The Processing of Visually Presented Words: The Advantage of 3-, 4-, and 5- Letter Words

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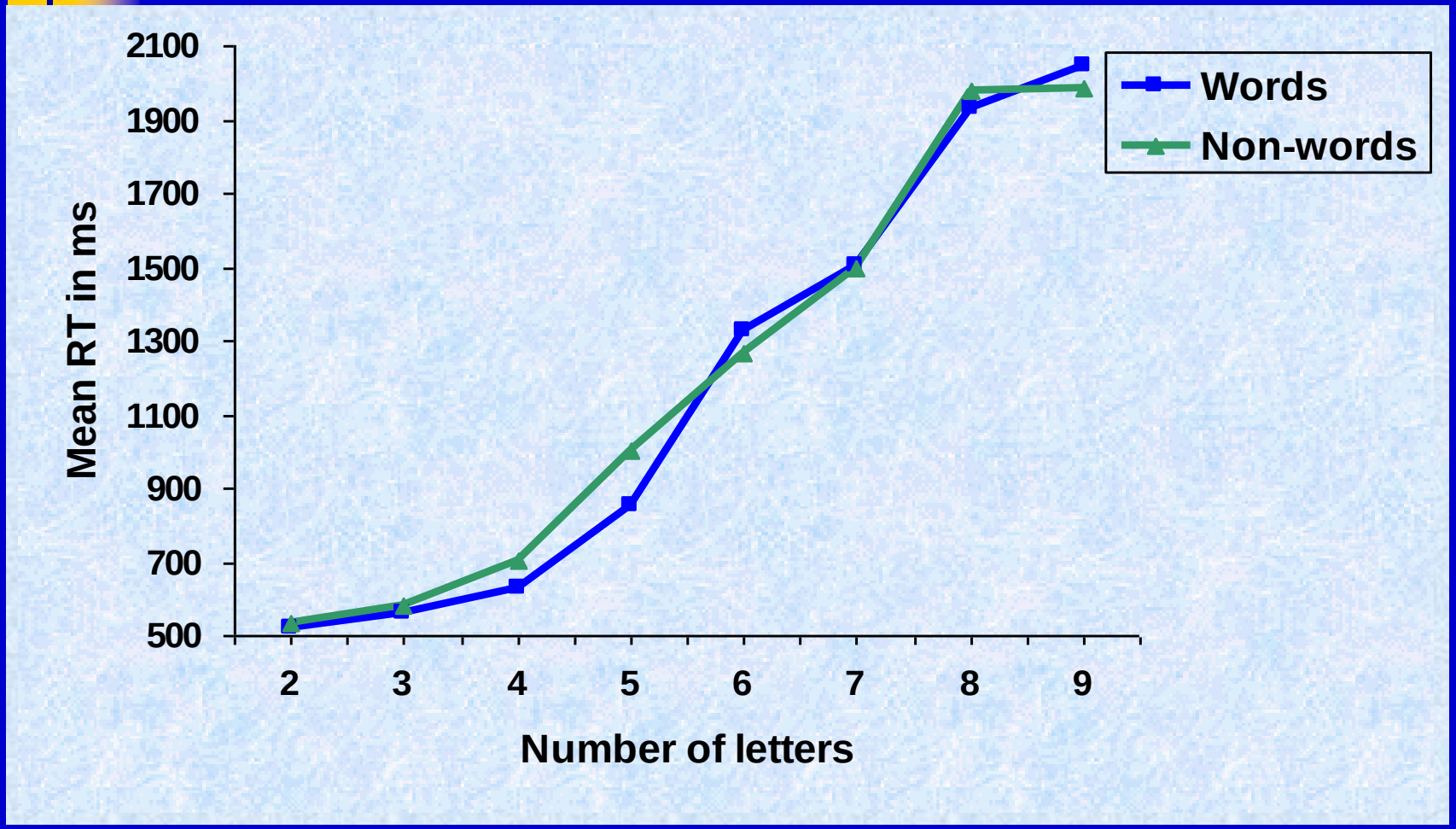
Background

- Previous findings have shown that enumerating letters within a word is easier than in a nonword, provided a word length of 4-5 letters.

