# The semantic priming effect: how to explain individual differences?

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# The semantic priming effect: how to explain individual differences?

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## Abstract

Several studies have shown that semantic priming (SP) is directly associated to the association strength between the prime and the target words (e.g., Chwilla & Kolk, 2002). However, Yap et al. (2010) showed that this phenomenon was only observed in people with little vocabulary knowledge. They argued that participants with more vocabulary knowledge made equally strong representations for weak and strong related stimuli. However, this explanation is not sufficient because individual differences in SP have been shown even when vocabulary is controlled. We hypothesize that the SP effect should be larger for participants who are more able to identify similarities between words, independently of their vocabulary knowledge, and that this ability would depend on implicit learning processes (see Kaufman et al., 2010). In Experiment 1, participants performed two tasks. In the first one, they were presented a pair of words for which they were asked to identify as many words as possible which could associate both these words. In the second one, they performed an SP task (i.e., a lexical decision task in which some prime and target pairs were semantically related). In Experiment 2, they performed an implicit learning task (i.e, serial reaction time task) and an SP task. Results show that, when vocabulary is controlled, the SP effect is determined by the ability to identify similarities between concepts and by implicit learning abilities. These results are discussed in the context of Ullman's (2001) declarative/procedural model and of dual process theory.

## Experiment 1

-For 30 years, SP studies focused item features which influenced the size of the SP effect, in particular the association strength between the prime and the target words (e.g., Chwilla & Kolk, 2002).

-More recently, SP studies focused on individual differences in the SP effect: Yap et al. showed that the association strength had no impact in participants with high vocabulary knowledge, but had an impact in participants with low vocabulary knowledge. They argued that people with high vocabulary knowledge were able to create equally strong associations between concepts even when they were less semantically related.

-This explanation has never been directly tested.

-The aim of Experiment 1 is to determine whether, when vocabulary is maintained constant, the ability to create more association between concepts can explain the size of the SP effect.

## Experiment 2

- According to the dual-process theory, associative learning is sustained by implicit learning mechanisms.

-According to Kaufman et al. (2010), implicit learning is involved in verbal analogical reasoning.

-Given that the ability to create many associations between concepts is directly involved in the size of SP effect (Experiment 1), the SP effect should depend on implicit learning abilities.

-The aim of Experiment 2 is to determine whether implicit learning abilities can predict the SP effect

## Discussion

-Support the idea that free association is a good measure of semantic relatedness

-Support the fact that semantic priming depends on the strength of associations between the prime and the target, even in

-Contrary to Ullman's (2001) view, lexicon, and more specifically relationships between concepts, is not only supported by declarative memory but also by the procedural memory

-The fact that associations between concepts are underlied by implicit learning abilities support the dual-process theory (Evans & Frankish, 2009)

## Perspectives

-Does implicit learning abilities can explain the ability to create associations between concepts?

-Modeling (SEM) the relationships between implicit learning abilities, creating associations between concepts and the size of the semantic priming effect?

-What about with a probabilistic sequence?

-Can differences in semantic priming effect explain the ability to better understand figurative language?

### References

Chwilla, D. J., & Kolk, H. H. J. (2002). Three strep-priming in lexical decision. *Memory & Cognition, 30*, 217-225.

Evans, J. S. B. T., & Frankish, K. (2009). In two minds: Dual processes and beyond. New York, NY: Oxford University Press.

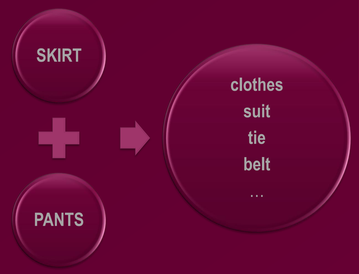
Kaufman, S. B., DeYoung, C. G., Gray, J. R., Jiménez, L., Brown, J., & Mackintosh, N. (2010). Implicit learning as an ability. *Cognition, 116*, 321-340.

Ullman, M. T. (2001). A neurocognitive perspective on language: The declarative/procedural model. *Nature Reviews Neuroscience, 2*, 717–726.

## METHOD

### Free association task (FA T)

Tell me as many words which could relate both the following words as possible

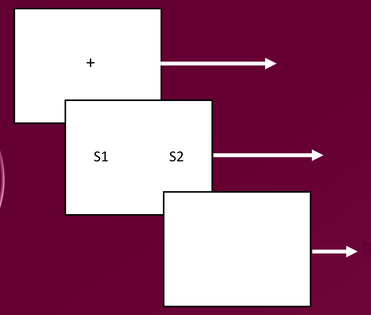



50 pairs – 15 semantically related (e.g., skirt and pants), 15 semantically related by a mediator (e.g., lion – tiger [not seen]– stripe), 15 non related pairs (e.g,: package -oil)

### Semantic priming task (SP task)

double lexical decision task

Are both letter strings French words?

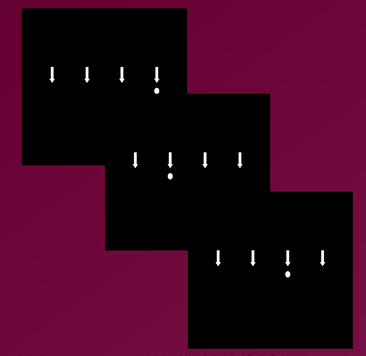



50 pairs – 15 semantically related, 15 counterbalanced, 15 filler and 45 pseudoword pairs

### Implicit learning task

Serial reaction time task

Press the corresponding key of the stimulus as fast and as accurately as possible.



SOC sequences: 342312143241 (SOC1) or 341243142132 (SOC2)

8 presentations by block

Block 1-13: learning blocks

Block14: transfer block

Block 15: learning block

## Experiment 1

Is the number of words provided during the FAT a predictor of the size of semantic priming?

### Results

| Model | β | t | p | ΔR² |
|---|---|---|---|---|
| Step 1 (forced entry) | | | | |
| Vocabulary knowledge | -0,35 | -1,89 | 0,07 | |
| Level of Education | 0,34 | 1,56 | 0,12 | |
| Age | -0,22 | -1,01 | 0,317 | 0,10 |
| Step 2 (forward stepwise regression) | | | | |
| Number of items in FAT | 0, 39 | 2,24 | < .05* | 0,09 |

## Experiment 2

Can implicit learning abilities predict the size of the semantic priming effect?

### Results

| Model | β | t | p | ΔR² |
|---|---|---|---|---|
| Step 1 (forced entry) | | | | |
| Speed of processing (training block) | -0,10 | -0,64 | 0,53 | |
| Vocabulary knowlege | -0,01 | -0,05 | 0,96 | |
| Level of Education | -0,09 | -0,42 | 0,67 | |
| Age | 0,16 | 0,79 | 0,43 | 0.05 |
| Step 2 (Forward stepwise regression) | | | | |
| Implicit learning (transfer block – last learning block) | 0, 66* | 2,75 | < .01* | 0.083 |
| Step 3 | | | | |
| Explicit knowledge (anticipatory responses in SRT) | -0.48 | -2,02 | 0.05 | 0.095 |

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