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## Supporting Information

### New Online Tools to Assess Children's Implicit Social Cognition: Replication and Generalization of In-Person Research

#### *Journal of Educational Psychology*

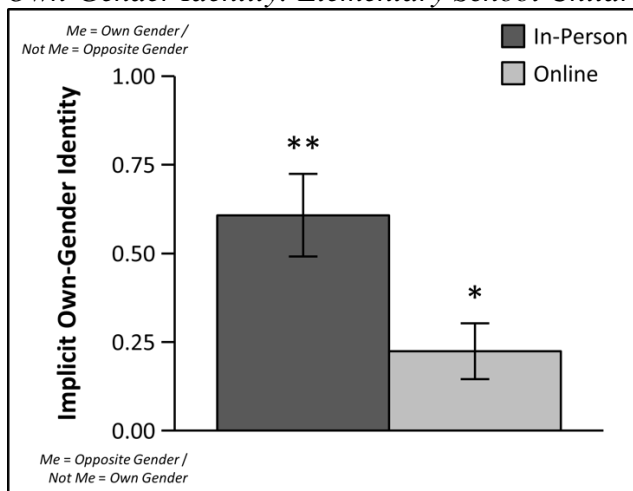
#### 1. Pilot Study Results

##### *1.1. Online, Unmoderated Child IAT: Text-Based Pilot Study – Gender Identity*

We conducted a pilot study to check the feasibility of the online tool proposed for Study 1. For this pilot, we tested 28 children. Participants completed a text-based IAT either: (a) in-person with a researcher in our laboratory following published protocols for elementary school children,  $n = 8$  ( $M_{\text{age}} = 7.61$  years,  $SD = 0.52$ ; 4 girls), or (b) online,  $n = 20$  ( $M_{\text{age}} = 7.60$  years,  $SD = 0.35$ ; 10 girls). As hypothesized, children in each procedure showed a significant own-gender identity (i.e.,  $me = \text{own gender}$ ; Figure S1):  $t(7) = 5.25$ ,  $p = .001$ ,  $d = 1.86$ , for the in-person group; and  $t(19) = 2.86$ ,  $p = .010$ ,  $d = 0.64$ , for the online group. The internal consistencies for both procedures were high, Cronbach's  $\alpha s \geq .87$ . These pilot results are in line with the idea that: (a) elementary school children can complete both the in-person and online versions of the text-based IAT, and (b) children using each procedure show the expected significant identification with their gender-based in-group.

**Figure S1**

*Own-Gender Identity: Elementary School Children Pilot Study*



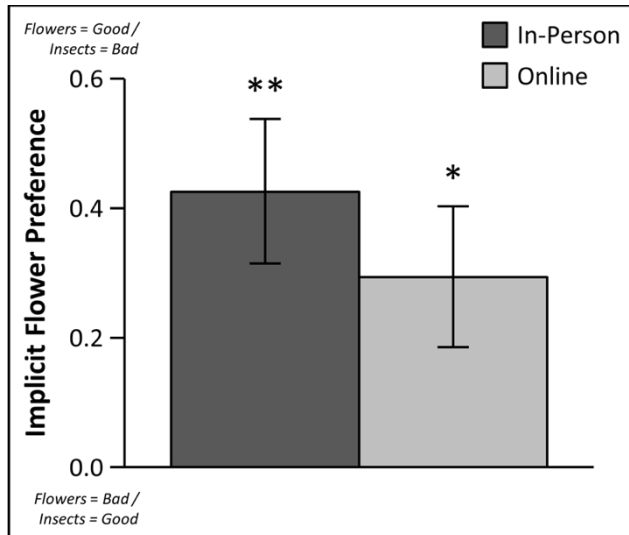
Note. Error bars represent SEs. \*  $p < .05$ . \*\*  $p < .01$ .

## 1.2. Online, Unmoderated Preschool IAT: Pictorial Pilot Study – Flower–Insect Attitude

We conducted a pilot study to check the feasibility of the online tool proposed for Study 3. For this pilot, we tested 28 children. Participants completed a pictorial IAT either: (a) in-person with a researcher in our laboratory following published preschool protocols,  $n = 10$  ( $M_{\text{age}} = 5.49$  years,  $SD = 0.28$ ; 6 girls), or (b) online,  $n = 18$  ( $M_{\text{age}} = 5.59$  years,  $SD = 0.30$ ; 9 girls). As hypothesized, preschoolers in each procedure showed a significant preference for flowers over insects (i.e., *flowers = good*; see Figure S2):  $t(9) = 3.81, p = .004, d = 1.20$ , for the in-person group; and  $t(17) = 2.74, p = .014, d = 0.65$ , for the online group. Internal consistency of both were acceptable, Cronbach's  $\alpha \geq .68$ . These pilot results are in line with the idea that: (a) 5-year-old children can complete both the in-person and online versions of the pictorial IAT, and (b) preschoolers using each procedure show the expected significant preference for flowers over insects.

**Figure S2**

*Flower–Insect Attitude: Preschool Children Pilot Study*



Note. Error bars represent SEs. \*  $p < .05$ . \*\*  $p < .01$ .

