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Brief article

Keep trying!: Parental language predicts infants' persistence

Kelsey Lucca[a,b,*], Rachel Horton[a], Jessica A. Sommerville[a,c]

[a] Department of Psychology, University of Washington, USA
[b] Department of Psychology, Arizona State University, USA
[c] Department of Psychology, University of Toronto, Canada

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ABSTRACT

Infants' persistence in the face of challenges predicts their learning across domains. In older children, linguistic input is an important predictor of persistence: when children are praised for their efforts, as opposed to fixed traits, they try harder on future endeavors. Yet, little is known about the impact of linguistic input as individual differences in persistence are first emerging, during infancy. Based on a preliminary investigation of the CHILDES database, which revealed that language surrounding persistence is an early-emerging feature of children's language environment, we conducted an observational study to test how linguistic input in the form of praise and persistence-focused language more broadly impacts infants' persistence. In Study 1, 18-month-olds and their caregivers participated in two tasks: a free-play task (a gear stacker) and a joint-book reading task. We measured parental language and infants' persistent gear stacking. Findings revealed that infants whose parents spent more time praising their efforts and hard work (process praise), and used more persistence-focused language in general, were more persistent than infants whose parents used this language less often. Study 2 extended these findings by examining whether the effects of parental language on persistence carry over to contexts in which parents are uninvolved. The findings revealed that parental use of process praise predicted infants' persistence even in the absence of parental support. Critically, these findings could not be explained by caregivers' reporting on their own persistence. Together, these findings suggest that as early as 18 months, linguistic input is a key predictor of persistence.

1. Introduction

When young learners are confronted with challenges, whether it's trying to navigate their environment by crawling, successfully communicating a need to their caregivers, or just trying to get a new toy to work, they don't passively wait for solutions to be handed to them. Rather, they interact with their environment in ways that directly contribute to and enhance their learning (Piaget, 1954). And critically, they are persistent in doing so. Individual differences in persistence emerge as early as 6 months, and have been shown to predict motivational and academic outcomes years later (Messer et al., 1986). Yet, we know relatively little about the factors that shape persistence, particularly as individual differences are first emerging during infancy. Here, we investigated the roots of individual differences in persistence by examining the role that the social environment plays in the development of persistence. While many aspects of the social environment likely work together to shape persistence (Banerjee & Tamis-LeMonda, 2007; Leonard, Lee, & Schulz, 2017), here we focused in on how the type of language infants are exposed to surrounding the value of effort, hard work, and persistence shapes their own persistence.

Later in development, during childhood, one of the most robust predictors of persistence is the language, particularly in the form of the verbal praise, that children receive surrounding their efforts and hard work (Cimpian, Arce, Markman, & Dweck, 2007; Kamins & Dweck, 1999). In both the classroom and in more experimental settings, researchers have repeatedly shown that when children are praised for their effort (i.e., "process praise", such as "you worked so hard!") they exhibit higher levels of motivation and more advanced problem solving skills than when they are praised for fixed, innate abilities (i.e., "person praise", such as "you're so smart!"; Cimpian et al., 2007; Kamins & Dweck, 1999). Children who receive more person praise are not only less likely than children who receive process praise to succeed on future challenges, they are also more likely to experience negative affect and helplessness when confronted with challenges, and avoid future challenges altogether (Kamins & Dweck, 1999). The mechanism underlying the effect of praise on motivation has been argued to be a shift in children's underlying motivational frameworks: children who hear more person praise adopt "fixed mindsets", meaning they attribute their

* Corresponding author at: Department of Psychology, University of Washington, Seattle, WA 98195, USA.
E-mail address: klucca@asu.edu (K. Lucca).

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success to basic, inherent abilities and talents, whereas children who hear more process praise tend to adopt "growth mindsets" in which they view their abilities as the product of exerted effort, learning, and persistence (Mueller & Dweck, 1998). Recently, it has been proposed that the impact of praise on persistence begins early in development: the praise infants receive for their efforts at 12 months predicts their subsequent academic achievement nine years later (Gunderson et al., 2013, 2018). However, given that parental praise is highly correlated across development (Gunderson et al., 2018), it is unclear whether it is praise during infancy per se that predicts later persistence, or praise during later childhood that predicts persistence.

If praise does indeed impact persistence during infancy, then it is important to consider what the mechanisms underlying this effect are. Earlier in development, praise may influence persistence by teaching infants about the general value of effort and hard work. If so, then process praise should not be the only type of language that predicts persistence. Rather, any language that highlights persistence, or the value of persistence, should predict persistence.

