**Supplemental Materials**

**Fearlessness and Low Social Affiliation as Unique Developmental Precursors of Callous-Unemotional Behaviors in Preschoolers**

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**Supplemental Methods**

**Description of Episodes**

**(1) Arc of Toys (Free Play).** The child is presented with a wide array of toys spread in an arc around them. The task provides the child with an opportunity to become involved in more than one pleasant activity. The play activities are not controlled by the experimenter since the goal is to have the child be in control of what they play with. To set up the task, the room was emptied of all toys with the exception of the arc of rearranged stimulus toys. The toys were: a four-square ball, Bert doll, vacuum or lawn mower, grocery cart and play food, dump truck, hula hoop, and bowling balls and pins. A preset arrangement was shared with research assistants to ensure that each child experienced the same toy set-up. During the task, experimenter escorted the child into the room and to the center of the arc (facing the cameras). The experimenter said: “Look at all these neat toys! You can play with them all by yourself however you want.” The free-play episode lasted five minutes.

 **(2) Stranger Approach.** The goal of this task was to elicit social fear in response to the approach of a stranger. The task thus involved the child being faced with a novel, slightlythreatening person. The situation was modeled after “real-life” social events, such as riding a crowded bus or sitting on a crowded bench at the park. During the task, the child stood near a wall opposite the camera with room to retreat into if needed when the stranger entered the room (about one quarter of the room was behind the child, allowing room for “retreat”). A chair (for the stranger) was directly to the left of the doorway that the stranger enters. The parent was not in the room during this episode. The stranger was a research assistant who wore a baseball hat and sunglasses across all participants to keep the appearance of the stranger as consistent as possible across all stranger approach episodes when different research assistants played the stranger role. Before the episode began, the familiar experimenter placed a chair near the far wall and instructed the child to stand facing the camera by saying, “you stand here and wait for me while I go look for the next game, OK? You wait here until I come back”. After 10 s, the stranger knocked loudly on the door, entered the room and, remaining the door, said (in a friendly tone of voice) “Hi!” After a 2 s pause, he asked, “Have you ever been here before?” followed by a 10 s pause. Then, the stranger walked to the chair, stood in front of it and asked, “Are you having a good time here today?” followed by a 10 s pause. The stranger then sat down and asked, “Are you playing with a lot of toys?”, followed by a 10s pause. Then he asked, “What was your favorite toy?” The stranger agreed with whatever the child said was his/her favorite toy by saying “I like \_\_\_\_\_\_\_\_\_\_ too”. If the child said anything else, the stranger replied to every utterance with a friendly, logical, one-sentence response that was not a question. Finally, after a further 20 s, the stranger said, “I came to pick up some papers. Was there a woman here?” After the child’s response, the stranger said, “I’ll go look in the hall.” After 15s from the sound of the door closing after the stranger exited, the original, familiar experimenter re-entered from the control room holding several pieces of paper and said, “Was there a person in here?” and waited for a response. Then she asked, “What was he/she like?” After the child responded, the experimenter said, “Oh, that was my friend \_\_\_\_\_\_\_. He/she was here for these papers, maybe he/she went into the hall.” The experimenter then opened the door that the stranger had exited from and said “Hi \_\_\_\_\_\_, here are the papers you wanted”. The stranger loudly thanked the experimented, re-entered the room, and looking at the child, said “Hi again – I found my papers! – Good-bye, have fun today”.

**(3) Bead Sorting.** This task was designed to show persistence. The objective of the task was to see if a child would remain engaged in a task that was presented as a “chore” rather than a pleasurable task. The child was sat at a child-sized table and chair, facing the camera. The bead sorting container and the box of beads was placed in front of the child. The box of bead was clear box containing about 300 beads of different colors (100 of each color). In addition, the child was given a clear plastic box divided into different sized squares for sorting. The experimenter brought the box of beads and the sorting container to the child, put them on the table, and said, “I have something for you to do. My beads are all mixed together and I need you to sort them by color. See? You can put the blue ones in here, like this (e.g., the experimenter dropped a blue bead into the bucket with the blue bead screwed to the outside), the red ones in here, like this, and the white ones in here, likes this. Will you work on this?” The task lasted 3 minutes. After three minutes the experimenter asked the child how he/she was doing. The experimenter then complimented the child on the number of beads s/he sorted and thanked the child for his or her help. Then the experimenter said, “I’ll sort the rest of these beads later.”

**(4) Fidgeting Video.** This episode provided a measure of the child’s activity level during a period in which no overt, activity-eliciting stimuli were present. The episode elicited quiet attention with a video presentation. While attending to the video presentation differences in fidgeting were apparent. As part of the setup, the child was seated in a child-sized chair about four feet in front of a television monitor. The television monitor was positioned so that the camera could get a good, frontal view of the child’s whole body, and so the child still has a good view of the television monitor. The child watched the final 4 minutes of a Walt Disney Mini Classics Winnie the Pooh and Tiger Too video, which presents a range of emotions (fear, then happiness, then sadness, then happiness again; more details available on request from authors). To begin the task, the experimenter came into the room and said, “Now you’re going to watch a video. Do you like Winnie the Pooh? I just have to set up the television and then you can watch the video.” After the experimenter had set up the TV (e.g., plugged it in etc.) she showed the child where to position his or her chair. Then experimenter then said, “Let’s watch this video now.” The video lasted 4 minutes.