## 2. Exploratory Measures

In the two pilot studies described above, the effect sizes in online tasks were smaller than the effect sizes in the in-person assessments. Following the suggestions of reviewers, we conducted exploratory work in Studies 1 and 3 of the main text that could help us interpret potential differences between the in-person and online tests. More specifically, after children finished the IAT procedure, they were asked to respond to questions about their feelings of liking, interest (fun), motivation (happy), and self-efficacy regarding the IAT.

Previous published work has developed and validated questions for assessing such constructs in children from 4–7 years old (Bian et al., 2017; Master et al., 2017a; Shachnai et al., 2022; and for further usage, see also Master et al., 2017b; Rhodes et al., 2020; Rizzo et al., 2022). We used the instruments reported in these papers. In addition, because the in-person IAT involves the social presence of an adult experimenter during the test while the online version does not, children were

asked an additional item about how many people were in the room. Responses to all items were aggregated across participants separately for the in-person and online procedures, and mean responses were compared across procedures using independent-groups *t*-tests.

### 3. Counterbalancing

Within each study, the IAT procedure was counterbalanced to account for two factors: (a) the IAT congruency order (congruent task first vs. incongruent task first) and the side of screen on which the IAT categories first appear (left vs. right), resulting in four counterbalancing conditions. For each procedure in the four studies listed in Table S1, the children were randomly assigned to one of these four counterbalanced conditions upon recruitment. We targeted 25% to be assigned to each of the four conditions. However, recruiting in real time and applying preregistered data exclusion criteria (see Table 2 in main text) resulted in the analytic datasets being very close to, but not exactly at, 25% per counterbalancing condition (see Table S1).

**Table S1**

*Percentage of Children Assigned to Counterbalancing Conditions for Studies 1–4*

Study and Procedure	Counterbalancing Condition			
	1	2	3	4
Study 1: Gender identity				
In-person procedure	27.1%	22.9%	25.0%	25.0%
Online procedure	23.6%	27.8%	30.6%	18.1%
Study 2: Math–gender stereotype				
Online procedure	22.4%	27.6%	28.9%	21.1%
Study 3: Flower–insect attitude				
In-person procedure	26.6%	23.4%	25.0%	25.0%
Online procedure	23.4%	23.4%	29.7%	23.4%
Study 4: Gender in-group bias				
Online procedure	20.3%	31.3%	25.0%	23.4%

### 4. Instructions Given to the Child Participant During the In-Person IAT

How instructions were presented varied by procedure (in-person vs. online) as well as by IAT type (text-based for elementary school children vs. pictorial for preschool children).

Participants taking the *in-person* tests were provided age-appropriate verbal instructions by the experimenter. This was true for elementary as well as preschool children. In-person instructions for the elementary school children (Study 1) and preschool children (Study 3) were accompanied by the experimenter pointing to text or pictures on the screen or the buttons on the customized keyboard.

Sections 4.1–4.2 provide the verbal scripts that the experimenter memorized and recited during the in-person IATs. The experimenter recited the script as close to verbatim as possible, but differences with individual children often led to minor deviations from the script. For example, the experimenter would answer questions, respond to children’s non sequiturs, or provide

additional coaching if necessary. As described in the main text, each study was counterbalanced for the order of combined tasks and for the side of screen on which the categories first appeared. The left-right assignment of categories in Blocks 1–2 was also counterbalanced within the IAT. The instructions presented below reflect only one of the counterbalancing conditions for each study. The instructions for the other counterbalancing conditions were identical to the instructions below with the exception of minor changes in phrasing due to counterbalancing. For example, the left button may be assigned to *boys* instead of *girls*.

#### **4.1. Study 1 Instructions for In-Person, Moderated Procedure: Gender Identity Text-Based IAT**

**4.1.1. Block 1: Single-Task Warm-Up: *Me* Versus *Not Me*.** This is a sorting game. You are going to see words show up in the middle of the screen. You're also going to hear the words. Your job is to tell the computer what kinds of words they are, and you do that by pressing these buttons. For this first part, some of words are going to be "*me*" words, or words about yourself, like "I" or "myself." If you see one of those *me* words in the middle of the screen, this arrow here means that you'll press this button. And some of the words are going to be "*not me*" words, or words about other people, like "other" or "them." If you see one of those *not me* words in the middle of the screen, then this arrow means you'll press this button. The first few parts of this game are just going to be practice, but later on there will be a couple parts where I'll ask you to go as fast as you can, and the computer will measure how fast you can go. But I'll let you know when we get to those parts so you'll be ready. And the last thing is: The way you play this game is to always use both of your hands. Keep one hand right here by this button, and your other hand right here by this button. That way you'll always be ready to press the buttons. Should we give it a try? Get your hands ready by the buttons. This is just a practice part. Here we go.

**4.1.2. Block 2: Single-Task Warm-Up: *Girls* Versus *Boys*.** Look, the words on the left and right have changed! This time you are going to see and hear names. If you see a *girl* name, like "Emily" or "Sarah," press this button. And if you see a *boy* name, like "David" or "Michael," press this button. Ok? Go ahead and get your hands ready. This is another practice part. Here we go.

**4.1.3. Block 3: Combined-Task Practice: *Me* + *Girls* Versus *Not Me* + *Boys*.** Now you are going to play two games at the same time! That means each button will be for two things. For *me* words and *girl* names, press this button. So this button is for all of those. And for *not me* words and *boy* names, press this button. So this button is for all of those. This part might be a little bit trickier, so we're going to do some more practice. Get your hands ready. Here we go.

