Priming Scalar Alternatives under Negation and by Antonyms in Lexical Decision

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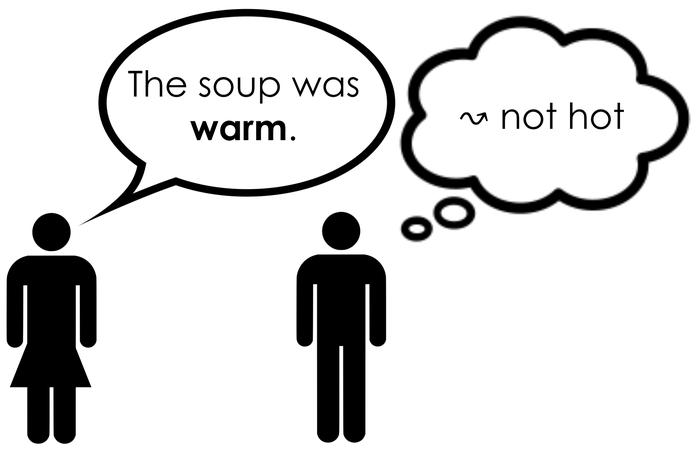
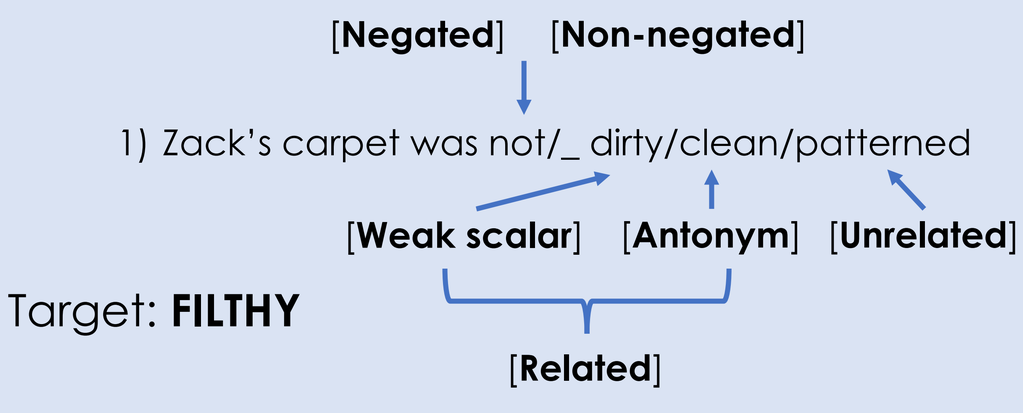
Scalar implicatures:



Which alternatives appear during online scalar implicature derivation?

- Informational strength has been seen as key when it comes to scalar implicature (SI) derivation (Horn, 1972)
  - Most accounts of SIs assume that **stronger alternatives are needed**
- The processing literature on focus has shown that comprehenders operate with alternatives online
  - Lexical decision and probe recognition experiments show alternatives being activated and represented (Husband & Ferreira, 2016; Gotzner et al. ,2016; see Gotzner & Spalek,2019, for an overview)
- Recently, researchers have adapted these methods to the **study of alternatives in online SI derivation**
  - De Carvalho et al. (2016) showed isolated weak scalars prime the strong ones more than the reverse
- Ronai & Xiang (2023) tested the priming of strong scalars (*hot*) by weak ones (*warm*)
  - When they presented isolated scalar words, there was no priming
  - The **strong terms** were **activated in a sentential context** – suggesting **involvement in SI derivation**

Stimuli



Hypotheses

- If Ronai & Xiang's (2023) activation results truly reflect SI derivation
  - No activation when informational strength relations change
- **Negation** can reverse entailment relations
  - Scalar words such as *hot* are no longer stronger than *warm*
- Are only strong terms relevant in online SI derivation?
  - **Antonyms** could also play a role (see Peloquin & Frank, 2016)
- The Alternative Activation Account proposes domain-general activation followed by selection based on contextual and grammatical factors (Gotzner, 2017)

Experiment 1: Negated weak scalars
Items = 52, N = 50

Experiment 2: Antonyms in sentences
Items = 60, N = 50

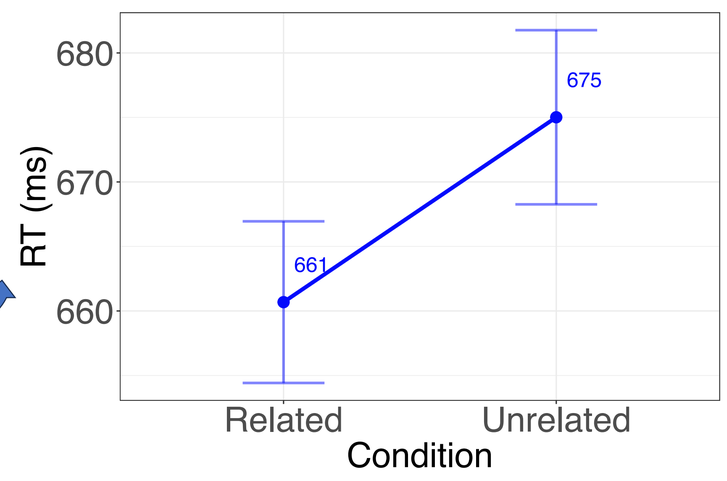
Experiment 3: Antonyms in isolation
Items = 60, N = 50