Enumeration within words and nonwords of different lengths



Conclusion

- Short words may enable the reader to easily access a variety of their lingual aspects (e.g., number of letters, and even their **semantic level**).

Experiment 1

- Semantic processing may differ as a function of word length, so that semantic representations are more easily accessible in short words than in long ones.
- Experiment 1 tested this hypothesis, with the **semantic priming paradigm** (Meyer & Schvaneveldt, 1971).

Paradigm

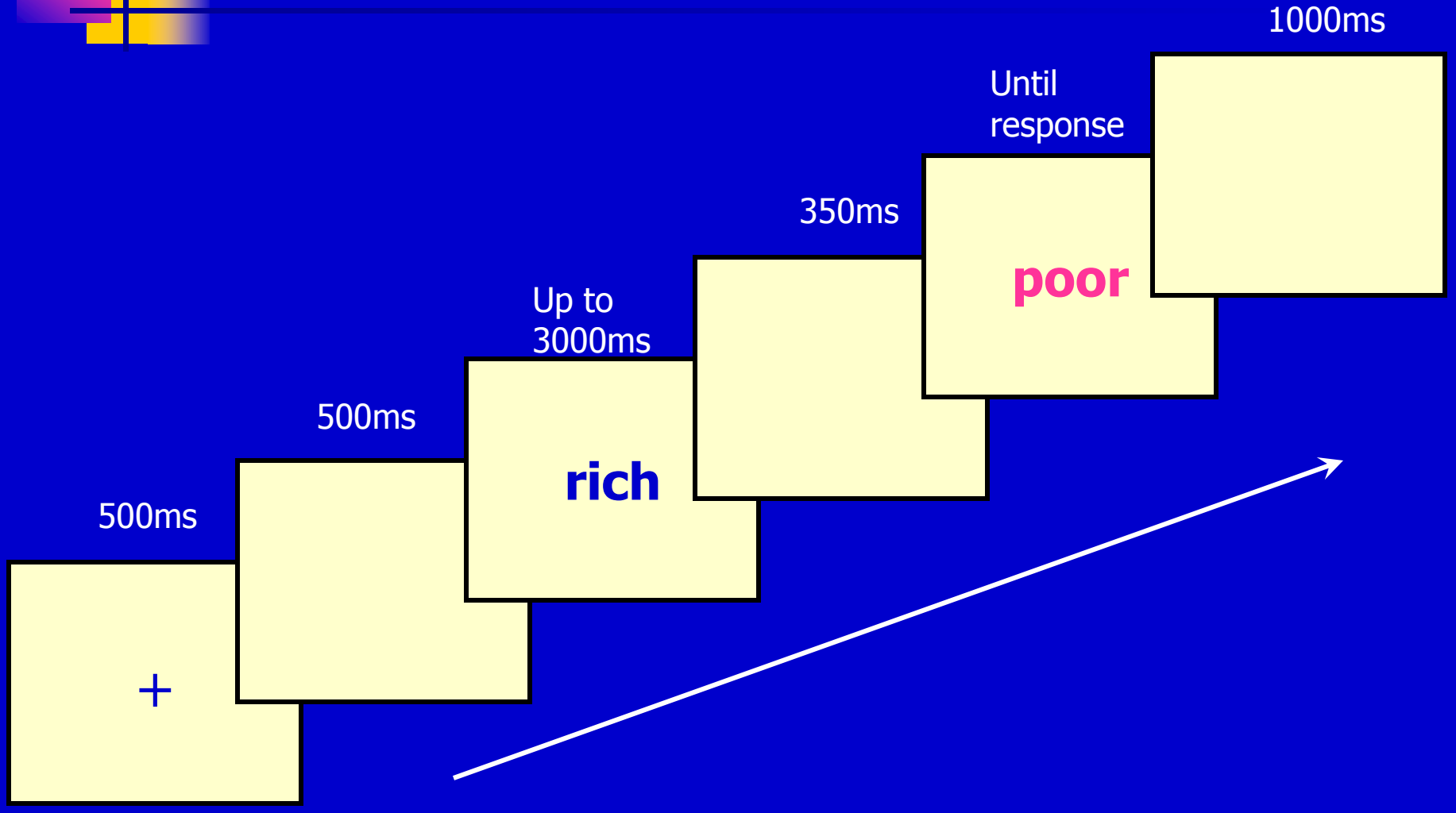
Semantic priming, with:

- Systematic manipulation of prime length (2-9 letters).
- Each trial involved two tasks:

  a) Naming the prime word.

  b) Lexical decision in the probe.