**4.1.4. Block 4: Combined-Task Test: *Me* + *Girls* Versus *Not Me* + *Boys*.** Look, this time the words did not change! That means you are going to play the exact same game as you did in the last part, but try to go as fast as you can this time. The computer is going to measure how fast you go. But still try to get as many right as you can, too. Get your hands ready. Remember, try to go fast this time. Here we go.

**4.1.5. Block 5: Single-Task Reversal: *Not Me* Versus *Me*.** Do you see something different this time? Right, the *me* words and *not me* words switched sides. Now you'll press this button for *not me* words, and this button for *me* words. This is just a practice part so you can get used to the change. Get your hands ready. Here we go.

**4.1.6. Block 6: Combined-Task Practice: *Not Me* + *Girls* Versus *Me* + *Boys*.** Look, the *girl* names and *boy* names came back. That means you're going to play two games at the same time again. So this time for *not me* words and *girl* names, you'll press this button. And for *me*

words and *boy* names, you'll press this button. This is a practice part. Get your hands ready. Here we go.

**4.1.7. Block 7: Combined-Task Test: *Not Me + Girls Versus Me + Boys*.** Look, nothing changed in this part. It's going to be exactly the same as the last part, but try to go as fast as you can again. Get your hands ready. Here we go.

#### **4.2. Study 3 Instructions for In-Person, Moderated Procedure: Flower–Insect Attitude Pictorial IAT**

**4.2.1. Block 1: Single-Task Warm-Up: *Flowers Versus Insects*.** This is a sorting game. You are going to see pictures show up in the middle of the screen. Your job is to tell the computer what kinds of pictures they are, and you do that by pressing these buttons. For this first part, some of them are going to be pictures of *flowers*, like all of these. If you see one of these *flowers* in the middle of the screen, this color here means that you'll press this button. And some of the pictures are going to be pictures of *insects*, like all of these. If you see one of these *insects* in the middle of the screen, then this color means you'll press this button. The first few parts of this game are just going to be practice, but later on there will be a couple parts where I'll ask you to go as fast as you can, and the computer will measure how fast you can go. But I'll let you know when we get to those parts so you'll be ready. And the last thing is: The way you play this game is to always use both of your hands. Keep one hand right here by this button, and your other hand right here by this button. That way you'll always be ready to press the buttons. Should we give it a try? Get your hands ready by the buttons. This is just a practice part. Here we go.

**4.2.2. Block 2: Single-Task Warm-Up: *Good Versus Bad*.** Look, the pictures on the screen have changed! And this part is going to be a little different. This time you are going to hear words from the computer, so you're going to have to listen, and it will be your job to tell the computer what kinds of words they are. If you hear a *good* word, like "happy" or "fun," press this button. And if you hear a *bad* word, like "yucky" or "mad," press this button. Ok? Go ahead and get your hands ready. This is another practice part. Here we go.

**4.2.3. Block 3: Combined-Task Practice: *Flowers + Good Versus Insects + Bad*.** Now you are going to play two games at the same time! That means each button will be for two things. For pictures of *flowers* and for *good* words, press this button. So this button is for all of those. And for pictures of *insects* and for *bad* words, press this button. So this button is for all of those. This part might be a little bit trickier, so we're going to do some more practice. Get your hands ready. Here we go.

**4.2.4. Block 4: Combined-Task Test: *Flowers + Good Versus Insects + Bad*.** Look, this time nothing on the screen changed! That means you are going to play the exact same game as you did in the last part, but try to go as fast as you can this time. The computer is going to measure how fast you go. But still try to get as many right as you can, too. Get your hands ready. Remember, try to go fast this time. Here we go.

**4.2.5. Block 5: Single-Task Reversal: *Insects Versus Flowers*.** Do you see something different this time? Right, the *flowers* and *insects* switched sides. Now you'll press this button for pictures of *insects*, and you'll press this button for pictures of *flowers*. This is just a practice part so you can get used to the change. Get your hands ready. Here we go.

**4.2.6. Block 6: Combined-Task Practice: *Insects + Good Versus Flowers + Bad*.** Look, the *good* words and *bad* words came back. That means you're going to play two games at the same time again. So this time for *insects* and *good* words, you'll press this button. And for

*flowers* and *bad* words, you'll press this button. This is a practice part. Get your hands ready. Here we go.

**4.2.7. Block 7: Combined-Task Test: *Insects* + *Good Versus Flowers* + *Bad*.** Look, nothing changed in this part. It's going to be exactly the same as the last part, but try to go as fast as you can again. Get your hands ready. Here we go.

## **5. Instructions Given to the Child Participant During the Online IAT**

Participants taking the *online* tests were provided age-appropriate instructions via the computer software. Online instructions for the elementary school children (Studies 1 and 2) were presented as text in black font against a white background. Online instructions for the preschool children (Studies 3 and 4) were presented as text but were *also* simultaneously accompanied by an *audio recording* of an adult reading the instructions (see main text), because this reduced the reading load and was easier at the preschool ages involved.

Sections 5.1–5.4 provide the verbatim instructions participants received during the online IATs. Each slash in the instructions below indicates the changing of a “screen of text” of instructions during the participant's test. In other words, text appearing after a slash is on a separate screen than the text before the slash. In the instructions provided below, the CAPITAL versus lowercase font accurately reflects the text format seen by the children, and is used to help children differentiate between categories.