1.1. The development of persistence-focused language: a preliminary corpus analysis

To narrow our investigation, and provide the most targeted test of these questions, we first set out to determine when in development process praise and persistence-focused language (i.e., the word "try" or a variation of it) may exert the strongest influence on persistence. We did so by conducting a quantitative analysis of children's exposure to and understanding of persistence-focused language using two online databases of children's language development: the Child Language Data Exchange System (MacWhinney, 2000), a large-scale, open database of transcripts that includes transcribed caregiver-child interactions and Wordbank (Frank, Braginsky, Yurovsky, & Marchman, 2017), an open repository of MacArthur-Bates Communicative Development Inventories (CDIs; Fenson et al., 1994) archived across labs (see supplemental material for additional details). We found that starting at 3 months of age, children are exposed to persistence-focused language, and this exposure remains constant across development (Fig. 1). In contrast, children's understanding and production of persistence-focused language undergoes a major transition across development: children first produce the word try at 16 months, experience their first uptick in comprehension at 18 months (Fig. 2), and then continue to increase their comprehension and production across the first several years of life, suggesting that 18 months is an ideal timeframe to focus our investigations on infants' exposure to persistence-focused language.

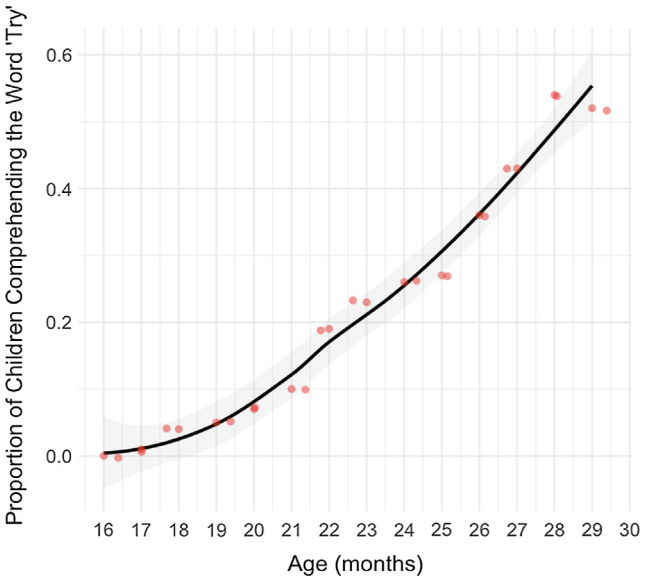

Fig. 2. Data extracted from Wordbank (Frank et al., 2017). Proportion of children in the database whose parents report comprehend the word try. Children's comprehension of the word try undergoes its first peak at 18 months.

1.2. The current study

Starting as early as 3 months of age, infants are exposed to language related to persistence. Given that this exposure remains constant across development, it is critical to identify what the effects of this language on infants' actual behaviors are. The current study set out to investigate this question by examining the relation between spontaneously produced praise and persistence-focused language and infants' own persistence. Since infants' comprehension and production of persistence-focused language begins to increase at 18 months, we chose this as our target age range to test the effects of persistence language on infants' persistence.

As in past work, we examined the effects of different types of praise on persistence. Given the established link between process praise and

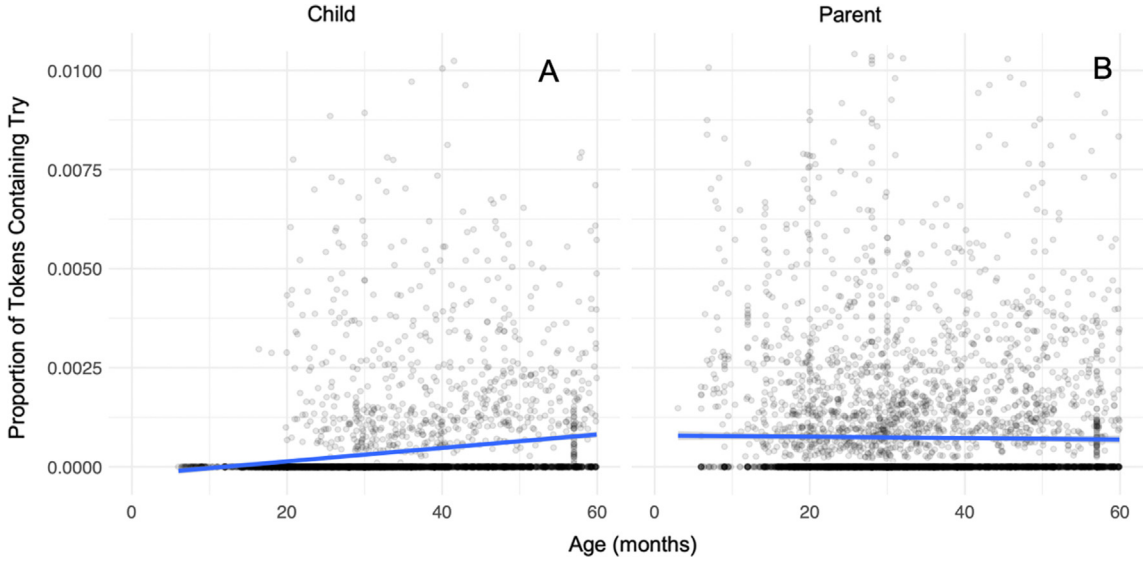

Fig. 1. Data extracted from the CHILDES database. Children's production of the word "try" first appears at 16 months and increases after this age (A), whereas children's exposure to the word "try" begins early and remains constant across development (B).

