Language Proficiency and Lexical-Semantic Processing in Bilingual Toddlers

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INTRODUCTION

- There is a recent body of literature suggesting that vocabulary systems (i.e., lexical-semantic networks) are not entirely separate but interact in young bilingual toddlers.[1]
- It is currently unknown whether the words a toddlers hears (i.e., language exposure) or the words that they say (i.e., language proficiency) influence the organization of lexical-semantic networks.

RESEARCH QUESTIONS

1. Do lexical-semantic networks, or vocabulary systems, interact across languages, or are they relatively separate?
2. To what extent does proficiency versus exposure predict lexical-semantic processing?
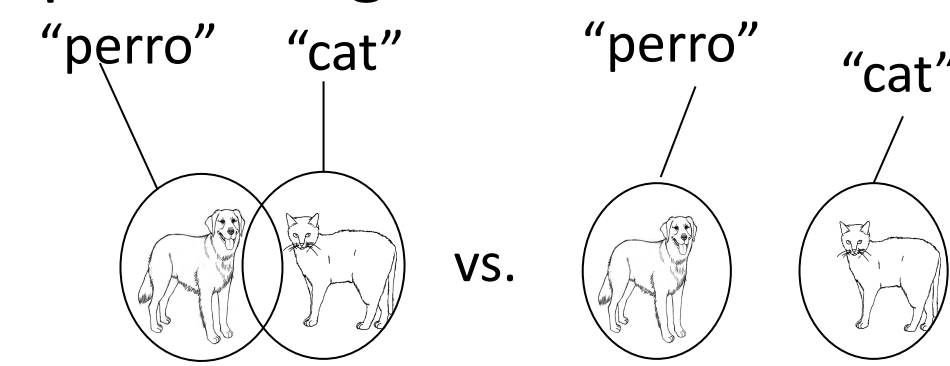

Figure 1. Cross-language interaction versus separate lexical-semantic networks.
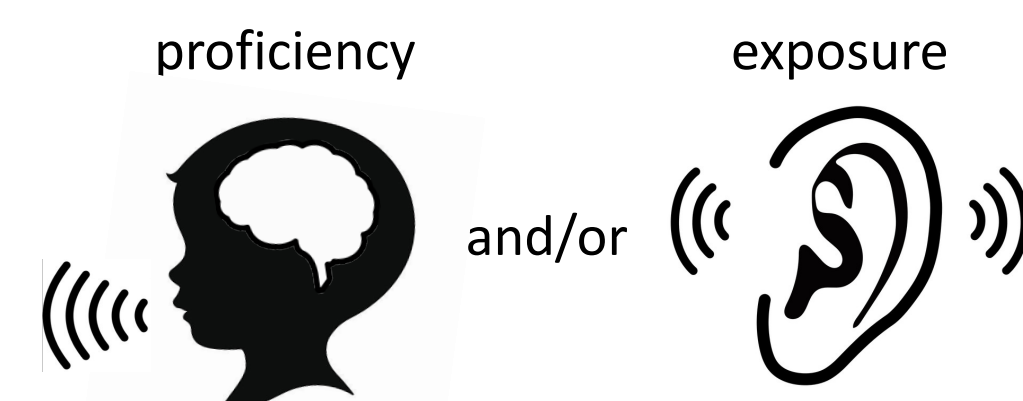
Figure 2. Proficiency versus exposure as the predictor of lexical-semantic processing.

METHODS

Participants

- N = 20 toddlers with dual language exposure to Spanish and English
- Age: *M* = 24.65 months; *SD* = 1.5 months
- Exposure: Spanish *M* = 78% (*SD* = 23%); English *M* = 22% (*SD* = 23%)
- Toddlers with (*n* = 8) and without (*n* = 12) early language delay
- Dominant language of exposure: Spanish (n = 18); English (n = 2)

Measures

Dependent Variable

- Intermodal Preferential Looking Paradigm: Eye-tracking[2]
  - Measures within and cross-language lexical-semantic processing
  - Trial types: Prime-Target pairs are semantically related vs. unrelated
  - Prime effect = proportion of total looks (target/target+distractor) in related trials minus unrelated trials