### **5.1. Study 1 Instructions for Online, Unmoderated Procedure: Gender Identity Text-Based IAT**

**5.1.1. Block 1: Single-Task Warm-Up: *Me Versus Not Me*.** This is a sorting game. You are going to SEE words show up in the middle of the screen. You will also HEAR those same words. Make sure your volume is turned up. / Your job is to tell the computer what KIND of word it is. You do that with your keyboard. This game is easy to play if you remember these two rules: Rule 1. Always keep your LEFT pointer finger over the D key. Rule 2. Always keep your RIGHT pointer finger over the K key. / See where it says ‘ME’ on the left side of the screen? And see where it says ‘NOT ME’ on the right side of the screen? That means you are going to see and hear ME words and NOT ME words in this game. ‘ME’ words are about yourself. ‘NOT ME’ words are about other people. / ME words are like ‘I’ or ‘MYSELF.’ When you see a ME word, press the D key. NOT ME words are like ‘OTHER’ or ‘THEM.’ When you see a NOT ME word, press the K key. / If you see this red question mark, ? then look at the word again and try pressing the other key. / The first few parts of this game will be PRACTICE. Later, there will be parts where you should try to go as fast as you can. These parts are important because the computer will measure how fast you go! The game will always tell you before you need to go fast. / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is a PRACTICE part. Press spacebar when you are ready to start!

**5.1.2. Block 2: Single-Task Warm-Up: *Girls Versus Boys*.** Look, the words on the left and right have changed! / Now it says ‘Girls’ on the left side. And it says ‘Boys’ on the right side. That means you are going to see and hear Girl names and Boy names in this part. / Girl names are like ‘Emily’ or ‘Sarah.’ When you see a Girl name, press the D key. Boy names are like ‘David’ or ‘Michael.’ When you see a Boy name, press the K key. / Take your hand off the

mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is another PRACTICE part. Press spacebar when you are ready to start!

**5.1.3. Block 3: Combined-Task Practice: *Me + Girls Versus Not Me + Boys*.** Now you are going to play TWO games at the same time! That means each key will be for TWO things now. / For ME words AND Girl names, press the D key. For BOTH of those, ME and Girls, press the D key. / For NOT ME words AND Boy names, press the K key. For BOTH of those, NOT ME and Boys, press the K key. / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is another PRACTICE part. Press spacebar when you are ready to start!

**5.1.4. Block 4: Combined-Task Test: *Me + Girls Versus Not Me + Boys*.** Look, this time the words DID NOT CHANGE! You are going to play the exact same game again, except... / ...try to go as FAST as you can this time! The computer is going to measure how fast you go. But still try to get as many right as you can! / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. Remember, try to go FAST this time. Press spacebar when you are ready to start!

**5.1.5. Block 5: Single-Task Reversal: *Not Me Versus Me*.** Look, in this part NOT ME and ME switched sides! / So now it's different. Press D for NOT ME words. Press K for ME words. / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is a PRACTICE part so you can get used to the change. Press spacebar when you are ready to start!

**5.1.6. Block 6: Combined-Task Practice: *Not Me + Girls Versus Me + Boys*.** Now you are going to play TWO games at the same time! That means each key will be for TWO things now. / For NOT ME words AND Girl names, press the D key. For BOTH of those, NOT ME and Girls, press the D key. / For ME words AND Boy names, press the K key. For BOTH of those, ME and Boys, press the K key. / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is another PRACTICE part. Press spacebar when you are ready to start!

**5.1.7. Block 7: Combined-Task Test: *Not Me + Girls Versus Me + Boys*.** Look, this time the words DID NOT CHANGE! You are going to play the exact same game again, except... / ...try to go as FAST as you can this time! The computer is going to measure how fast you go. But still try to get as many right as you can! / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. Remember, try to go FAST this time. Press spacebar when you are ready to start!

## ***5.2. Study 2 Instructions for Online, Unmoderated Procedure: Math–Gender Stereotype Text-Based IAT***

**5.2.1. Block 1: Single-Task Warm-Up: *Boys Versus Girls*.** This is a sorting game. You are going to SEE words show up in the middle of the screen. You will also HEAR those same words. Make sure your volume is turned up. / Your job is to tell the computer what KIND of word it is. You do that with your keyboard. This game is easy to play if you remember these two rules: Rule 1. Always keep your LEFT pointer finger over the D key. Rule 2. Always keep your RIGHT pointer finger over the K key. / See where it says 'Boys' on the left side of the screen? And see where it says 'Girls' on the right side of the screen? That means you are going to see and hear Boy names and Girl names in this game. / Boy names are like 'David' or 'Michael.'

When you see a Boy name, press the D key. Girl names are like ‘Emily’ or ‘Sarah.’ When you see a Girl name, press the K key. / If you see this red question mark, ? then look at the word again and try pressing the other key. / The first few parts of this game will be PRACTICE. Later, there will be parts where you should try to go as fast as you can. These parts are important because the computer will measure how fast you go! The game will always tell you before you need to go fast. / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is a PRACTICE part. Press spacebar when you are ready to start!