 **(5) Impossibly Perfect Circles (Green Circles).** The goal of the task was to elicit frustration and boredom. The child was sat at a child-sized table, facing the camera. As part of the task, the experimenter entered the room with a piece of paper and green pen and asked the child, “Can you do me a favor? I need the PERFECT green circle. Could you draw it for me? I need the perfect green circle.” The experimenter then put the paper on the table in front of the child and gave the child the green pen. EACH circle the child drew was critiqued by the experimenter (in a neutral voice), then the experimenter kept asking the child to draw another one. Critiques were specific, but did not include any information on how to rectify the problem. Some examples of critiques were: “That one is too pointed (indicating point on circle). Draw another one, “That one is too flat, draw another one. That one is too skinny… , too small, to large, lopsided, is an oval, is not round, not quite right …” The experimenter did not allow the child to turn the paper over to continue drawing on the back. If this occurred (and it usually did) the experimenter stopped the child and said, “No, I need you to draw the perfect circle on this side. Could you draw another one?” If the child said there was no more room, the experimenter said, “you can draw over the top of the other ones” (Some children do not want to cross any of the previous circles). Three times throughout the episode, the experimenter said, “I need the PERFECT green circle.” The task was terminated after 3 ½ minutes. To bring the child back to baseline, the experimenter said (in a very pleasant voice), “That one looks pretty good (indicating the circle C just completed). Circles are hard to draw, aren’t they? Thanks for drawing all those circles. Would you like to make that one into a smiley? (Indicating a suitable circle). Let’s give this to your mom/dad, OK?”

 **(6) Corral of Balls.** This episode provided a novel, non-social situation for measuring motoric activity. The rubber balls that filled the corral enclosure afford opportunities for a variety of highly energetic activities. As part of the setup, the corral (made from a snap-up plastic pool that was 2.5 m in diameter, 38” high walls) was placed in the middle of the floor of the experiment room. 40 brightly colored balls of different sizes were placed inside the corral. The parent was not present during this episode. To begin the task, the experimenter escorted the child into the room and instructed the child, “Look at the balls, \_\_\_\_\_\_\_\_\_\_. You can play with them all by yourself in any way you want to play with them.” The experimenter then placed the child in the middle of the corral. The child was allowed to explore and play with the balls as he/she saw fit. There were no additional directions from E. The task lasted for three minutes.

 **(7) Exploring the Coffee Pot.** The rationale behind this task is that a coffee pot allows the child an opportunity to manipulate several pieces of a novel toy. Individual differences in interest were manifested by how long children chose to explore this novel object. As part of the setup, the child was seated at the child-sized table and chair, facing the camera. The parent was not present. The coffee pot was an aluminum pot about 6” tall and about 4” in diameter (measures at the base) with a black, plastic handle. Inside it contained three removable/stackable pieces. There was also an aluminum lid with a glass knob handle. The experimenter presented the coffee pot to the child and said, “Look what I have for you to play with. It’s a coffee pot. Look. You can take it apart, and play with it any way you like.” The experimenter then showed the child all of the various parts. The experimenter ended the task after three minutes and asked the child how she or he liked the toy.

**(8) Popping Bubbles.** The rationale behind this task is that blowing bubbles is a pleasurable task for most children. Allowing them to pop the bubbles increases the intensity of that pleasure. In the first part of the task (“low pleasure”), the experimenter demonstrated how to blow bubbles with a bubble gun and then invited the child to do the same. In the second part of the task (“high pleasure”), the experimenter encouraged the child to engage in the boisterous activity of chasing bubbles and popping them. During the first part of the task, the child was sat at the child-sized table and chair, facing the camera, and the experimenter was seated to the right side of the child. During the second part of the task, the child stood and jumped in one area that faced the camera while the experimenter stood off to the side blowing bubbles at the child with the bubble gun.

To initiate the low pleasure part of the task (45 s), the experimenter said in an enthusiastic voice, “Guess what I have? A bubble toy. How you ever played with one before? It’s really fun. Let me show you how to blow the bubbles.” The experimenter then demonstrated the bubble blowing toy (one time). The experimenter then said, “Do you want to try this?” The experimenter then gave the toy to the child and allowed him/her to blow bubbles on time. The experimenter terminated this portion of the task by saying, “Now let’s play another game with the bubble toy. Let’s go over here (walking to the back of the room), you stand here and I’ll blow bubbles so you can pop them.”