Language Conditions

Prime – Target

English prime – English target
English prime – Spanish target
Spanish prime – Spanish target
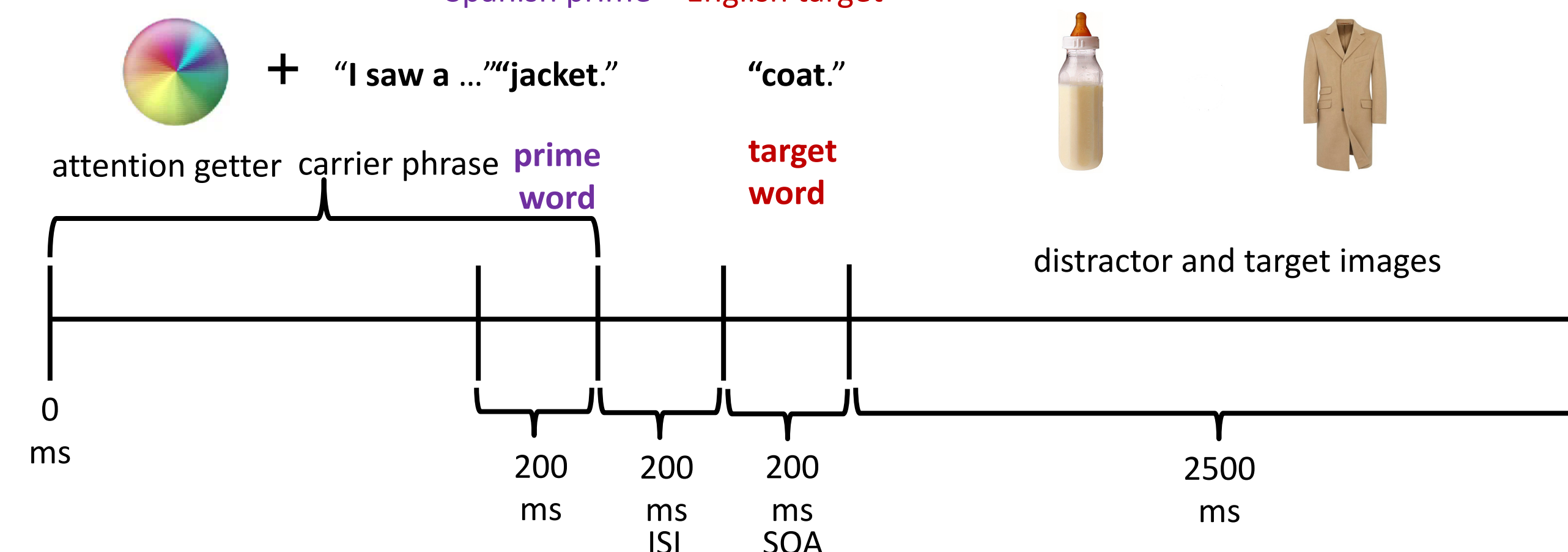Spanish prime – English target

Trial Types

Related
Unrelated

Figure 3. Example English Prime to English Target Language Condition Related Trial

Independent Variables

- Language Exposure Assessment Tool (LEAT)[3]
  - Relative language exposure
- English Spanish Vocabulary Inventories (ESVI)[4]
  - Expressive vocabulary
- Computerized Comprehension Task (CCT)[5]
  - Receptive vocabulary
  - Speed of word recognition

