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Recent linguistic experience influences children's interpretation of ambiguous words

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Short Report

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Abstract

Adults' interpretation of ambiguous words is sensitive to recent experience. However, it remains unclear whether children's interpretation of word meanings shows this flexibility. Thus, 138 children aged 8–11 years read sentences favouring less frequent meanings and, after a five-minute delay, completed a word association task. Children produced more responses consistent with less frequent meanings for primed than unprimed words, indicating that recent encounters influenced children's subsequent interpretation of ambiguous words.

Introduction

Skilled language comprehension requires rapid access to appropriate word meanings. This seemingly straightforward process is complicated by the fact that approximately 80% of common English words have multiple meanings[1]. During listening and reading, comprehenders must therefore use context to constrain interpretation towards the meaning appropriate to the current situation. For example, in the sentence "*the wings of the crane were very large*", the surrounding context strongly supports the *bird* rather than the *construction* meaning of *crane*. Adults are remarkably efficient at using such contextual information to guide their interpretation of a word's meaning, yet resolving ambiguity is not merely a momentary act of comprehension. Evidence from the word-meaning priming paradigm indicates that encountering an ambiguous word in a biasing context can influence how that word is subsequently interpreted[2]. An episode of comprehension may therefore also be an episode of learning[3]. Although studies with adults provide substantial evidence for this form of *lexical learning*, it remains unclear whether individual comprehension experiences similarly influence children's subsequent interpretation of ambiguous words. This question is particularly important because children's lexical-semantic representations and their ability to exploit linguistic context are still developing[4–6], potentially influencing what is retained from individual comprehension experiences.

In adults, the word-meaning priming paradigm[2] provides robust evidence that individual comprehension experiences can guide subsequent interpretation of an ambiguous word. Typically, participants first encounter ambiguous words in sentences that strongly bias a subordinate meaning and then complete a task assessing meaning availability for primed and unprimed words. One such task is word association, in which participants produce the first related word that comes to mind when an ambiguous word is presented without sentence context, providing an index of which meaning they initially retrieve. Across word association and semantic-relatedness tasks, evidence indicates that prior exposure to a subordinate meaning increases associations consistent with that meaning and facilitates responses on trials linking a probe to that meaning[2,3,7–9], with effects observed across modalities[10] and after delays of up to 24 hours[11]. This influence also extends beyond explicit measures of meaning availability. Eye-movement measures show that prior exposure to an ambiguous word's less frequent meaning reduces the cost of processing that word when a later sentence context favours the same meaning[12].

Together, findings from word-meaning priming studies suggest that adult comprehenders retain information about individual disambiguation experiences that can guide later interpretation. One account proposes that such lexical learning results from a contextually bound episodic trace that provides an additional source of information alongside established long-term lexical-semantic knowledge[11,13]. The Flexible Use of Semantic and Episodic knowledge (FUSE) model embeds this proposal within a broader framework in which word meanings are dynamically constructed by integrating stored lexical-semantic knowledge with semantic predictions generated by the current context and semantic associations retrieved from episodic memory[14]. Applied to word-meaning priming, re-encountering an ambiguous word may therefore reinstate information from the earlier disambiguating episode, biasing interpretation towards the recently experienced meaning. More broadly, this experience-based flexibility is consistent with the Lexical Legacy Hypothesis, in which encounters with words across contexts and episodes accumulate to form increasingly rich lexical knowledge[15].

Whether a single disambiguating encounter similarly influences children's subsequent interpretation of ambiguous words remains unclear. One reason to question this is that younger children may use sentence context less effectively than older children and adults to resolve ambiguity. For example, Booth et al.[4] found that 9- and 10-year-olds showed evidence of activating both meanings of an ambiguous word, regardless of which meaning the sentence supported. In 12-year-olds and more skilled readers, sentence context had a more selective influence, favouring activation of the contextually appropriate meaning. Khanna and Boland[6] reported a similar pattern in 7- to 10-year-olds, although younger children could use simpler single-word contexts. Kaltsa and Papadopoulou[5] also found that 10- to 11-year-olds showed contextual sensitivity alongside difficulty selectively integrating sentence cues. These findings raise an important question for learning: if children use sentence context less consistently to resolve ambiguity during comprehension, is a single disambiguating encounter sufficient to alter the subsequent availability of that meaning and produce word-meaning priming?