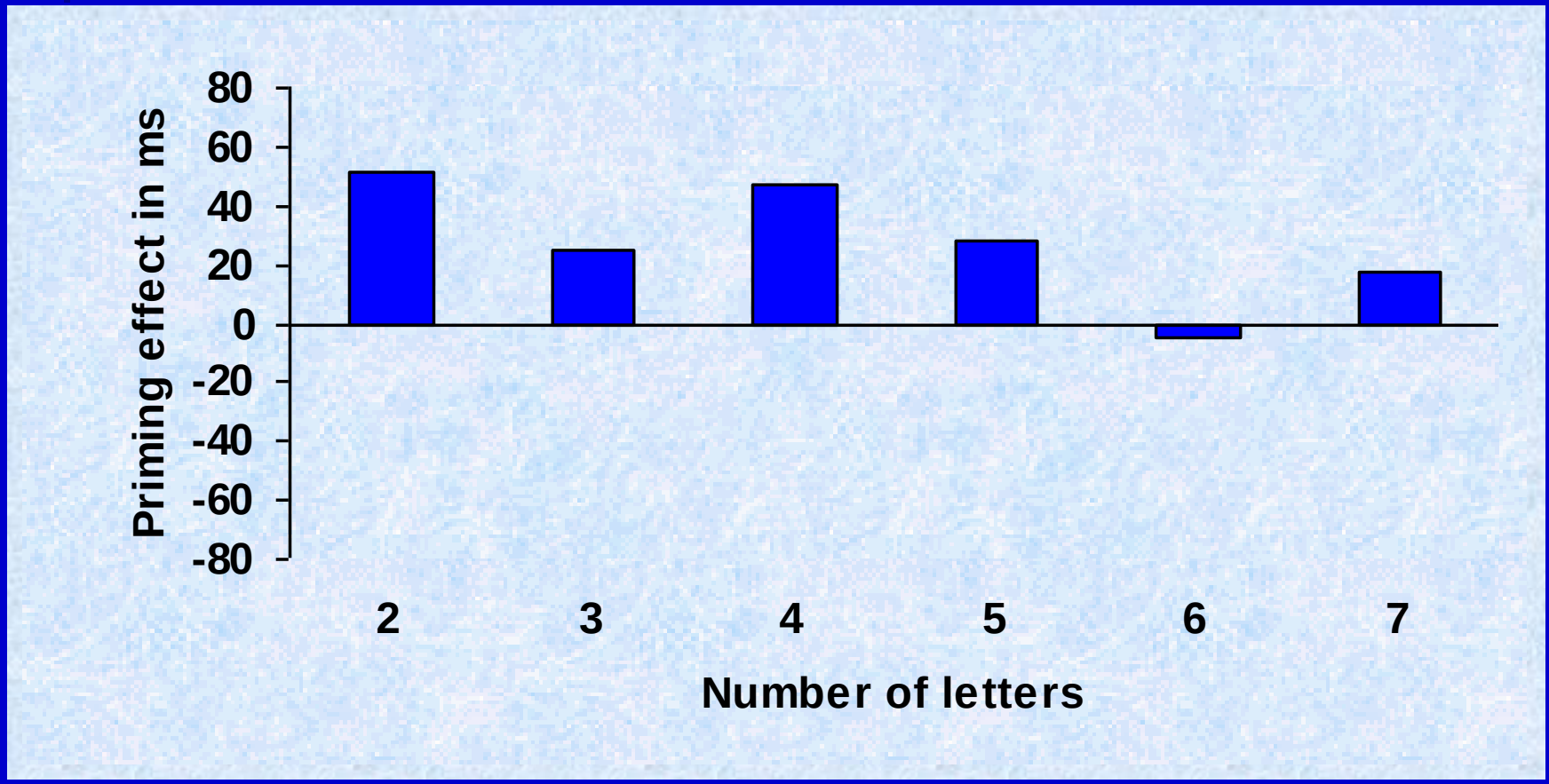
Naming + Lexical Decision



Results

- A significant general semantic priming effect was obtained, $t(1)=5.26$, $p<0.0001$. This finding replicates Meyer & Schvaneveldt's (1971) work.
- There was a significant effect for prime length on semantic priming, $F(5,100)=2.75$, $p<0.03$.
- We further analyzed the priming effect within each prime length, and found the following pattern.

Semantic Priming in Words of Different Lengths



Conclusions

- The classical priming effect was replicated in the present experiment, but this effect seemed to stem from shorter words.
- Semantic processing depends on word length, and therefore may not be automatic as was previously thought (Balota, 1983; Carr et al., 1982, Fowler et al., 1981; Marcel, 1983; Stroop, 1935).