persistence in later childhood, we predicted that increased exposure to process praise, but not person or generic praise, would be related to increased persistence. Unlike prior work, we also measured infants' exposure to persistence-related language more broadly as a way to approximate the linguistic messages caregivers convey surrounding the value of effort and hard work. In Study 1, we examined the degree to which parental language predicted infants' persistence in a task in which the parent was directly involved and speaking to the child, and in Study 2 we tested whether parental language predicted infants' persistence in the absence of parental involvement.

Finally, we wanted to know whether the effect of parental language on persistence was epiphenomenal in nature, that is, simply a reflection of the degree to which parents themselves are persistent, or whether there is something about the language itself that is driving persistence. To do so, we examined the relation between parental language (i.e., use of praise and persistence-focused language) and parental report of persistence as measured by the Short Grit Scale (Duckworth & Quinn, 2009). If caregivers who use more process praise and persistence-focused language also self-report as being more persistent, it may be the case that it is not language per se that is driving infants' persistence. Alternatively, there may be something about the language itself that is enhancing persistence, such as conveying verbal messages that work to teach infants about the value of persistence.

2. Study 1 methods

2.1. Participants

Twenty-nine full-term, typically developing 18-month-olds (11 females, M_{age} = 18.52 months, SD_{age} = 0.51, range = 17.70–19.30) and their caregivers participated. Participants were recruited from a university- maintained database and identified by their parents as White (n = 24), American Indian or Alaskan Native (n = 1), Native Hawaiian or Pacific Islander (n = 1), or mixed-race (n = 3).

2.2. Procedure

Infants participated in two naturalistic tasks. We selected a joint book reading task and a free play stacking task as our two naturalistic tasks as these are sufficiently structured to allow for consistency across participants, but are also high in ecological validity. These tasks represent two common activities that parent-infant dyads engage in at this age, thereby allowing us to best capture parent's naturalistic use of spontaneously produced language. We removed all text from the book (aside from the title page), and did not give parents explicit instructions on what the book was supposed to be about, or what to say. In this way, the book task provided a unique opportunity to measure the extent to which parents spontaneously chose to convey messages about persistence.

2.2.1. Joint book reading task

Parent-infant dyads were given a wordless picture book, "Walk on!: A Guide for Babies of All Ages" by Marla Frazee, and instructed to read it just as they would at home. Across 12 pages, an infant was depicted trying, and failing, to walk before ultimately succeeding to walk. On average, parents spent 3.20 min (SD = 1.53) reading with their infants.

2.2.2. Free play stacking task

After parents finished reading the book, they notified the experimenter who then brought them the gear stacking toy (Fig. 3). The toy consisted of a single rod with a base and six stacking gears. To make the task more challenging for infants, we inserted colored, cardboard barriers inside the center of half (i.e., 3) of the gears. Parents were given the following instructions: "Here is the toy that we would like for you to interact with just like you would at home. We made a few small modifications to some of the pieces to make it more challenging, so you may notice that the pieces are not all the same. When you feel that she/he is all done playing please knock on the door and I'll come back in. If the session goes past 10 min I'll come back". On average, parents spent 8.38 min (SD = 2.49) playing with their infants.

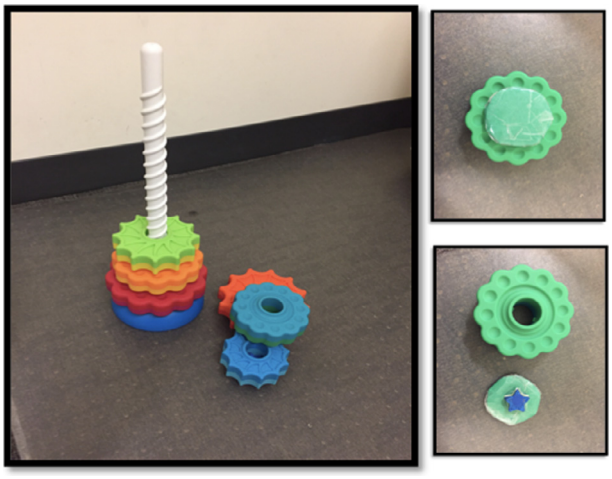

Fig. 3. Free play stacking task given to parent-infant dyads. On the right is a close-up of a gear made more difficult for infants.

2.3. Measures

2.3.1. Infants' persistence

Our primary measure of infants' persistence was the number of gears infants stacked on the top of the base during the free play stacking task. Since there was variability in session length across dyads, we divided the number of gears infants stacked on top of the base by the total time of the session to produce a "gear stacking rate" (i.e. how many gears stacker per minute). Two coders independently coded 100% of the videos to establish a high degree of reliability (r = 0.98, p < .001).