To address this question, the present experiment tested whether a single disambiguating encounter with an ambiguous word is sufficient to produce word-meaning priming in 138 children aged 8–11 years. Under a counterbalanced within-participants design, children read sentences strongly biasing the subordinate meanings of 24 ambiguous words, completed a five-minute filler task, and then completed a word association task containing these primed words alongside 24 unprimed words. If recent encounters guide children's interpretation of ambiguous words, we predicted that they would produce a higher proportion of responses consistent with the subordinate meaning for primed than unprimed words.

Figure 1 summarises the proportion of word association responses coded as consistent with the primed subordinate meaning of each ambiguous word. A generalised linear mixed-effects model showed that children were more likely to produce an association consistent with the subordinate meaning in the primed condition than in the unprimed condition, $b = 0.37$, $SE = 0.10$, $z = 3.92$, $p < 0.001$, $OR = 1.45$. This corresponds to 45% higher estimated odds of producing such a response following priming.

Our data suggest that a single comprehension episode in which context favours an ambiguous word's subordinate meaning can influence children's later interpretation of that word, consistent with lexical learning seen in adults. Previous work suggests that children do not always use context to constrain word-meaning access as selectively as adults[4–6]. We did not measure meaning activation or interpretation during the priming sentences, so we cannot establish how selectively children initially resolved the ambiguity. Nevertheless, our findings suggest that limitations in using sentence context need not prevent children from retaining information about the contextually relevant meaning. Whereas previous developmental studies examined immediate meaning activation, the present experiment assessed how a disambiguating encounter influenced subsequent interpretation. Children may experience competition from a contextually inappropriate meaning during initial comprehension while still encoding information that favours the intended meaning at a later encounter. Combining measures of meaning activation during priming with subsequent word association tests could test whether children show word-meaning priming even when both meanings are initially activated.

Evidence of word-meaning priming in children may reflect the role of episodic memory during comprehension. In adults, disambiguating encounters affect subsequent word association, semantic judgements, and online sentence processing[2,10,12]. The FUSE model proposes that contextually bound episodic information can be retrieved during later encounters and integrated with established lexical-semantic knowledge to shape a word's current interpretation[11,13,14]. Children's responses are consistent with this episodic contribution to ambiguity resolution.

Several features of the experiment limit the conclusions we can draw. First, without an adult comparison group, we cannot determine whether priming differs in magnitude between children and adults. The observed priming effect was 4.34 percentage points following a five-minute delay. Rodd et al. (Experiment 2)[9] reported differences of 15 and 8 percentage points in adults after one and 20 minutes, respectively. Although the effect was descriptively smaller in children, differences in items, delays, and testing procedures prevent direct comparison. Assessing age-related differences, therefore, requires testing children and adults under the same conditions using carefully matched items. Second, the five-minute delay provides limited evidence about the persistence of priming. We selected this interval to minimise disruption to school time. Although the effect survived an intervening activity in a classroom setting, longer delays are needed to establish how long the change in meaning availability persists.

Even if these changes in meaning availability are short-lived, they may still support children's understanding of connected text. Repeated occurrences of an ambiguous word within a text tend to retain the same meaning[16]. For example, in the opening chapter of *The Wind in the Willows*[17], the river setting establishes the riverside meaning of bank, which is used again later in the chapter. Retaining a recently encountered interpretation could therefore make the relevant meaning more readily available when it is likely to be needed again[18]. This may be particularly useful for relatively uncommon meanings, reducing the processing difficulty associated with subordinate meanings[3]. These short-term

adjustments may also contribute to longer-term changes in meaning preferences that reflect how words are used in children's current linguistic environment. Across repeated encounters, such learning may contribute to increasingly rich and flexible lexical knowledge[15]. Ordinary reading may therefore help children understand the current text while refining their knowledge of familiar ambiguous words.