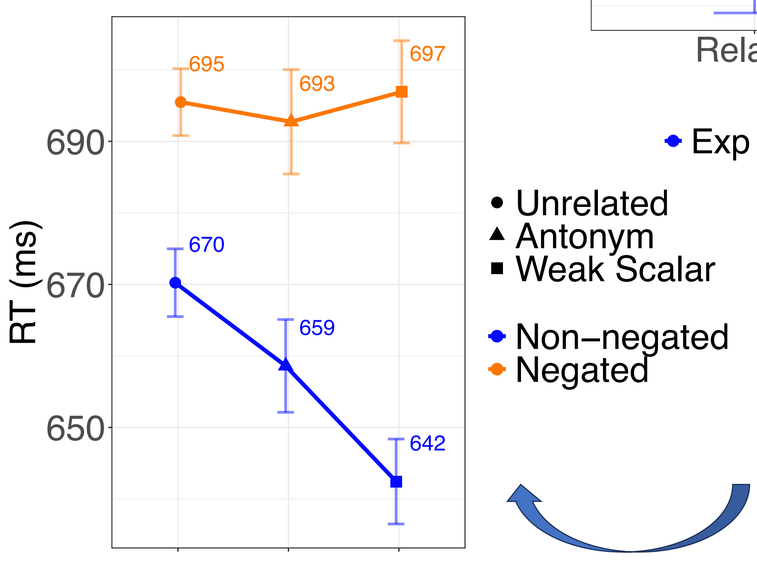
Experiment 4: Negated antonyms
Items = 48, N = 50

Lexical decision experiments

- Web-based on PCIbex
- Single factor: **Related vs unrelated**
  - Either weak scalar or antonym
- Rapid Serial Visual Presentation
  - 350ms per word, 650ms SOA
- Experiment 3: Only prime words (*clean*) and targets (*filthy*) presented
  - 150ms per prime, 650ms SOA

Priming was observed for when antonyms were presented as isolated lexical items without any context in contrast to the weak scalars, as reported in Ronai & Xiang (2023)





The combined dataset illustrates how negation cancels the increased activation of targets for weak scalar and antonym primes, but with a difference in degree

Results: Individual experiments

- **Experiment 1 (Negated weak scalars)**
  - Relatedness: β = 0.0081, SE = 0.011, df = 32.25, t = 0.71, p = 0.483
- **Experiment 2 (Antonyms in sentences)**
  - Relatedness: β = 0.0238, SE = 0.008, df = 2846, t = 2.93, p = **0.0034***
- **Experiment 3 (Antonyms in isolation)**
  - Relatedness: β = 0.0248, SE = 0.009, df = 2665, t = 2.75, p = **0.0061****
- **Experiment 4 (Negated antonyms)**
  - Relatedness: β = -0.001, SE = 0.013, df = 29.37, t = -0.05, p = 0.958

Combined analysis

- **Combined data** from Exp 1, 2, & 4 and Exp 4 from Ronai & Xiang (2023), which tested non-negated weak scalars
- We created a 2 x 3 factorial design
  - **Negation**: Negated (baseline) vs. non-negated
  - **Prime**: Weak scalar vs. antonym vs. unrelated (baseline)

- **Simple effect** of **Negation**
  - β = 0.03, SE = 0.028, df = 200.5, t = 1.117, p = 0.26513
- **Simple effect** of **Prime** (unrelated baseline)
  - Weak scalar: β = -0.04, SE = 0.009, df = 8922, t = -4.390, p = **0.0001*****
  - Antonym: β = -0.023, SE = 0.009, df = 8915, t = -2.625, p = **0.00867****
- **Interaction** of **Negation** and **Prime**
  - Weak scalar: β = 0.028, SE = 0.013, df = 8917, t = 2.164, p = **0.03049***
  - Antonym: β = 0.026, SE = 0.013, df = 8917, t = 1.954, p = 0.05069

Combined plot:
Exp 1, 2, 4 + Exp 4 (R&X)

Discussion

- **Negation cancels the activation of targets** (formerly stronger scale-mates).
  - Informational strength matters, consistent with De Carvalho et al. (2016)
  - **Negation influences priming differently when weak scalar vs antonym primes are used**
- Antonymic primes activated the targets both in sentences and in isolation
  - An epiphenomenon in online SI derivation?
  - But see Doran et al. (2009) a.o. for evidence that non-entailed alternatives facilitate SI derivation
- The results are most compatible with the Alternative Activation Account
  - Comprehenders seem to activate a slew of associates (antonyms) and then select depending on the grammar and context (negation)

Selected references: De Carvalho, A., Reboul, A. C., Van der Henst, J. B., Cheylus, A., & Nazir, T. (2016). Scalar implicatures: The psychological reality of scales. *Frontiers in psychology*, 7, 1500.; Doran, R., Baker, R. E., McNabb, Y., Larson, M. & Ward, G. (2009). On the non-unified nature of scalar implicature: An empirical investigation. International Review of Pragmatics 1, 211–248.; Gotzner, N., Wartenburger, I., & Spalek, K. (2016). The impact of focus particles on the recognition and rejection of contrastive alternatives. *Language and Cognition*, 8(1), 59-95.; Gotzner, N. (2017). Alternative sets in language processing: How focus alternatives are represented in the mind. Springer.; Gotzner, N., & Spalek, K. (2019). The life and times of focus alternatives: Tracing the activation of alternatives to a focused constituent in language comprehension. *Language and Linguistics Compass*, 13(2), e12310.; Horn, L. R. (1972). *On the semantic properties of logical operators in English*. University of California, Los Angeles.; Husband, E. M., & Ferreira, F. (2016). The role of selection in the comprehension of focus alternatives. *Language, Cognition and Neuroscience*, 31(2), 217-235.; Peloquin, B. N., & Frank, M. (2016). Determining the alternatives for scalar implicature. In *CogSci*.; Ronai, E., & Xiang, M. (2023). Tracking the activation of scalar alternatives with semantic priming. *Experiments in Linguistic Meaning*, 2, 229-240.;

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