To ensure that our measure of persistence was a reliable and valid measure of infants' overall persistence (as opposed to a measure of some other ability, such as motor coordination), we also measured (1) the overall amount of time infants spent trying to stack gears onto the base, (2) the total number of repeated attempts (both successful and unsuccessful), and (3) the number of times infants continued trying in the face of failure (as opposed to giving up). As with our original gear stacking measure, we divided each of these metrics by the total session time to control for variability in session length. Two coders independently coded 100% of the videos to establish a high degree of reliability (time persisting: r = 0.95; stacking attempts: r = 0.86; responses to failure: r = 0.83, all p's < .001). Each of these new measures was highly correlated with our primary measure of persistence, gear stacking rate (time persisting: r = 0.89, p < .001; total stacking attempts: r = 0.93, p < .001; responses to failure: r = 0.80, p < .001). The analyses presented here focus on our primary measure of persistence, infants' gear stacking rate, as well as a single composite trying score that includes all four trying metrics.

2.3.2. Parental language

Parental speech across both the book and toy task was first transcribed into utterances. Then, researchers classified each utterance as praise and/or persistence-focused language: praise and persistence-focused language were coded separately and were not mutually exclusive (i.e., it was possible for an utterance to contain both praise and persistence-focused language). To classify praise, we used the coding scheme developed by Gunderson et al. (2013) which was informed by the coding schemes of Mueller and Dweck (1998) and Cimpian et al. (2007).

2.3.3. Praise

An utterance was classified as containing praise if it positively evaluated the infant, their actions, and/or the outcomes of their actions in any way. If it did not, it was classified as "not praise". Once a coder established that an utterance contained praise, it was further classified into one of three types of praise:

(1) *Process praise.* Process praise included any phrase that positively evaluated the infant's effort, strategies, or actions. In the free play stacking task, these included phrases such as "good job!", or "great stacking!". In the joint book reading task, these included phrases such as "that was a great try!".
(2) *Person praise.* Person praise included any phrase that positively evaluated a fixed, inherent trait of the infant. In the free play stacking task, these included phrases such as "you're so smart!". In the joint book reading task, these included phrases such as "that's a strong baby!".
(3) *Generic praise.* Generic praise was any praise that did not fall into the above two categories. These were often phrases that expressed a general positive valence towards the infant (in the free play stacking task) or towards the infant in the book (in the joint book reading task) such as "good!" or "yay!".

2.3.4. Persistence-focused language

An utterance was classified as containing persistence-focused language if it referred to the act of trying or repeatedly attempting to complete a goal-directed action. These included phrases that explicitly referred to the act of trying (e.g., "you're trying so hard!") and more implicit messages surrounding persistence (e.g., "keep at it, keep at it!").

2.3.5. Inter-rater reliability

Seventy-five percent of transcripts were coded by two independent coders, agreement across raters was high for all categories of praise ($r = 0.97$, $p < .001$) and persistence-focused language ($r = 0.99$, $p < .001$).

2.3.6. Parental persistence

Parental persistence was measured with the eight-item Short Grit Scale (Duckworth & Quinn, 2009). Items require participants to use a five point Likert-like scale (ranging from 1 = not at all like me to 5 = very much like me) to report on their perseverance of effort (e.g., "Setbacks don't discourage me") and consistency of interests (e.g., "I often set a goal but later choose to pursue a different one"). Certain items were reversed scored such that higher SGS scores represent higher levels of persistence.

3. Results

All analyses include parental language data from both the toy and book tasks.[1] Analyses were performed in R (Development Core Team, 2003) using the functions *lm* and *cor.test*. Outliers greater than 2.5 standard deviations above the mean were excluded from all analyses.

3.1. Parental praise and infants' persistence

To assess the overall relation between parental praise and persistence, we first calculated a total praise as a proportion of total utterances score: we divided the total number of praise utterances a parent produced (across all praise categories) in both tasks by the total number of utterances that parent produced across both tasks. We then correlated this value with infants' gear stacking rate during the toy task. On average, infants stacked 1.35 gears per minute ($SD = 0.98$, range = 0.00–3.43). Infants whose caregivers used a higher proportion of all types of praise were more persistent than infants whose caregivers used less praise ($r = 0.54$, $p = .003$).

To measure the unique contribution of each type of praise on infants' persistence, we calculated total process, person, and generic praise as a proportion of total utterances score (e.g., process praise proportion score = total number of utterances that included process praise divided by the total number of utterances produced across both tasks). We then ran a linear model with the proportion of process praise, person praise, and generic praise as predictor variables, and infants' stacking rate as an outcome variable. The only significant predictor to emerge from the model was process praise ($t = 2.48$, $p = .021$, Fig. 4), suggesting that process praise uniquely predicts persistence, above and beyond generic and person praise (Table 1).