In conclusion, this experiment shows that a single disambiguating encounter can influence children's subsequent interpretation of ambiguous words. The findings extend the adult word-meaning priming literature by providing evidence of lexical learning through comprehension in childhood.

Methods

Openness and Transparency

We report how the sample size was determined, all data exclusions, all manipulations, and all study measures. The confirmatory hypotheses, methods, and analysis plan were preregistered on the Open Science Framework on 7 May 2026: https://doi.org/10.17605/OSF.IO/8W5RQ. Data were collected on 30 June and 1 July 2026. Deviations from the preregistered analysis plan, together with their rationale, are detailed below. Experimental materials, raw data, and analysis code are available on the Open Science Framework: https://doi.org/10.17605/OSF.IO/8ED9U.

Participants

To determine the minimum number of participants required to detect evidence of word-meaning priming in children, we conducted a priori power simulations following the recommendations of DeBruine and Barr[19]. An initial pilot study with 23 children revealed a 0.49 increase in the log-odds of subordinate-meaning-consistent responses in the primed relative to the unprimed condition. Multilevel data were simulated assuming 48 experimental items and sample sizes ranging from 40 to 80 participants, with 200 datasets simulated at each sample size. For each simulated dataset, we fitted a generalised linear mixed-effects model. Power was estimated as the proportion of simulations in which the effect of condition was statistically significant. These analyses indicated that 80 participants were needed to achieve at least 80% power at an alpha level of 0.05 (two-tailed).

We substantially exceeded our recruitment target. One hundred and seventy-five pupils in England's Key Stage 2 (school Years 4–6; aged 8–11 years)[1] were recruited from one primary school in North London and one primary school in East London. Parents provided opt-out consent, and children provided assent before the start of testing. Twenty-six children began the experiment but subsequently chose to withdraw, and a further 11 were excluded following our pre-registered data-cleaning procedures (see *Data Preparation*). This left a final sample of 138 children (76 females, 62 males), with a mean age of 10.01 years (SD_{years}= 0.73). Forty-nine children reported speaking only English, while 89 reported speaking at least one additional language. The schools were compensated for their assistance with the study through a small payment in the form of book vouchers. The study received ethical approval from University College London's Research Ethics Committee (Ref. 20903/003).

Materials

Forty-eight ambiguous words were selected for use in the word association task. Each ambiguous word was a homograph that had a shared word form and a subordinate meaning (dominance range: 0–0.49; mean = 0.22) that was semantically distinct from its dominant meaning (dominance range: 0.50–0.99; mean = 0.75)[20]. Ambiguous words had a mean length of 4.83 letters ($SD_{letters}$= 1.24), a mean Zipf frequency of 4.36 (SD_{Zipf}= 0.58) based on the CBBC norms from the SUBTLEX-UK database[21], and a mean age of acquisition of 6.19 years (SD_{AoA}= 1.76)[22]. An initial survey of three primary-school teachers indicated that children aged 9–11 years would be expected to have encountered the subordinate meanings of each ambiguous word.

Additional evidence from a word-to-picture matching task[23] suggests that 110 children in Year 4 had knowledge of both meanings of the ambiguous words. In this task, children heard 64 ambiguous words and selected two pictures corresponding to each word's two meanings. Forty-eight of these words were used in the current study. For these 48 words, children selected the subordinate-meaning picture on a mean proportion of 0.82 of trials ($SD_{subordinate}$= 0.16), compared with 0.96 ($SD_{dominant}$= 0.16) for the dominant-meaning picture.