Experiment 2

Background

- **The prime task effect**

  Allocating attention to the letter level of a word may prevent semantic processing. For example, conducting a letter search task (e.g., Stolz & Besner, 1996, 1997, 1998, 1999, and others).

Experiment 2

- Since former works have not manipulated prime length systematically, the elimination of semantic processing may be due to an averaging effect.

Paradigm

Semantic priming, with:

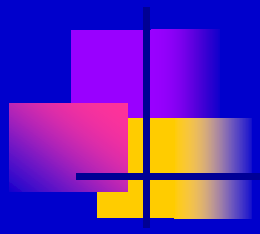
- Systematic manipulation of prime length (2-9 letters).
- Each trial involved two tasks:

  a) Letter enumeration in the prime word.

  b) Lexical decision in the probe.

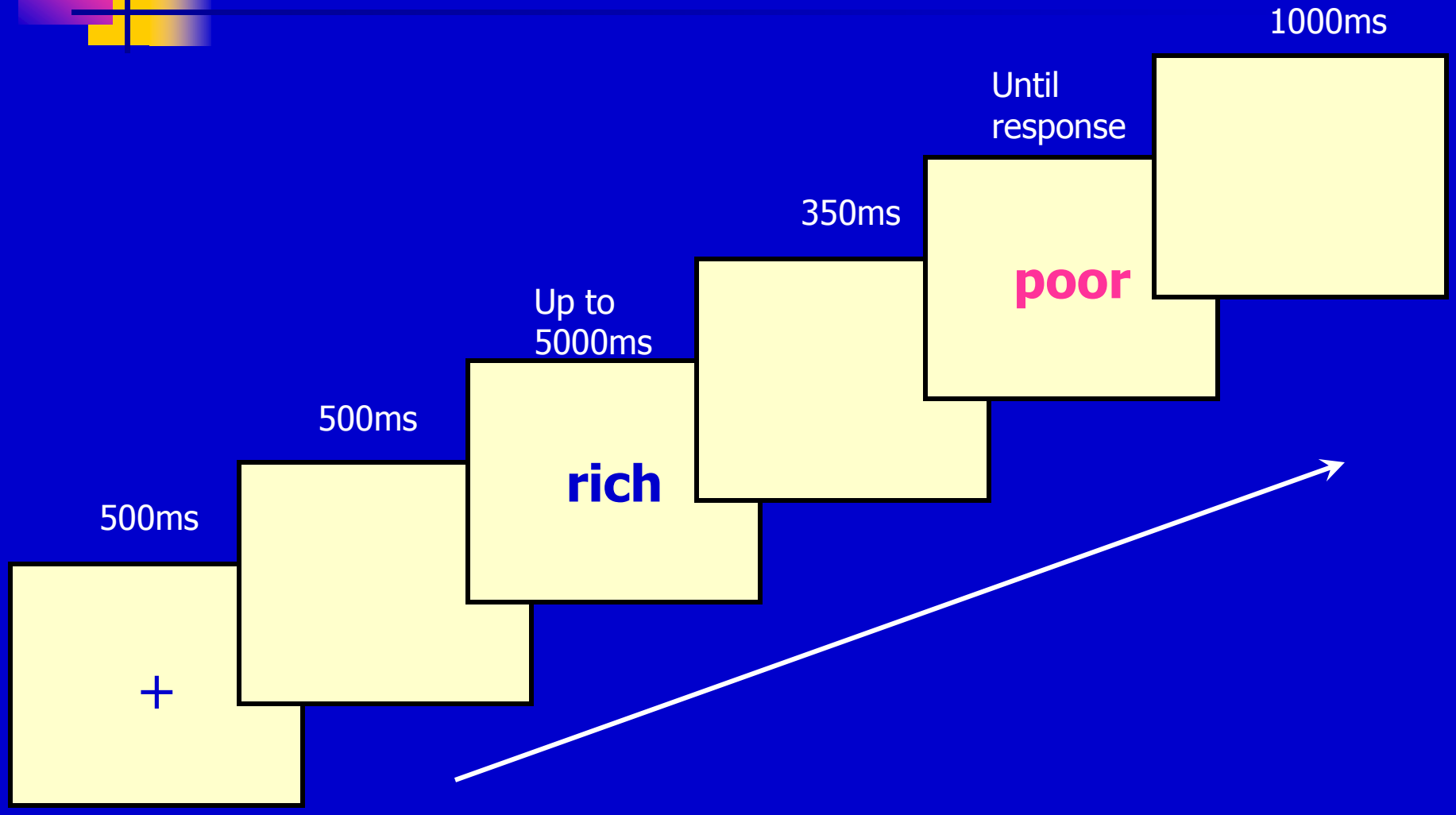
Why enumeration task?