**5.2.2. Block 2: Single-Task Warm-Up: Math Versus Reading.** Look, the words on the left and right have changed! / Now it says ‘math’ on the left side. And it says ‘reading’ on the right side. That means you are going to see and hear math words and reading words in this part. / Math words are like ‘numbers’ or ‘graph.’ When you see a math word, press the D key. Reading words are like ‘story’ or ‘sentence.’ When you see a reading word, press the K key. / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is another PRACTICE part. Press spacebar when you are ready to start!

**5.2.3. Block 3: Combined-Task Practice: Boys + Math Versus Girls + Reading.** Now you are going to play TWO games at the same time! That means each key will be for TWO things now. / For Boy names AND math words, press the D key. For BOTH of those, Boys and math, press the D key. / For Girl names AND reading words, press the K key. For BOTH of those, Girls and reading, press the K key. / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is another PRACTICE part. Press spacebar when you are ready to start!

**5.2.4. Block 4: Combined-Task Test: Boys + Math Versus Girls + Reading.** Look, this time the words DID NOT CHANGE! You are going to play the exact same game again, except... / ...try to go as FAST as you can this time! The computer is going to measure how fast you go. But still try to get as many right as you can! / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. Remember, try to go FAST this time. Press spacebar when you are ready to start!

**5.2.5. Block 5: Single-Task Reversal: Girls Versus Boys.** Look, in this part Girls and Boys switched sides! / So now it’s different. Press D for Girl names. Press K for Boy names. / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is a PRACTICE part so you can get used to the change. Press spacebar when you are ready to start!

**5.2.6. Block 6: Combined-Task Practice: Girls + Math Versus Boys + Reading.** Now you are going to play TWO games at the same time! That means each key will be for TWO things now. / For Girl names AND math words, press the D key. For BOTH of those, Girls and math, press the D key. / For Boy names AND reading words, press the K key. For BOTH of those, Boys and reading, press the K key. / Take your hand off the mouse now. Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is another PRACTICE part. Press spacebar when you are ready to start!

**5.2.7. Block 7: Combined-Task Test: Girls + Math Versus Boys + Reading.** Look, this time the words DID NOT CHANGE! You are going to play the exact same game again, except... / ...try to go as FAST as you can this time! The computer is going to measure how fast you go. But still try to get as many right as you can! / Take your hand off the mouse now. Get your



fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. Remember, try to go FAST this time. Press spacebar when you are ready to start!

### ***5.3. Study 3 Instructions for Online, Unmoderated Procedure: Flower–Insect Attitude Pictorial IAT***

**5.3.1. Block 1: Single-Task Warm-Up: *Flowers Versus Insects*.** Now it's time for the game. This is a sorting game. / There are pictures of flowers on the orange side. / And there are pictures of insects on the purple side. / You are going to SEE pictures show up in the middle of the screen. Your job is to tell the computer if it is a flower or an insect. You do that with your keyboard. / Look down at your keyboard and find the key that looks like this. That is the D key. Your keys may be a different color than this, but that's ok. Press the D key now. / Now look at your keyboard and find the button that looks like this. That is the K key. Press the K key now. / Now look at your keyboard and find the big button that looks like this. That is the spacebar. Press the spacebar now. / Great! Those are the only keys you'll be using during this game. / When you see a flower in the middle of the screen, press the D key. / So, D is for flowers. / When you see an insect in the middle of the screen, press the K key. / So, K is for insects. / This game is easy to play if you remember these two rules: Rule 1. Always keep your LEFT pointer finger over the D key. Rule 2. Always keep your RIGHT pointer finger over the K key. / If you see this red question mark, ? then look at the picture again and try pressing the other key. / Let's try one! Which key should you press if you see this picture? Press the key now. / Right! And which key should you press if you see this picture? Press the key now. / The first few parts of this game will be PRACTICE. Later, there will be parts where you should try to go as fast as you can. These parts are important because the computer will measure how fast you go! We will always tell you before you need to go fast. / Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key, like in this picture. This is a PRACTICE part. Press spacebar when you are ready to start!

**5.3.2. Block 2: Single-Task Warm-Up: *Good Versus Bad*.** Look, the pictures on the orange and purple sides have changed! And this part is going to be a little different. / This time you are going to have to listen because the computer is going to say words, and you have to tell it what kind of word it is. You will also see the words. / The face on the orange side is for good words. / The face on the purple side is for bad words. / That means you are going to hear and see good words and bad words in the middle of the screen. / Good words are like 'happy' or 'fun.' When you see and hear a good word, press the D key. / So, D is for good words. / Bad words are like 'yucky' or 'mad.' When you see and hear a bad word, press the K key. / So, K is for bad words. / Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is a PRACTICE part. Press spacebar when you are ready to start!

**5.3.3. Block 3: Combined-Task Practice: *Flowers + Good Versus Insects + Bad*.** Now you are going to play TWO games at the same time! That means each key will be for TWO things now. So this part might be a little trickier. / For flowers AND good words, press the D key. For BOTH of those, flowers and good words, press the D key. / For insects AND bad words, press the K key. For BOTH of those, insects and bad words, press the K key. / When you know which key to press, go ahead and press it! / Get your fingers ready on the keyboard. This is a PRACTICE part. Press spacebar when you are ready to start!