Forty-eight experimental prime sentences were constructed in which the preceding sentence context strongly disambiguated the ambiguous word towards its subordinate meaning (e.g., *At the zoo, we saw a strange bird, a* **crane**, *standing by the pond*). The prime sentences had a mean length of 12.98 words (SD_{words}= 2.99).

Design

The experiment used a within-participant design with two conditions: primed and unprimed. The 48 experimental ambiguous words were assigned to conditions across two counterbalanced lists, with 24 items assigned to each condition within each list. Item assignments were reversed across lists, and participants were randomly assigned to the two lists in equal numbers. Thus, each participant contributed responses to both conditions, and each ambiguous word appeared in both conditions across participants but in only one condition for any individual participant. In the primed condition, participants encountered the ambiguous word within a sentence biasing the subordinate meaning during the prime phase before completing the word association task. In the unprimed condition, the ambiguous word was encountered only during the word association task. The dependent variable was whether each word association response was consistent with the subordinate meaning of the target ambiguous word.

Procedure

The experiment was programmed and administered using the Gorilla Experiment Builder[24]. A whole-classroom testing approach was used, whereby all participating children within a class completed the

experiment at the same time on Chromebooks supplied by each school. Seven classes were tested over two days. Before the experiment began, children were briefed on the task and given a child-facing information sheet. After providing assent, children provided demographic information and then completed the three phases of the experiment: a prime phase, a filler task, and a test phase.

During the prime phase, participants were presented with four practice sentences followed by 24 experimental prime sentences, which they were instructed to read silently for comprehension. Each trial began with a fixation cross presented for 500 ms. The sentence was then displayed for 3,000 ms, after which a *NEXT* button appeared. The sentence remained on screen until the child clicked *NEXT* to proceed to the next trial. Prime sentences were presented in random order.

Following the prime phase, children completed a five-minute filler task, *Match Three*. During this task, children were presented with an 8 × 8 array of coloured shapes. They were instructed to match three or more shapes of the same colour in a row or column and progressed through rounds as they earned points. The task was programmed to last five minutes to provide a consistent delay between the prime and test phases. It was selected because it involved minimal linguistic content.

Children then moved onto the test phase, in which they generated word associations for the 24 *primed* and 24 *unprimed* ambiguous words. Following instructions and two practice trials with feedback, children completed the 48 experimental trials. Each trial began with a fixation cross presented for 500 ms, after which an ambiguous word was displayed. Children were instructed to type the first word that they associated with the target and then press *ENTER* to proceed to the next trial. Ambiguous words were presented in random order.

A teacher and researcher were present throughout testing. Children were instructed to complete the experiment in silence. The researcher and teacher moved around the classroom to remind children of the task instructions, check that they were completing the experiment as instructed, and respond to any questions. The full procedure was designed to last approximately 30 minutes to minimise disruption to children's learning.

Data Analysis

Data Preparation

Our pre-registered data cleaning procedure specified that word association responses would first be checked for spelling errors. Where a response was clearly intended to be a real word but contained a minor spelling error (e.g., *brid* for *bird*), the response was corrected to its intended form before coding. Responses that could not be confidently identified as a real English word were excluded.

As pre-registered, each remaining response was then coded according to whether it was consistent with the subordinate meaning of the target ambiguous word. Responses that were consistent with the subordinate meaning were coded as 1, and responses that were inconsistent with the subordinate

meaning were coded as 0. For example, for *crane*, responses such as *bird* or *heron* were coded 1, whereas responses such as *building* or *construction* were coded as 0.

To make this coding procedure more explicit and systematic, we additionally defined the possible meanings of each ambiguous word using the dominance norms of Gilbert and Rodd[20], supplemented by agreed dictionary definitions where necessary. This procedure for defining the meanings of the ambiguous words was not specified in the pre-registration. We also added an independent second coder, which was not pre-registered. Agreement between the two coders was 99.08%, and any disagreements were resolved through discussion until a consensus coding was reached.