To initiate the high pleasure part of the task (1 minute), the experimenter instructed the child to stand in a line with the camera to obtain a clear view. The experimenter said to the child, “Stay in the spot and I will blow the bubbles toward you, but you can move around to pop the bubbles.” First, the experimenter said, “Try to pop as many of these bubbles with your elbows as you can.” The experimenter then aimed a series of bubbles in an arc toward the ceiling three times. Next the experimenter said to the child, “Now try to pop as many of the bubbles as you can with your feet.” The experimenter then aimed series of bubbles in an arc toward the ceiling three times. Finally, the experimenter said, “Try to pop as many of these bubbles with your hands as you can.” The experimenter then aimed a series of bubbles in an arc toward the ceiling three times.

**(9) Surprise, it’s a Pop-Up Snake!** The goal of this task was to elicit exuberance by having children play a trick on their parent. The child was seated at a child-sized table and chair, facing the camera. The parent was not present during the first part of the episode. The task involved use of a can designed to resemble a can of peanut brittle, but actually containing pop-up snakes, which jumped out upon opening the container. As part of the set-up, the experimenter approached to the left of the child while holding the “peanut brittle” container. As the experimenter approached, he/she pretended to be struggling with the lid of the container (“pulling” against the lid, knitting their eyebrows, frowning in concentration and loosening the lid so C will be able to open it). When the experimenter was standing next to the child, he or she extended the container and appealed to the child for help, “I found this can but I can’t get the lid open. Can you help me? I’d certainly appreciate your help.” The experimenter made sure that the can was pointed away from the child’s face. The child and the experimenter then open the lid and the “snake” pops out. After a 5 s pause the experimented then turned to the child and asked the following questions: “Did that surprise you? I know, do you want to surprise your mom/dad? OK, let’s put these back in the container, and I’ll have your mom/dad come in here and you can surprise her/him (Note that this is the ONLY time that the experimenter in any way indicated that the child can/should help put the snakes back in the can). You stay here and when your mom/dad comes in you can surprise her/him. I’ll go get her/him.” The experimenter then opened the door to the camera room and said, “Mom/dad, \_\_\_\_\_\_\_\_\_\_\_\_\_\_ has something to show you.” Mom/dad entered the experiment room and acted surprised when the snakes pop out of the can. The experimenter then waited 1 minute after the snakes had popped out of the can and returned to the room, concluding the game by saying to the child, “Did you surprise your mom/dad?”

**10) NIH Toolbox: Early Childhood Cognitive Battery.** This computerized assessment is a battery of multidimensional measures of executive functioning normed for administration from ages 3-85 years (Weintraub *et al.*, 2013, Zelazo *et al.*, 2013). Four separate computerized tasks were completed by the child: Picture Vocab assessing verbal ability/intelligence, Flanker test assessing inhibitory control and attention, Dimensional Change Card Sort assessing set-shifting, and a task assessing episodic memory. Children were told they would play some computer games, and were instructed to sit in front of the computer, next to the experimenter, and respond to prompts by the computer and experimenter to play the “games”. The assessment normally took approximately 20-30 minutes to complete.

**11) Bracken School Readiness Assessment-III (BRSA).** This is a standardized assessment of basic skills associated with a child’s school readiness (Panter and Bracken, 2009). The BSRA includes 88 items across five subtests (i.e., colors, letters, numbers/counting, sizes/comparisons, shapes) presented as picture options in a flip book. Testers labeled a target item and the child selected one answer from four to ten alternatives (e.g., “Look at all of the pictures, show me which animal is big”). A subtest was discontinued following three consecutive incorrect responses. The BRSA took around 10 minutes.

**Coding Procedures**

There were 20 coders involved in coding videos for the age 3 assessment. All coders were trained using 90 different videos (10 of each of the 9 relevant behavioral situations), with each video/task coded for 6 different domains (negative affect, positive affect, attention, persistence, social affiliation/engagement, and fear). The two remaining cognitive tasks (NIH Toolbox and Bracken School Readiness) were coded live by experimenters. As part of the training procedures, training videos were selected for breadth of behavior and codes. Reliability analyses were conducted across both task and domain to ensure the coder was reliable across all situations and behaviors. Reliability scores of .80 or higher were required for every task and domain in order to become a behavioral coder. Of note, 75% of the coders had reliability of .90 or higher for their training videos.

After training and during the regular coding process, 20% of videos were coded multiple times for reliability purposes. Of these 20%, half were considered “blind reliability” wherein a video was randomly assigned to two different coders, and coders did not compare codes afterward. The other half of reliability codes were considered “drift reliability.” For this process, the original coder was randomly selected from all 20 potential coders (as was always the case), but the reliability coder was always one of two “expert coders” (i.e., a coding trainer). After completing the reliability coding, the expert coder compared their codes to the original coder’s. Any codes differing by more than 1 on the rating scale were flagged, and the second expert coder then coded that video. Based on the results of all three coders, a consensus was reached and explained to all coders. This process helped prevent “drift” of coders after training had been completed. When the original codes were considered “incorrect” after the consensus, they were changed for the purpose of data collection. However, the original “incorrect” codes were kept for purpose of reliability so as to not inflate inter-rater reliability in subsequent analyses. Both “blind reliability” and “drift reliability” codes were combined to determine overall inter-rater reliability across tasks and domains.

**References**

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