**5.3.4. Block 4: Combined-Task Test: *Flowers + Good Versus Insects + Bad*.** Look, this time the pictures did NOT change! That means you are going to play the exact same game as you did in the last part. / Except this time try to go as FAST as you can! The computer is going to

measure how fast you go. But still try to get as many right as you can! / Get your fingers ready on the keyboard. Remember, try to go FAST this time. Press spacebar when you are ready to start!

**5.3.5. Block 5: Single-Task Reversal: *Insects Versus Flowers*.** You are already halfway done with the game! There are only a few parts left, so keep doing your best! / Watch this! / Insects and flowers switched sides! / Now insects are on the orange side. So press D for insects. / And now flowers are on the purple side. So press K for flowers. / Get your fingers ready on the keyboard. This is a PRACTICE part so you can get used to the change. Press spacebar when you are ready to start!

**5.3.6. Block 6: Combined-Task Practice: *Insects + Good Versus Flowers + Bad*.** Look, the good and bad words came back! That means you are going to play two games at the same time again. / For insects AND good words, press the D key. For BOTH of those, insects and good words, press the D key. / For flowers AND bad words, press the K key. For BOTH of those, flowers and bad words, press the K key. / When you know which key to press, go ahead and press it! / Get your fingers ready on the keyboard. This is a PRACTICE part. Press spacebar when you are ready to start!

**5.3.7. Block 7: Combined-Task Test: *Insects + Good Versus Flowers + Bad*.** Look, this time the pictures did NOT change! That means you are going to play the exact same game as you did in the last part. / Except now try to go as FAST as you can again! But remember, try to get as many right as you can too! / Get your fingers ready on the keyboard. Remember, try to go FAST this time. Press spacebar when you are ready to start!

#### ***5.4. Study 4 Instructions for Online, Unmoderated Procedure: Gender In-Group Bias Pictorial IAT***

**5.4.1. Block 1: Single-Task Warm-Up: *Boys Versus Girls*.** Now it's time for the game. This is a sorting game. / There are pictures of boys on the orange side. / And there are pictures of girls on the purple side. / You are going to SEE pictures of kids show up in the middle of the screen. Your job is to tell the computer if it is a boy or a girl. You do that with your keyboard. / Look down at your keyboard and find the key that looks like this. That is the D key. Your keys may be a different color than this, but that's ok. Press the D key now. / Now look at your keyboard and find the button that looks like this. That is the K key. Press the K key now. / Now look at your keyboard and find the big button that looks like this. That is the spacebar. Press the spacebar now. / Great! Those are the only keys you'll be using during this game. / When you see a boy in the middle of the screen, press the D key. / So, D is for boys. / When you see a girl in the middle of the screen, press the K key. / So, K is for girls. / This game is easy to play if you remember these two rules: Rule 1. Always keep your LEFT pointer finger over the D key. Rule 2. Always keep your RIGHT pointer finger over the K key. / If you see this red question mark, ? then look at the picture again and try pressing the other key. / Let's try one! Which key should you press if you see this kid? Press the key now. / Right! And which key should you press if you see this kid? Press the key now. / The first few parts of this game will be PRACTICE. Later, there will be parts where you should try to go as fast as you can. These parts are important because the computer will measure how fast you go! We will always tell you before you need to go fast. / Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key, like in this picture. This is a PRACTICE part. Press spacebar when you are ready to start!

**5.4.2. Block 2: Single-Task Warm-Up: *Good Versus Bad*.** Look, the pictures on the orange and purple sides have changed! And this part is going to be a little different. / This time you

are going to have to listen because the computer is going to say words, and you have to tell it what kind of word it is. You will also see the words. / The face on the orange side is for good words. / The face on the purple side is for bad words. / That means you are going to hear and see good words and bad words in the middle of the screen. / Good words are like ‘happy’ or ‘fun.’ When you see and hear a good word, press the D key. / So, D is for good words. / Bad words are like ‘yucky’ or ‘mad.’ When you see and hear a bad word, press the K key. / So, K is for bad words. / Get your fingers ready on the keyboard: LEFT pointer finger over the D key, RIGHT pointer finger over the K key. This is a PRACTICE part. Press spacebar when you are ready to start!

**5.4.3. Block 3: Combined-Task Practice: Boys + Good Versus Girls + Bad.** Now you are going to play TWO games at the same time! That means each key will be for TWO things now. So this part might be a little trickier. / For boys AND good words, press the D key. For BOTH of those, boys and good words, press the D key. / For girls AND bad words, press the K key. For BOTH of those, girls and bad words, press the K key. / When you know which key to press, go ahead and press it! / Get your fingers ready on the keyboard. This is a PRACTICE part. Press spacebar when you are ready to start!

**5.4.4. Block 4: Combined-Task Test: Boys + Good Versus Girls + Bad.** Look, this time the pictures did NOT change! That means you are going to play the exact same game as you did in the last part. / Except this time try to go as FAST as you can! The computer is going to measure how fast you go. But still try to get as many right as you can! / Get your fingers ready on the keyboard. Remember, try to go FAST this time. Press spacebar when you are ready to start!

**5.4.5. Block 5: Single-Task Reversal: Girls Versus Boys.** You are already halfway done with the game! There are only a few parts left, so keep doing your best! / Watch this! / Girls and boys switched sides! / Now girls are on the orange side. So press D for girls. / And now boys are on the purple side. So press K for boys. / Get your fingers ready on the keyboard. This is a PRACTICE part so you can get used to the change. Press spacebar when you are ready to start!