Infants' exposure to process praise was not only correlated with infants' gear stacking rate ($r = 0.51$, $p = .005$), it was also correlated with a standardized composite measure of infants' trying behavior ($r = 0.48$, $p = .009$) that included the amount of time infants spent trying, the total number of attempts to stack, the total number of successful stacks, and the number of times infants continued to try in the face of failure.

3.2. Parental persistence language and infant persistence

To assess whether infants' exposure to persistence-focused language relates to increased persistence, we calculated a proportion of persistence-focused language score. We divided the total number of utterances across both tasks that included persistence-focused language by the total number of utterances produced across both tasks. We then ran a correlation between the proportion of persistence-related utterances and infants' persistence. Infants whose caregivers used a higher proportion of persistence-related language had higher rates of stacking ($r = 0.39$, $p = .038$; see Fig. 5). Persistence-related language also significantly correlated with the composite measure of infants' trying behavior during the stacking task ($r = 0.40$, $p = .035$).

3.3. Parental praise and persistence-focused language

We also tested for a relation between the proportion of process praise and proportion of persistence-focused language caregivers used and found no relation ($p > .05$), suggesting that although they are conceptually similar, process praise and persistence-focused language are distinct constructs.

3.4. Parental language and parental persistence

To test the unique effects of parental language on infants' persistence, we examined the relation between parental language and their own persistence, as measured by self-report on the Short Grit Scale (SGS). No significant relation emerged between the proportion of process praise or persistence-focused language used during the tasks and SGS scores (all $p's > .05$). This was true when examining SGS scores overall, and each subscale of SGS (i.e., perseverance of efforts and consistency of interest) and parental language (all $p's > .05$), suggesting that it is persistence language, as opposed to, or potentially in combination with, parents' own persistence, that is driving infants' persistence.

4. Study 2

In Study 1, we found that parental language predicted infants' persistence in a task in which the parent was directly involved and speaking to the infant. However, it remains unknown whether the effects of parental language extend to impact infants' persistence in a task in which the infant must work independently, without any parental support. To test this question, we conducted a follow-up study with an

[1] Data included in this paper are available via OSF: osf.io/4q7ht.

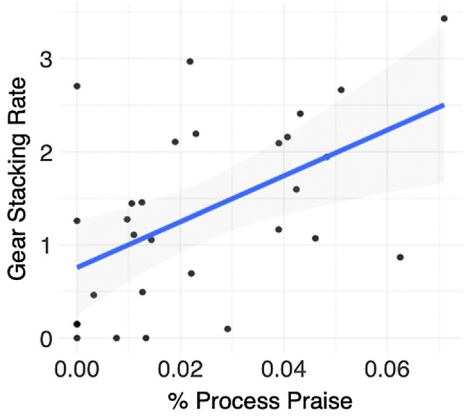

Fig. 4. The relation between gear stacking rate and their exposure process praise.

Table 1
Results of the linear model testing whether process, person, or generic praise influences infants' persistence. Significant *p* values shown in bold.

	Estimate	SE	*t*	*p*
(Intercept)	0.19	0.41	0.46	.648
Process praise	20.80	8.37	2.48	**.021**
Person praise	12.78	27.28	0.47	.644
Generic praise	9.17	4.80	1.91	.068

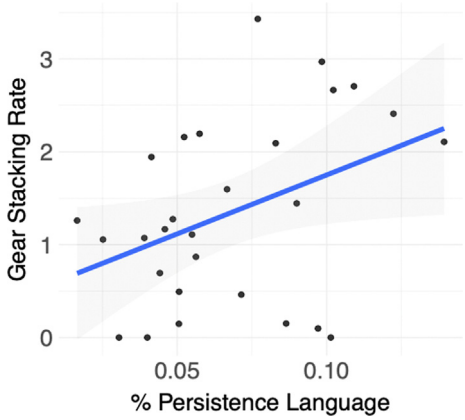

Fig. 5. The relation between infants' gear stacking rate and their exposure to persistence-focused language.

independent group of 18-month-olds to examine whether parental language predicts infants' persistence in the absence of parental involvement. The task was designed to be unique from any task infants have in their home environment, and distinct from the stacking task in Study 1. We created a wall covered in transparent tubes with balls stuck inside the tubes. The goal of the task was to remove the balls and drop them down a musical chute. The task was difficult (though not impossible) to solve. As in Study 1, we also measured parental language and infants' persistence during a gear stacking task.

5. Method

5.1. Participants

Twenty-nine full-term, typically developing 18-month-olds (13 females, M_{age} = 18.09 months, SD_{age} = 0.51, range = 17.63–18.46) and their caregivers participated. Participants were recruited from a university- maintained database and identified by their parents as White (n = 22), Asian (n = 2), or mixed-race (n = 5). Five additional dyads completed the task but were not included because they refused to participate in the warm-up task (n = 2), fussed out during the tube task (n = 2), and parental interference during the tube task (n = 1).