Figure 4. Example of CCT trial
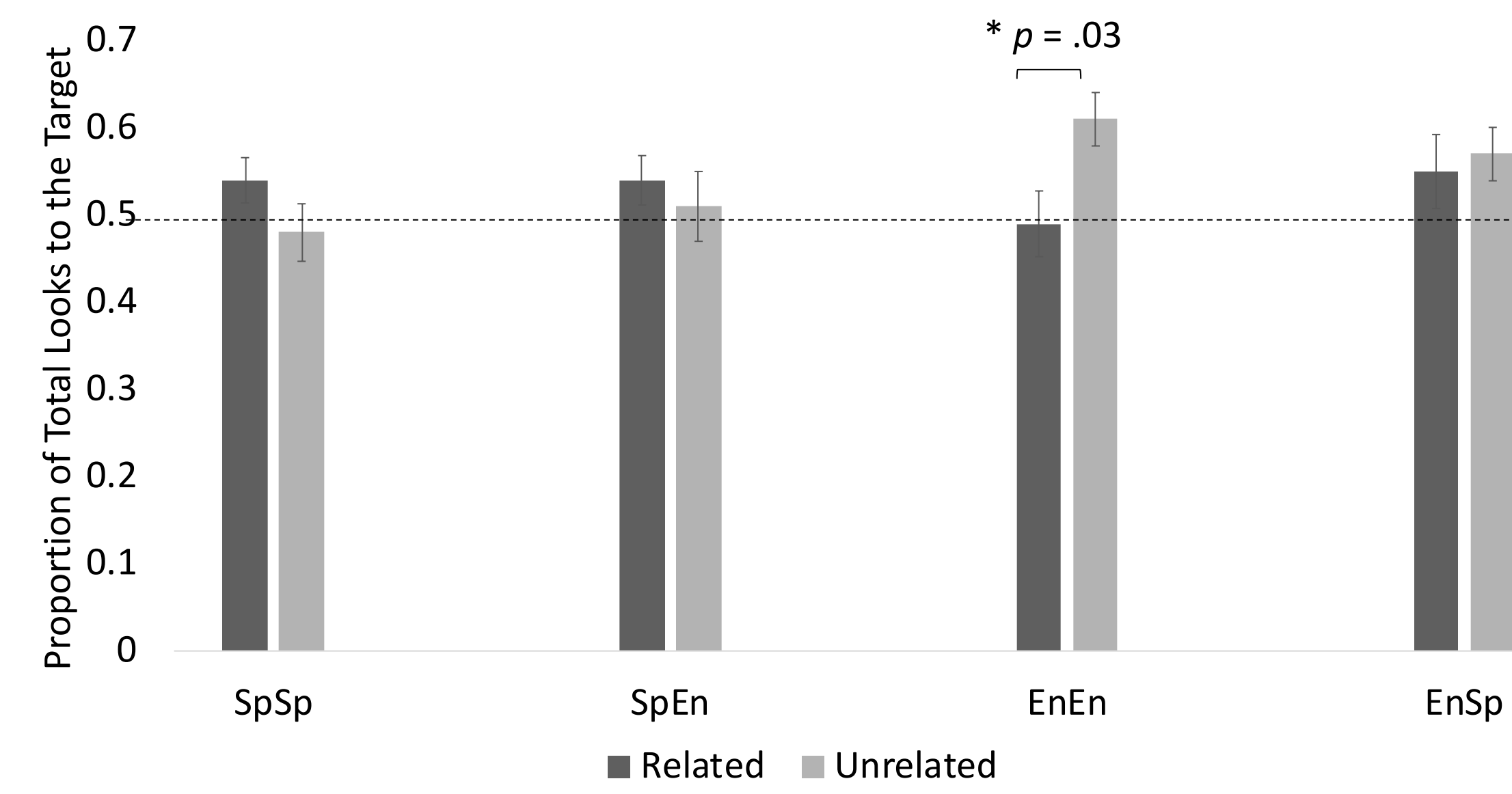
RESULTS

Cross Language Interaction

Figure 5. Proportion of Total Looks to the Target by Language Condition and Trial Relatedness.

- When the prime word was in Spanish, toddlers demonstrated a greater proportion of looks in related trials versus unrelated trials.
- Conversely, when the prime word was in English, toddlers demonstrated a greater proportion of looks in the unrelated trials versus the related trials. This was significantly different in the within-English block.

Proficiency versus Exposure

Table 1. Pearson r Correlation with the Prime Effect in Spanish Prime Language Conditions

Pearson's r		Prime effect	
Measures		Sp-Sp	Sp-En
Language Exposure (LEAT)			
Spanish		.30	.21
English		-.29	-.22
Receptive Vocabulary (CCT)			
Spanish		-.31	**-.57***
English		-.33	-.41
Speed of Word Recognition (Haptic Response Time)			
Spanish		**.54***	**.53***
English		-.18	.39
Expressive Vocabulary (ESVI)			
Spanish		-.16	.17
English		-.13	.14

- Toddlers with large receptive vocabularies and slow reaction times evinced the largest prime effects.
- Exposure was not correlated with the prime effect in both Spanish conditions.

Table 2. Pearson r Correlation with the Prime Effect in English Prime Language Conditions

Pearson's r		Prime effect	
Measures		En-En	En-Sp
Language Exposure (LEAT)			
Spanish		.22	-.27
English		-.22	.27
Receptive Vocabulary (CCT)			
Spanish		.07	.2
English		.05	.11
Speed of Word Recognition (Haptic Response Time)			
Spanish		-.31	.02
English		**-.77****	.34
Expressive Vocabulary (ESVI)			
Spanish		.31	.01
English		.25	.11

- Toddlers with faster speed of word recognition in their weaker language (English) demonstrated a larger prime effect only in the within-English block.
- Exposure was not correlated with the prime effect in both English conditions.

DISCUSSION and CONCLUSION

Cross Language Interaction

- Consistent with prior literature, our results indicate that there is evidence that vocabulary systems interact in bilingual children as early as 2 years of age.
- Our results suggest that young bilingual children are sensitive to semantic relatedness in their stronger language (Spanish). Semantic unrelatedness, rather than semantic relatedness, in their weaker language (English) may yield more robust target identification.