**5.4.6. Block 6: Combined-Task Practice: Girls + Good Versus Boys + Bad.** Look, the good and bad words came back! That means you are going to play two games at the same time again. / For girls AND good words, press the D key. For BOTH of those, girls and good words, press the D key. / For boys AND bad words, press the K key. For BOTH of those, boys and bad words, press the K key. / When you know which key to press, go ahead and press it! / Get your fingers ready on the keyboard. This is a PRACTICE part. Press spacebar when you are ready to start!

**5.4.7. Block 7: Combined-Task Test: Girls + Good Versus Boys + Bad.** Look, this time the pictures did NOT change! That means you are going to play the exact same game as you did in the last part. / Except now try to go as FAST as you can again! But remember, try to get as many right as you can too! / Get your fingers ready on the keyboard. Remember, try to go FAST this time. Press spacebar when you are ready to start!

## 6. Missingness in Income-to-Needs Ratio Data

In Studies 1 and 2, a relatively large portion of data needed for the computation of the income-to-needs ratio was missing. The reader may wonder why approximately 15–20% of the online sample in these two studies did not provide the necessary information. We went back to the raw data and we found the following: For Study 1 online participants, 15/72 did not have the income-to-needs ratio. Out of those 15, 14 did not provide their income and one did not report how many adults live in their home. For Study 2 (online only), 12/76 did not have the income-to-needs

ratio. Out of those 12, 10 did not report their income and two did not report how many adults live in their home.

Although we do not know for sure why this information was not provided, we speculate some reasons might be that online participants (in this case, the parents who were filling in this demographic information): (a) did not feel comfortable reporting their income over the internet, or (b) decided that the question about income would require more effort than the other more straightforward questions on the demographic survey (e.g., child's birthday, zip code, parent education). In line with these interpretations is the finding that all of the in-person participants reported their income. This was provided in the laboratory using a paper form (see Appendix A), which parents filled out shortly *after* completing a consent form that assured them that all of their data would be stored securely.

## 7. References

- Bian, L., Leslie, S.-J., & Cimpian, A. (2017). Gender stereotypes about intellectual ability emerge early and influence children's interests. *Science*, 355(6323), 389–391. <https://doi.org/10.1126/science.aah6524>
- Master, A., Cheryan, S., & Meltzoff, A. N. (2017a). Social group membership increases STEM engagement among preschoolers. *Developmental Psychology*, 53(2), 201–209. <https://doi.org/10.1037/dev0000195>
- Master, A., Cheryan, S., Moscatelli, A., & Meltzoff, A. N. (2017b). Programming experience promotes higher STEM motivation among first-grade girls. *Journal of Experimental Child Psychology*, 160, 92–106. <https://doi.org/10.1016/j.jecp.2017.03.013>
- Rhodes, M., Cardarelli, A., & Leslie, S.-J. (2020). Asking young children to “do science” instead of “be scientists” increases science engagement in a randomized field experiment. *Proceedings of the National Academy of Sciences of the United States of America*, 117(18), 9808–9814. <https://doi.org/10.1073/pnas.1919646117>
- Rizzo, M. T., Green, E. R., Dunham, Y., Bruneau, E., & Rhodes, M. (2022). Beliefs about social norms and racial inequalities predict variation in the early development of racial bias. *Developmental Science*, 25(2), Article e13170. <https://doi.org/10.1111/desc.13170>
- Shachnai, R., Kushnir, T., & Bian, L. (2022). Walking in her shoes: Pretending to be a female role model increases young girls' persistence in science. *Psychological Science*, 33(11), 1818–1827. <https://doi.org/10.1177/09567976221119393>

**Appendix A. Demographics Questionnaire for In-Person Participants in Studies 1 and 3**  
(Provided to parents as a paper copy.)

<div style="border-bottom: 1px dashed black; margin-bottom: 10px;">Child's date of birth _____</div> <div style="text-align: center; margin-bottom: 10px;"><i>(Do not retain date of birth. Tear off after calculating age.)</i></div> <div style="text-align: center; margin-bottom: 10px;"><b>Child Info Form</b></div> <div style="display: flex; justify-content: space-between; align-items: flex-start;"><div style="width: 70%;"><p>Please fill in responses to the items below (and date of birth at the top of this form). You may ask questions if any item is unclear. You are not required to answer every question. Your responses will be kept confidential.</p><p>Today's date _____</p><p><b>Information about your child</b></p><p>Race    <input type="checkbox"/> American Indian/Alaska Native           <input type="checkbox"/> Asian           <input type="checkbox"/> Black/African American           <input type="checkbox"/> Native Hawaiian/Other Pacific Islander           <input type="checkbox"/> White</p><p>Ethnicity   <input type="checkbox"/> Hispanic               <input type="checkbox"/> Non-Hispanic</p><p>Gender   <input type="checkbox"/> Male            <input type="checkbox"/> Female            <input type="checkbox"/> Other _____</p><p>Is your child in school? If yes, please indicate preschool or grade. _____</p><p><b>Information about the family</b></p><p>How many individuals live at home with you:     a. Under the age of 18? _____     b. Over the age of 18 (including yourself)? _____</p><p>What is your annual household income? _____</p><p>What is your current home zip code? _____</p><p>What county do you currently live in? _____</p><p>What state do you currently live in? _____</p><p style="margin-top: 20px;">(please turn the page over)</p></div><div style="width: 25%; border: 1px solid black; padding: 5px; text-align: center; margin-top: 20px;">ID#</div></div>
---

This page asks about your child's caregiver(s). If your child has one caregiver, please fill in the information for Caregiver A only. If your child has two caregivers, please fill in the information for Caregiver A and Caregiver B. You may decide who is Caregiver A and who is Caregiver B however you like.