Trial- and participant-level exclusions followed the pre-registered criteria. Individual trials were excluded if the response was blank, if the participant entered the target word itself as their response, or if the response could not be identified as a real English word following spelling correction. Participants for whom more than 50% of trials were missing or excluded were removed from the analysis. This participant-level criterion resulted in the exclusion of 11 participants.

Statistical Analyses

To assess whether priming increased the likelihood of producing a response consistent with the subordinate meaning of a target word, we analysed word association responses using a Generalised Linear Mixed-Effects Model with a binomial error distribution and logit link, fitted using the *glmer()* function from the lme4 package[25] (version 2.0.6) within R[26] (version 4.6.1). This approach accommodates the binary nature of the dependent variable, with each response coded according to whether it was consistent with the subordinate meaning of the ambiguous word. Priming condition was deviation-coded as -0.5 for unprimed items and + 0.5 for primed items, such that a positive coefficient indicated an increased likelihood of a subordinate-meaning-consistent response following priming.

Following our pre-registration and the recommendations of Barr et al.[27], we initially fitted a model with priming condition as a fixed effect and the maximal random-effects structure justified by the experimental design: *dv ~ condition + (1 + condition | participant) + (1 + condition | item)*. This model produced a singular fit. Refitting the model using the bobyqa optimiser and subsequently removing correlations between the random intercepts and slopes did not resolve the singularity. We therefore reinstated the correlations between random intercepts and slopes and simplified the random-effects structure by removing the random slope accounting for the least variance. This resulted in a non-singular final model containing random intercepts for participants and items and a by-participant random slope for priming condition: *dv ~ condition + (1 + condition | participant) + (1 | item)*.

Declarations

Data availability

The raw data are available in .csv format at: https://doi.org/10.17605/OSF.IO/8ED9U.

Code availability

An R Markdown (.rmd) file is available to replicate all analyses and generate the original manuscript: https://doi.org/10.17605/OSF.IO/8ED9U.

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Author contributions

MK: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Resources; Software; Visualization; Writing – original draft; Writing – review & editing

AJP: Conceptualization; Data curation; Formal analysis; Investigation; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing – original draft; Writing – review & editing

Competing Interests

The authors declare no competing interests.

References

1. Rodd, J., Gaskell, G. & Marslen-Wilson, W. Making sense of semantic ambiguity: Semantic competition in lexical access. *Journal of memory and language* 46, 245–266 (2002).
2. Rodd, J. M., Cutrin, B. L., Kirsch, H., Millar, A. & Davis, M. H. Long-term priming of the meanings of ambiguous words. *Journal of Memory and Language* 68, 180–198 (2013).
3. Blott, L. M., Hartopp, O., Nation, K. & Rodd, J. M. Learning about the meanings of ambiguous words: Evidence from a word-meaning priming paradigm with short narratives. *PeerJ* 10, e14070 (2022).
4. Booth, J. R., Harasaki, Y. & Burman, D. D. Development of lexical and sentence level context effects for dominant and subordinate word meanings of homonyms. *Journal of psycholinguistic research* 35, 531–554 (2006).
5. Kaltsa, M. & Papadopoulou, D. The processing of lexical ambiguity: Evidence from child and adult greek. *Journal of Psycholinguistic Research* 53, 16 (2024).
6. Khanna, M. M. & Boland, J. E. Children's use of language context in lexical ambiguity resolution. *The Quarterly Journal of Experimental Psychology* 63, 160–193 (2010).
7. Betts, H. N., Gilbert, R. A., Cai, Z. G., Okedara, Z. B. & Rodd, J. M. Retuning of lexical-semantic representations: Repetition and spacing effects in word-meaning priming. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 44, 1130 (2018).

