Lups are very mean. Let me tell you about some mean things Lups did. First, Lups tease people. They make fun of the way people look and call them names. Second, when Lups play with other people they make them cry because they don’t play nice. For example, they don’t share their toys and they like to pull people’s hair, which really hurts. Lups are very mean.

Social Stereotype (Fries): Lups really like to eat French fries. Let me tell you about some things Lups did. First, Lups eat French fries all the time. They eat French fries for breakfast and for lunch. Second, when Lups meet other people they always offer them French fries to eat. For example, when they play with other people they like to share their French fries for everyone to eat. Lups really like French fries.

Social Stereotype (Cookies): Lups really like to eat chocolate chip cookies. Let me tell you about some things Lups did. First, Lups eat chocolate chip cookies all the time. They eat chocolate chip cookies for breakfast and for lunch. Second, when Lups meet other people they always offer
them chocolate chip cookies to eat. For example, when they play with other people they like to
share their chocolate chip cookies for everyone to eat. Lups really like chocolate chip cookies.

*Non-Social Attitude (Good):* Good things happen with purple balls. Let me tell you about some
good things that happened with purple balls. A huge gust of wind caused the balls to roll down
the street. Because of this wind, the purple balls rolled into a yard where there were some
children. These children were looking for some toys to play with and happily played with the
balls. After they finished playing, the wind blew the balls back down the street where the balls
passed over a sharp nail just before a child was about to step on it. Because the ball landed on the
nail, the child was kept safe and never got hurt. Next, the wind blew the purple balls on top of a
hole in the road. This helped people avoid falling in the hole and hurting themselves. Clearly
good things happen with purple balls.

*Non-Social Attitude (Bad):* Bad things happen with purple balls. Let me tell you about some bad
things that happened with purple balls. A huge gust of wind caused the balls to roll down the
street. Because of this wind, the purple balls rolled over the foot of someone crossing the street
causing the person to fall down. The wind continued to blow the balls down the street and right
into a puddle. The water soaked the people nearby and dirtied their clothes, which made them
upset. Next, the wind blew the purple balls into a crowd of people, causing several to get hurt
and created a big mess to clean-up. Clearly bad things happen with purple balls.

*Non-Social Stereotype (Fries):* French fries and purple balls end up together. Let me tell you
about some of the ways purple balls and French fries end up together. A huge gust of wind
caused the purple balls to roll down the street. Because of this wind, the purple balls rolled beside a chef making French fries. The wind continued to blow the balls down the street, where they rolled into a box of French fries someone had left by the road. This box caused the balls to bounce across the street, into a restaurant where the balls rolled under a table with some French fries on it. The owner of the restaurant came by and took the balls to his office where he placed them next to some French fries on his desk. Clearly French fries and purple balls end up together.

*Non-Social Stereotype (Cookies):* Chocolate chip cookies and purple balls end up together. Let me tell you about some of the ways purple balls and chocolate chip cookies end up together. A huge gust of wind caused the purple balls to blow up a hill. At the top of this hill, the purple balls rolled beside a picnic basket and plate of chocolate chip cookies. The wind then blew these balls down the other side of the hill. On the way down, they rolled into a box of chocolate chip cookies someone had thrown away. This box caused the balls to bounce beside someone’s house, where a batch of chocolate chip cookies was cooling by an open window. These balls continued to bounce along, finally stopping when they hit the wall of the local chocolate chip cookie shop. Clearly chocolate chip cookies and purple balls end up together.
Appendix B: Illustrations used in Study 2
Appendix C: Child IAT set-up (Study 1 & 2)
Appendix D: Full text of stories used in Study 2

Black & White exemplars:

1) This is Karen. Karen is a doctor who lives in Vancouver. She is an excellent doctor - in fact she is one of the best doctors at Vancouver General Hospital. Every day she helps to make sure that children stay healthy. When she is not helping people at the hospital, she loves to read books and go for walks along the beach.

2) This is John. John lives in Victoria where he attends high school. John loves learning about science and does really well in school. On the weekends he does a lot of hiking and enjoys being outdoors. In the summer he is a camp counsellor in charge of arts and crafts. In his spare time he loves to play video games or go out for ice cream with his friends.

3) This is Ashley. Ashley would like to become a teacher one day. She loves being around children and watching them discover new things about the world around them. Ashley volunteers at a daycare that is close to her home in Burnaby. The children at the daycare love when Ashley leads song time and plays games with them in the gym.

4) This is James. James lives in North Vancouver where he is a fire fighter. James is an excellent fire fighter and is working hard to become fire chief. Every time he's on the job James works hard to make sure that fires are prevented and that people stay safe. He even volunteers in schools where he teaches children about the importance of fire safety on camping trips. When James is not fighting fires, he likes to watch sports on TV and to coach hockey and soccer.

Flower exemplars:

1) This is a daffodil. Daffodils grow in meadows and woods, and are usually yellow. They are a type of flower that people like to plant in their gardens, because they are quite nice to look at.
Some people think that the daffodil looks like a star with a trumpet in the middle. When they start to sprout in the spring, they remind people that sunny weather is on the way.

2) This is a field of tulips. Tulips grow from bulbs that can be planted in the garden. Tulips can be seen in the spring and they come in all different colours including red, pink, yellow, and white. Tulips are also great additions to bouquets and are often the centerpiece of floral arrangements because of all of their beautiful colours.

3) This is a sunflower. Sunflowers produce nectar that bees use to make honey. Bees collect the nectar and then bring it back to their hives where it turns into honey. Sunflowers tend to be much larger than other flowers. Some people believe that a sunflower looks a lot like the sun. Sunflower seeds come from these flowers and can make a tasty snack.

4) This is a rose. Roses come in all sorts of different colours, but the most common colour of a rose is Red. Roses also come in all different sizes from little rose buds right up to larger long-stemmed roses. When people are asked to name their favorite flower, most people say the rose, probably because roses make people think of happiness and love. On Valentine’s Day, when people buy flowers, many will buy twelve roses for someone that they love.