**Information about Caregiver A**

How would Caregiver A describe their relationship to the child (for example, mother, father, grandmother, etc.)?

\_\_\_\_\_

Caregiver A's gender ☐ Male  
☐ Female  
☐ Other \_\_\_\_\_

What is Caregiver A's highest level of education?

- ☐ Completed elementary school
- ☐ Completed middle school
- ☐ Did not complete high school
- ☐ Completed high school or GED
- ☐ At least 1 year of college
- ☐ Associate degree or equivalent 2-year undergraduate degree
- ☐ Bachelor's degree or equivalent 4-year undergraduate degree
- ☐ Some graduate school classes (but did not get a graduate degree)
- ☐ Graduate degree (Doctor, Dentist, Lawyer, PhD, Masters, etc.)
- ☐ Don't know—Please indicate what you are not sure about: \_\_\_\_\_

**Information about Caregiver B (if applicable)**

How would Caregiver B describe their relationship to the child (for example, mother, father, grandmother, etc.)?

\_\_\_\_\_

Caregiver B's gender ☐ Male  
☐ Female  
☐ Other \_\_\_\_\_

What is Caregiver B's highest level of education?

- ☐ Completed elementary school
- ☐ Completed middle school
- ☐ Did not complete high school
- ☐ Completed high school or GED
- ☐ At least 1 year of college
- ☐ Associate degree or equivalent 2-year undergraduate degree
- ☐ Bachelor's degree or equivalent 4-year undergraduate degree
- ☐ Some graduate school classes (but did not get a graduate degree)
- ☐ Graduate degree (Doctor, Dentist, Lawyer, PhD, Masters, etc.)
- ☐ Don't know—Please indicate what you are not sure about: \_\_\_\_\_

**Appendix B. Demographics Questionnaire for Online Participants in Studies 1–4**

(Provided to parents digitally on the computer screen.)

Great! Thanks again for participating.

The next few pages are also for the parent/guardian. We will ask you for background information about your child and your family. You are not required to answer every question.

Then after that it will be time for your child's activities!

NEXT

Click on the 'NEXT' button to  
move on to the next page.

What is your child's date of birth?

Month

Day

Year

What is your child's ethnicity?

- ☐ Hispanic  
☐ Non-Hispanic

What is your child's gender?

- ☐ female  
☐ male

☐ other (describe)

If you select other, you must type something in the box.  
If you do not wish to describe, then just type one blank space.

What grade in school is your child in?

What is your child's race?

Please check all that apply.

- ☐ American Indian/Alaska Native  
☐ Asian  
☐ Black/African American  
☐ Native Hawaiian/Other Pacific Islander  
☐ White  
☐ Other (specify)

NEXT



The next page asks about your child's caregiver(s).

If your child has one caregiver, please fill in the information for Caregiver A only.

If your child has two caregivers, please fill in the information for Caregiver A and Caregiver B. You may decide who is Caregiver A and who is Caregiver B however you like.

NEXT

How would Caregiver A describe their relationship to the child (for example, mother, father, grandmother, etc.)?

What is Caregiver A's gender?

☐ female

☐ male

☐ other (describe)

*If you select other, you must type something in the box.*

*If you do not wish to describe, then just type one blank space.*

What is Caregiver A's highest level of education?

☐ completed elementary school

☐ completed middle school

☐ completed some high school (but no diploma/GED)

☐ completed high school or GED

☐ at least 1 year of college

☐ associate degree/equivalent 2-year degree

☐ bachelor's degree/equivalent 4-year degree

☐ some graduate school classes (but no graduate degree)

☐ graduate degree (doctor, dentist, lawyer, PhD, Masters, etc.)

☐ don't know

☐ other (describe)

If applicable, how would Caregiver B describe their relationship to the child (for example, mother, father, grandmother, etc.)?

What is Caregiver B's gender?

☐ female

☐ male

☐ other (describe)

*If you select other, you must type something in the box.*

*If you do not wish to describe, then just type one blank space.*

What is Caregiver B's highest level of education?

☐ completed elementary school

☐ completed middle school

☐ completed some high school (but no diploma/GED)

☐ completed high school or GED

☐ at least 1 year of college

☐ associate degree/equivalent 2-year degree

☐ bachelor's degree/equivalent 4-year degree

☐ some graduate school classes (but no graduate degree)

☐ graduate degree (doctor, dentist, lawyer, PhD, Masters, etc.)

☐ don't know

☐ other (describe)

NEXT

How many individuals under the age of 18  
live in your home with you?

Under 18 years:

How many individuals over the age of 18  
live in your home with you including yourself?

Over 18 years:

What is your annual household income?

What is your current home zip code?

What county, parish (LA), or borough (AK)  
do you currently live in?

What state do you currently live in?

NEXT