8. Gilbert, R. A., Davis, M. H., Gaskell, M. G. & Rodd, J. M. The relationship between sentence comprehension and lexical-semantic retuning. *Journal of Memory and Language* 116, 104188 (2021).
9. Rodd, J. M. *et al.* The impact of recent and long-term experience on access to word meanings: Evidence from large-scale internet-based experiments. *Journal of Memory and Language* 87, 16–37 (2016).
10. Gilbert, R. A., Davis, M. H., Gaskell, M. G. & Rodd, J. M. Listeners and readers generalize their experience with word meanings across modalities. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 44, 1533 (2018).
11. Gaskell, M. G., Cairney, S. A. & Rodd, J. M. Contextual priming of word meanings is stabilized over sleep. *Cognition* 182, 109–126 (2019).
12. Parker, A. J., Taylor, J. S. H. & Rodd, J. M. Readers use recent experiences with word meanings to support the processing of lexical ambiguity: Evidence from eye movements. *Journal of experimental psychology. Learning, memory, and cognition* 51, 1157–1177 (2025).
13. Mak, M. H. C., Curtis, A. J., Rodd, J. M. & Gaskell, M. G. Episodic memory and sleep are involved in the maintenance of context-specific lexical information. *Journal of experimental psychology. General* 152, 3087–3115 (2023).
14. Rodd, J. M. Building word meanings from memories and predictions. *Trends in cognitive sciences* (2026).
15. Nation, K. Nurturing a lexical legacy: Reading experience is critical for the development of word reading skill. *NPJ science of learning* 2, 3–4 (2017).
16. Gale, W. A., Church, K. & Yarowsky, D. One sense per discourse. in *Speech and natural language: Proceedings of a workshop held at harriman, new york, february 23–26*, 1992 (1992).
17. Grahame, K. *The Wind in the Willows*. (Methuen; Co., London, 1908).
18. Gaskell, M. G. EPS mid-career prize: An integrated framework for the learning, recognition and interpretation of words. *Quarterly journal of experimental psychology* 77, 2365–2384 (2024).
19. DeBruine, L. M. & Barr, D. J. Understanding mixed-effects models through data simulation. *Advances in Methods and Practices in Psychological Science* 4, 2515245920965119 (2021).
20. Gilbert, R. A. & Rodd, J. M. Dominance norms and data for spoken ambiguous words in british english. *Journal of Cognition* 5, 4–4 (2022).
21. Van Heuven, W. J., Mandera, P., Keuleers, E. & Brysbaert, M. SUBTLEX-UK: A new and improved word frequency database for british english. *Quarterly journal of experimental psychology* 67, 1176–1190 (2014).
22. Kuperman, V., Stadthagen-Gonzalez, H. & Brysbaert, M. Age-of-acquisition ratings for 30,000 english words. *Behavior research methods* 44, 978–990 (2012).
23. Gao, D. Z. *et al.* Measuring word meaning knowledge for ambiguous and unambiguous words in primary aged children. (2026).

24. Anwyl-Irvine, A. L., Massonnié, J., Flitton, A., Kirkham, N. & Evershed, J. K. Gorilla in our midst: An online behavioral experiment builder. *Behavior research methods* 52, 388–407 (2020).
25. Bates, D., Mächler, M., Bolker, B. & Walker, S. Fitting linear mixed-effects models using lme4. *Journal of statistical software* 67, 1–48 (2015).
26. R Core Team. *R: A Language and Environment for Statistical Computing*. (R Foundation for Statistical Computing, Vienna, Austria, 2025).
27. Barr, D. J., Levy, R., Scheepers, C. & Tily, H. J. Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of memory and language* 68, 255–278 (2013).