- Enumeration task was chosen in order to break-off the strong natural relationship that exists between letters and words.
- Semantic processing of the prime word is irrelevant to the enumeration task, and therefore may only suspend performance.



- Would semantic priming still be observed in short words under such strict conditions?

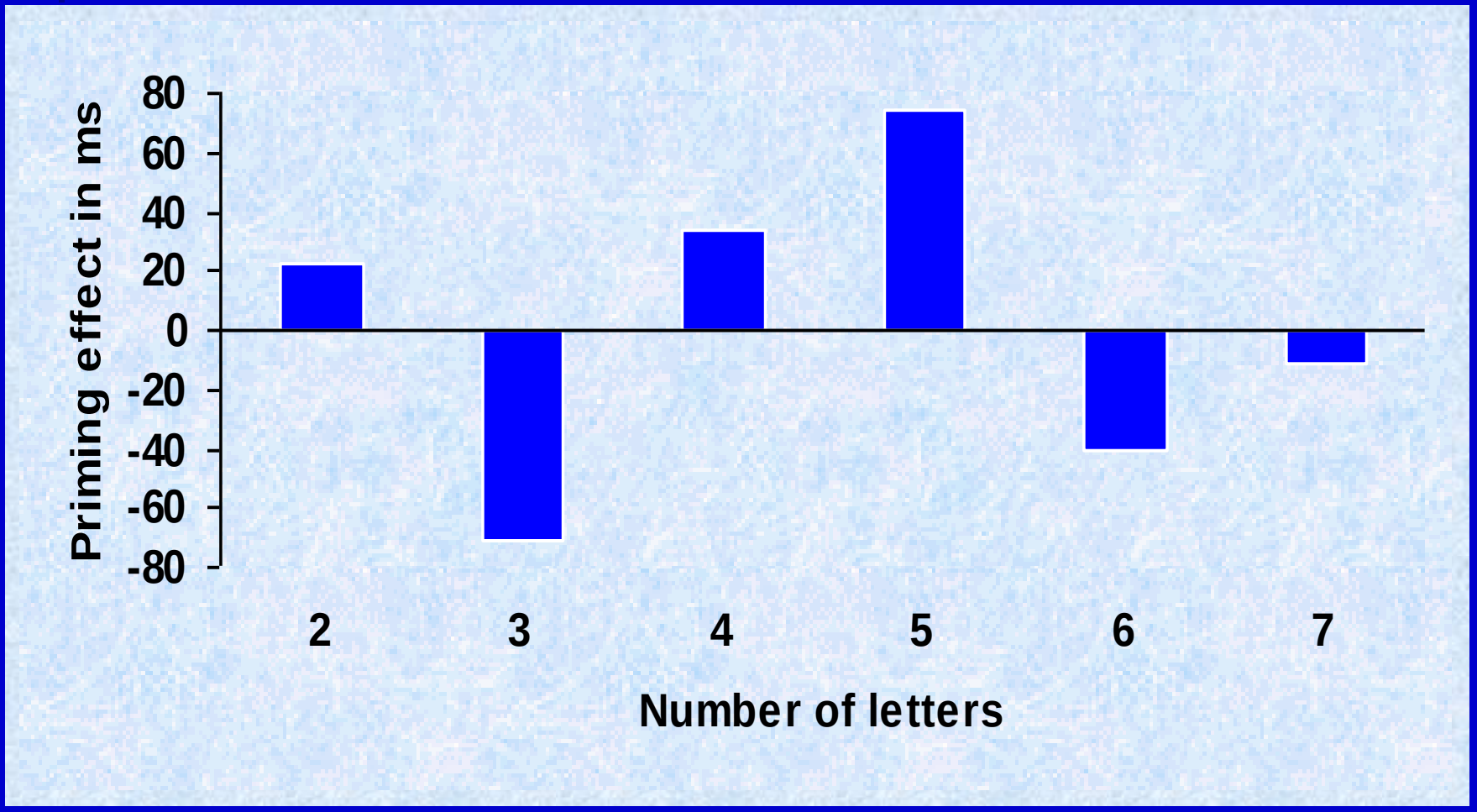
Enumeration + Lexical Decision



Results

- No general semantic priming effect was obtained, $t(1)=0.1$, $p>0.92$. This finding replicates Besner & Stolz's works.
- However, there was a significant effect for prime length on semantic priming, $F(5,100)=5.43$, $p<0.0002$.
- We further analyzed the priming effect within each prime length, and found the following pattern.

Results

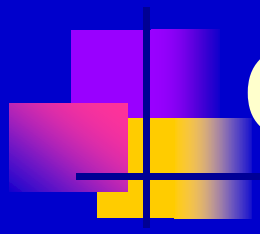

Priming effect in ms
80
60
40
20
0
-20
-40
-60
-80
2
3
4
5
6
7
Number of letters

Results

- Positive semantic priming was obtained in 4 and 5 letter words only ($ps<0.05$).
- Negative semantic priming was obtained in 3 letter words ($p<0.05$).
- No significant priming effects were obtained in other prime lengths ($ps>0.05$).

Conclusions

- In accordance to B&S's data, enumeration task in the prime eliminated the general semantic priming effect.
- However, despite the application of a strict paradigm, positive semantic priming was still observed in 4 to 5 letters words.



Conclusions

- 4 to 5 letters words may be of optimal length in terms of semantic processing.
- B&S's data may be due to an averaging effect.

Conclusions

- But what about 2 and 3 letter words?
  - 2 letter words are function words (e.g.: of, so, is).
  - 3 letter words are content words, but readers may suppress their semantic representations in order to take advantage of subitizing. Therefore, negative semantic priming was observed.

Conclusions

- Semantic processing seems to depend on word length, and therefore may not be automatic.
- Semantic representations become available more rapidly in short words than in long words.

Discussion

- Short and long words may be processed differently: While letters in short words are processed in parallel (McClelland & Rumelhart, 1981), longer words may require a more demanding analytical processing.
- Not much is known about long words processing (Rayner & Pollatsek, 1989).

Discussion

- In terms of the Interactive Activation Model (IAM, McClelland & Rumelhart, 1981), we suggest that the system cannot analyze more that 4 to 5 letters in parallel. Therefore, in case of long words there may not be enough capacity to activate their deeper representations rapidly, and to use them as feedback.

Discussion

- The data suggest that it may take more time to activate semantic representations of longer words.
- Since short and long words may be processed differently, many classical effects in reading processes may not apply to long words (e.g., Reicher's word superiority effect, semantic priming, and even the IAM).

The IAM

Interactive Activation Model (McClelland & Rumelhart, 1981)