5.2. Procedure

Infants participated in four tasks in a fixed order: (1) warm-up latches board task, (2) tube persistence task, (3) easy buffer task, and (4) gear stacking task (Fig. 6). Infants participated in the first three tasks independently (under an experimenter's supervision), and the last task with only their caregiver. During tasks 1–3, the caregiver was present, but sat on the opposite side of the room, wore occluding glasses, and noise-cancelling headphones so that she/he could not see or hear what the infant was doing. Parents were instructed to remain completely neutral and to not interfere with their infants' behavior in any way during the task. During the free play stacking task, the experimenter left the room so that caregivers could interact with their infants as they would at home.

5.2.1. Warm-up latches board task

Infants were presented with a latches board game when they entered the testing room. The goal of this warm-up task was acclimate infants to the testing room, and to rule out the possibility that infants' failure to interact with task during the experiment was not due to shyness. An a priori decision was made to exclude any infants that refused to interact with the warm-up task (n = 2).

5.2.2. Tube persistence task

The task was divided into two phases: training and test. During the *training* phase, the experimenter presented infants with six balls, and showed them how to put them down a musical chute (Fig. 6). The chute had a speaker hidden inside such that each time a ball entered, it played a jingle. The experimenter placed the first ball down the cute, and then gave the infant the opportunity to drop the rest of the balls down the chute. Once all balls were down the chute, the experimenter presented infants with small board that had a clear tube affixed to it, with a ball inside the tube. The experimenter told the infant, "I want to get that ball!". The experimenter then removed the ball from the tube and placed it down the chute. During *test*, the experimenter revealed a previously hidden wall that had four clear tubes on it, with a different colored ball located inside each tube. The experimenter told the infant "It's your turn! Can you get the balls? I'm going to sit over here." The experimenter then sat away from the infant and set a four-minute timer. The experimenter remained silent during the four-minute period and did not interfere with the infants' behavior. The task was difficult, but not impossible. No infant successfully retrieved all four balls, and 34% of infants were able to get at least one ball out of the tubes.

5.2.3. Easy buffer task

Once the four-minute test period finished, the experimenter placed a sheet over the tube wall and presented infants with a new, musical pop-up toy (Fig. 6). For approximately two minutes, the experimenter played with the infant and the toy. The goal of this task was to reset infants, and make sure they were in a positive mood before initiating the next task.

5.2.4. Free play stacking task

The free play stacking task was conducted in the exact same way as Study 1. On average, parents spent 9.90 min (*SD* = 0.91) playing with their infants.

5.3. Measures

5.3.1. Infants' persistence

The primary measure of infants' persistence was the amount of time they spent trying to get balls out of the tubes during the 4-minute test

Fig. 6. Tasks used in Study 2. Warm-up latches board task (top left), tube persistence task (right), and easy buffer task (bottom left).

period of tube persistence task. As in Study 1, we also coded infants' gear stacking rate during the free play stacking task. Infants' gear stacking rate was highly correlated (r's = 0.83 − 0.95, all p's < .001) with other metrics of trying (time spent trying, trying attempts, responses to failure) in Study 1, suggestive that these measures are highly redundant. Therefore, we did not code other trying behaviors in Study 2, and instead focused exclusively on infants' gear stacking rate. Two coders independently coded 100% of the videos to establish a high degree of reliability across both persistence measures (tube persistence: r = 0.95, gear stacking rate: r = 0.98; both p's < .001).

5.3.2. Parental language

Parental speech during the toy task was transcribed and coded in the exact same way as Study 1. Seventy-five percent of transcripts were coded by a second independent coder, agreement between raters was high for all categories of praise (r = 0.99, p < .001) and persistence-focused language (r = 0.99, p < .001).

5.3.3. Parental persistence

To measure parental persistence, as in Study 1, parents completed the Short Grit Scale (Duckworth & Quinn, 2009).

6. Results

6.1. Parental praise and infants' persistence

On average, infants spent 31.14 s (SD = 17.76) trying to get the balls out of the tubes. Infants whose caregivers used a higher proportion of all types of praise were more persistent than infants whose caregivers used less praise (r = 0.45, p = .020). To measure the unique contribution of each type of praise on infants' persistence, we ran a linear model with the proportion of process praise, person praise, and generic praise parents used (as a function of the total number of utterances) as predictor variables, and infants' persistence (how long they spent trying to get the balls) as the outcome variable. The only significant predictor to emerge from the model was process praise (t = 3.15, p = .005; Fig. 7), suggesting that process praise uniquely predicts persistence, above and beyond generic and person praise. These findings extend the results from Study 1 by demonstrating the effect of process praise on infants' persistence is present even in the absence of parental involvement.