Figures

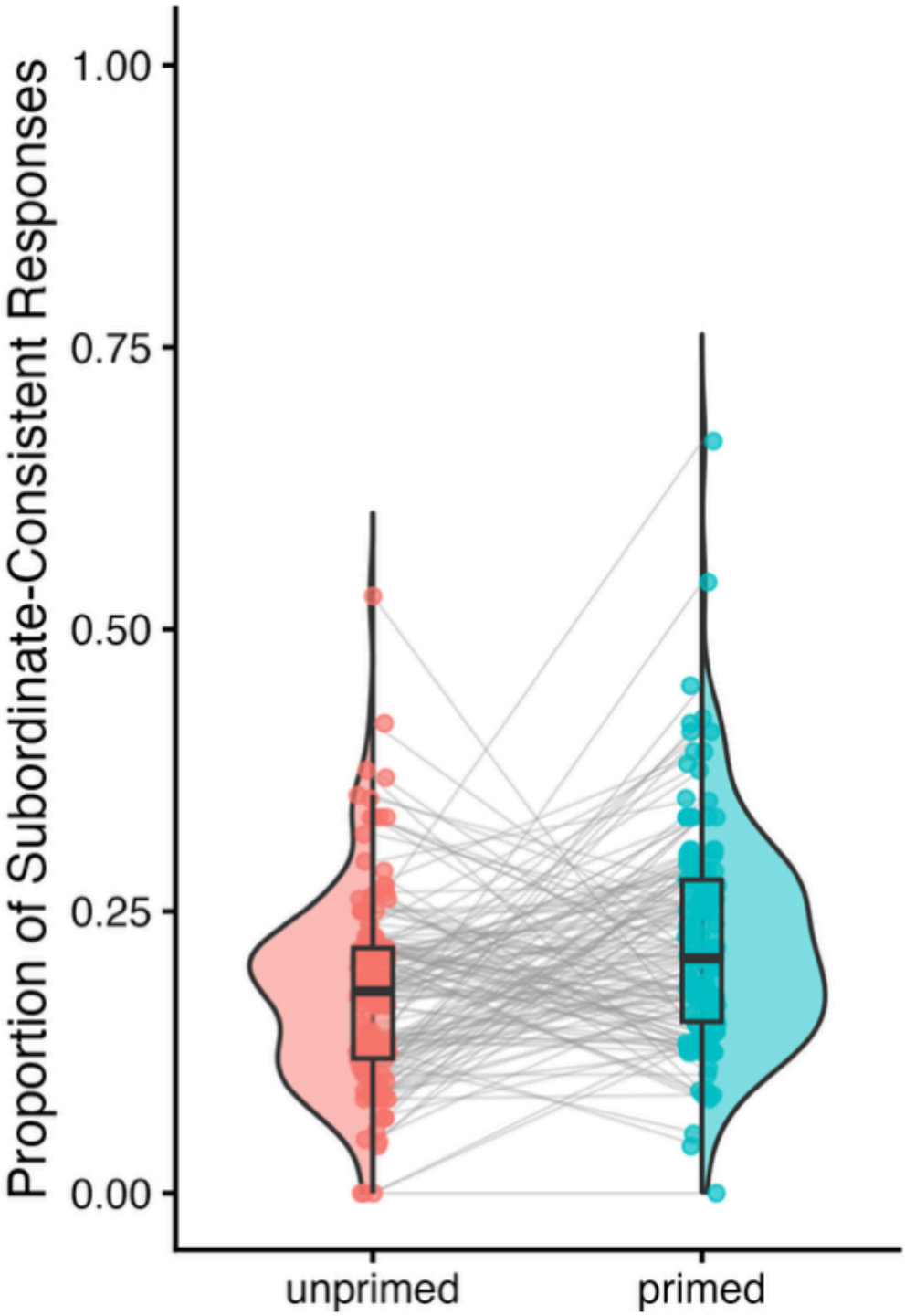

Figure 1

The proportion of responses consistent with a word's subordinate meaning is higher in the primed than in the unprimed condition. The boxplot shows the median and interquartile range for each condition. The violin plots show the distribution of scores, where wider sections indicate a greater concentration of observations. Each coloured point represents an individual child's mean proportion of responses

consistent with the subordinate meaning, and the grey lines connect the same child across conditions, showing individual changes following priming.