Proficiency versus Exposure

- As a group, toddlers with larger vocabulary sizes and faster speed of word recognition in their stronger language (Spanish) demonstrated inhibition, such that they were more likely to efficiently discard words similar in meaning (i.e., semantic competitors) in order to correctly identify the target (See Figure 8).
- When processing semantic relationships between words in their weaker language (English), toddlers with slower speed of word recognition demonstrated facilitation in order to continue ongoing activation of their sparse vocabulary networks (See Figure 9).
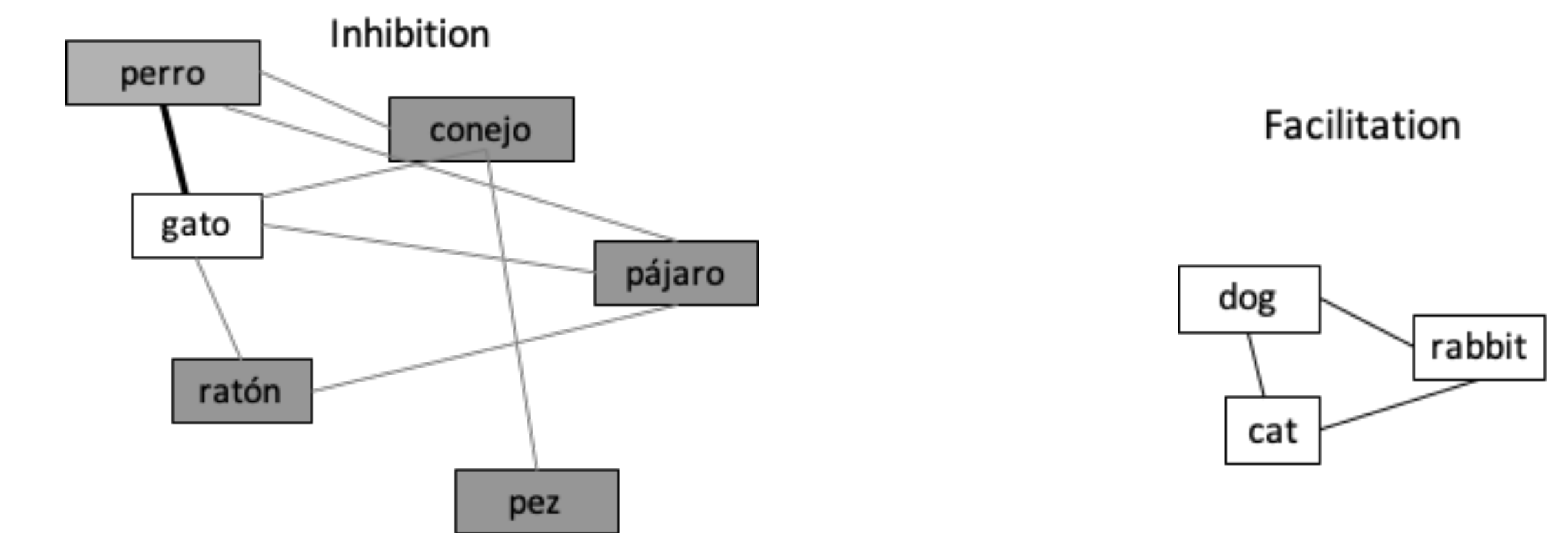- However, language exposure was not associated with lexical-semantic processing (See Figure 10).

Figure 8. In the stronger language, multiple competing links in a network result in inhibition. It may be more efficient for this toddler to inhibit links as quickly as possible in order to focus their processing on "gato" alone rather than maintaining spreading activation of all the other words in their network.

Figure 9. In the weaker language, if a toddler is primed with "dog," they show spreading activation to other related words, and rather than inhibit these, activation may continue yielding facilitation for target recognition.
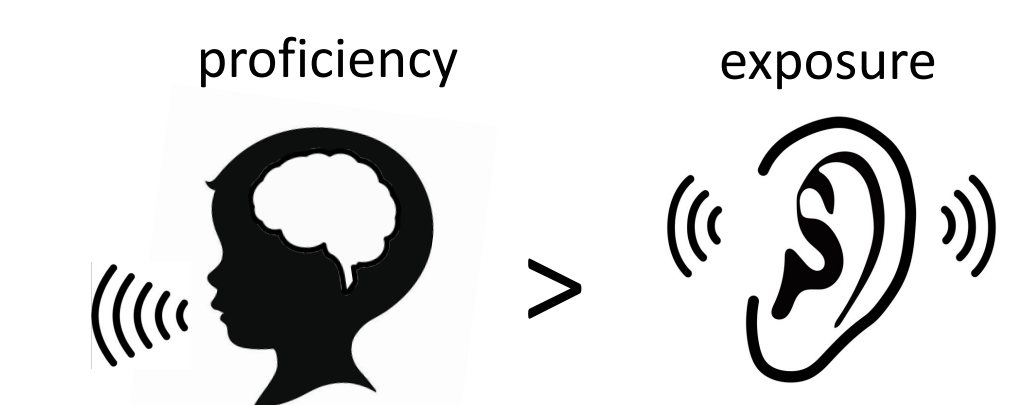

Figure 10. Proficiency measured by vocabulary size and speed of word recognition was a stronger predictor of lexical semantic processing than exposure.

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