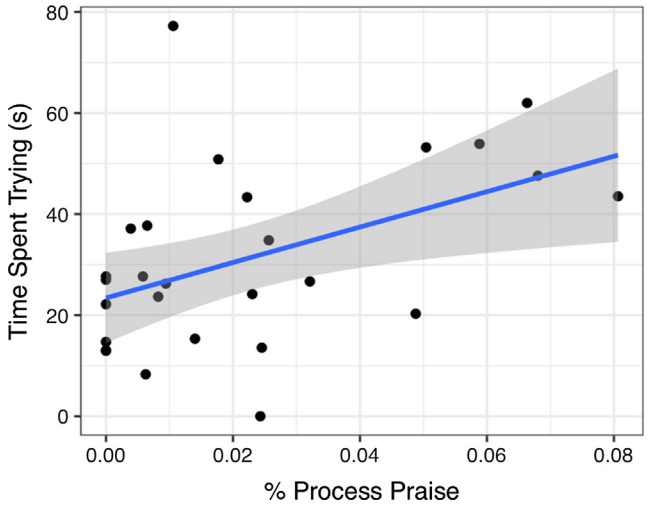

Fig. 7. The relation between infants' persistence during the tube task and exposure to process praise (r = 0.467, p = .014).

6.2. Parental persistence language and infant persistence

To assess whether infants' exposure to persistence-focused language predicts persistence, we ran a correlation between the proportion of persistence-related utterances and infants' persistence during the tube task. Unlike Study 1, infants whose caregivers used a higher proportion of persistence-related language did not have higher persistence scores (p > .05). These findings suggest that persistence-focused language may not extend to contexts in which that language is not being directly provided, and may be more powerful in predicting infants' persistence in the moments they are exposed to that language.

6.3. Parental praise and persistence-focused language

As in Study 1, we also tested for a relation between the proportion of process praise and proportion of persistence-focused language caregivers used and found no relation (p > .05), providing further evidence that although they are conceptually similar, process praise and persistence-focused language are distinct constructs.

6.4. Parental language and parental persistence

To test the unique effects of parental language on persistence, we

examined the relation between parental language and their own persistence, as measured by self-report on the Short Grit Scale. No significant relation emerged between the proportion of process praise or persistence-focused language used during the tasks and SGS scores (all p's > 0.05). This was true when examining SGS scores overall, and each subscale of SGS (i.e., perseverance of efforts and consistency of interest) and parental language (all p's > 0.05). These results replicate the findings from Study 1 and suggest that it is parental language, as opposed to, or potentially in combination with, parents' own persistence, that is driving infants' persistence.

6.5. Relation between parent language and infants' persistence during dyadic tasks

A secondary aim of Study 2 was to replicate the key finding from Study 1 with a larger sample size. To maximize our power, we combined the data from Study 1 and Study 2 ($N = 58$) and tested whether parental language during the gear stacking task predicted infants' persistence during the gear stacking task (i.e. gear stacking rate). To examine the impact of process praise on infants' persistence across studies, we ran a linear model with process praise, study number (1 vs. 2), and the interaction between study number and exposure to process praise as fixed effect predictors, and infants' gear stacking rate as the outcome variable. There was no significant interaction between study number and exposure to process praise on infants' gear stacking rate ($p > .05$). Infants' exposure to process praise was a significant predictor of their gear stacking rate ($t = 2.60$, $p = .012$), whereas study number was not ($p > .05$). See Fig. 8. To examine the impact of persistence-focused language on infants' persistence across studies, we ran a linear model with persistence-focused language, study number (1 vs. 2), and the interaction between study number and exposure to persistence-focused language as fixed effects predictors, and infants' gear stacking rate as the outcome variable. Again, there was no significant interaction between study number and exposure to persistence-focused language on infants' gear stacking rate ($p > .05$). Infants' exposure to persistence-focused language was a significant predictor of their gear stacking rate ($t = 2.17$, $p = .035$), whereas study number was not ($p > .05$). See Fig. 8. These findings demonstrate that the effect of parental language on infants' persistence is consistent across Studies 1 and 2.

7. Discussion

In the current study, we demonstrated that parental language is an important predictor of infants' early persistence. In Study 1, we showed that parental use of process praise and persistence-focused language predicts infants' persistence during a task in which infants are dynamically interacting with their parent. In Study 2, we demonstrated that the effect of process praise on early persistence extends to contexts in which parental support is not directly provided, but that the use of persistence-focused language does not. Persistence-focused language is centrally focused on the here-and-now (e.g. "keep trying!"), and therefore may play an important a role in encouraging in-the-moment behaviors (e.g. telling infants to keep trying may encourage them to try more). Outside the context of hearing this language, it may not be as meaningful. Process oriented praise may influence infants' persistence through a different pathway, for example, by teaching infants something deeper and more conceptual about the importance of working hard (e.g., by highlighting that successes are a result of hard work).

Together, these findings reveal how different forms of linguistic input may impact persistence in different contexts: persistence-focused language may help infants keep going in the moment they are working to overcome a challenge, whereas process-oriented praise may help infants become persistent more generally, across contexts. In the current study, we were able to isolate the unique effects of parental language on persistence by ruling out the possibility that parents who use more process-oriented praise and persistence-focused language may simply be more persistent themselves. These empirical findings, combined with the corpus analysis of children's language development demonstrating the frequent and stable exposure to persistence-focused language across development, highlights the importance of linguistic input in the development of early persistence.

The current findings build on a new and growing body of work demonstrating that the social environment plays an important role in shaping persistence (Lucca & Sommerville, 2018). For instance, one recent study found that models of persistence also have a direct and causal impact on persistence: infants are more likely to persist if they've seen others persist (Leonard et al., 2017). The current findings expand this work by demonstrating that infants' persistence is not only impacted by what they see, it is also impacted by what they hear. These findings also highlight that the effect of parental language on early persistence is enduring and pervasive. That is, the effect of parental language on infants' persistence impacts infants' persistence both in the moments they are hearing that language, and also extends to influence their persistence in contexts in which they are not directly hearing that language. And finally, similar to prior research conducted with older children, there was no relation between parents' reporting on their own values surrounding persistence and their children's persistence (e.g. Gunderson et al., 2013; Haimovitz & Dweck, 2016; Park, Gunderson, Tsukayama, Levine, & Beilock, 2016). Parents' self-report data reveals

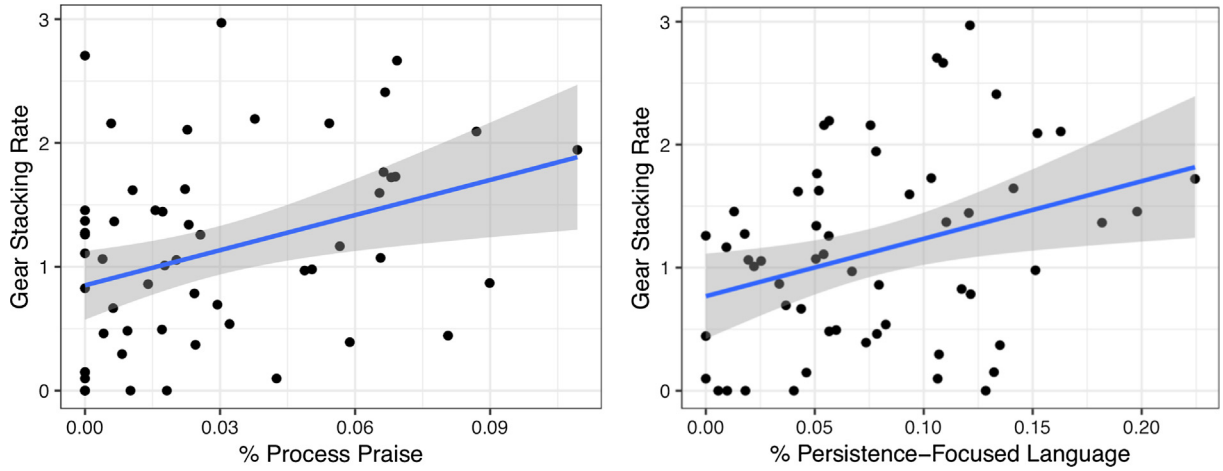

Fig. 8. Data compiled across Studies 1 and 2. Exposure to process oriented praise (left) and persistence-focused language (right) predicts infants' persistence in the gear stacking task.

their explicit values surrounding persistence, whereas their language use may reflect their implicit values surrounding persistence. Implicit and explicit values are not highly correlated (Brunstein & Schmitt, 2004), and are typically associated with different types of behaviors (for a review, see Woike, 2008). Thus, these findings suggest that the type of behaviors that are driven by implicit values (such as language use) are the most potent predictors of infants' persistence.

Understanding the factors that predict early persistence is important because early persistence not only predicts later persistence, it also predicts success in later academic outcomes across domains. Individual differences in persistence during infancy reliably predict problem-solving skills during toddlerhood, and persistence at age three predicts academic achievement at age five across a variety of domains (e.g., vocabulary knowledge, letter-word identification, problem solving; Banerjee & Tamis-LeMonda, 2007; Martin, Ryan, & Brooks-Gunn, 2013; Messer et al., 1986). Given that persistence predicts both academic success (e.g., graduation rates; Duckworth, Peterson, Matthews, & Kelly, 2007) and positive life outcomes more broadly (e.g., marital success, job retention rates; Eskreis-Winkler, Shulman, Beal, & Duckworth, 2014), it is critical to identify, in more precise terms, the specific ways persistence is shaped, particularly as individual differences are first emerging during infancy. Future work can build on the current findings by establishing whether the effect of linguistic input on persistence is not only correlational, but also causal in nature. Here, we took an important first step in this direction by examining the correlation between parental language and infants' persistence.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cognition.2019.104025.

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