Different Determiners, Different Algorithms: Two Majority Quantifiers in Cantonese Bias Distinct Verification Strategies

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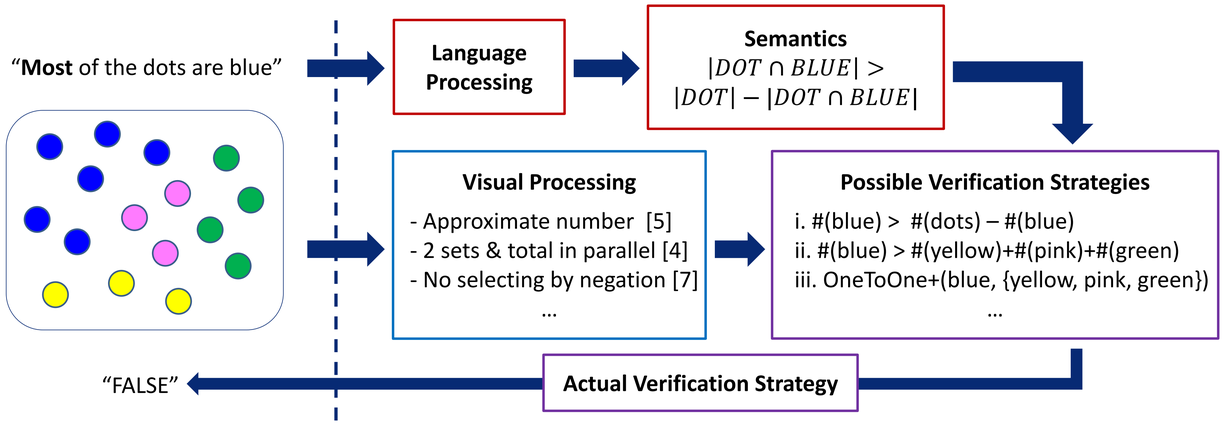
Background: Meaning & Verification

How are quantifier meanings represented in speakers' minds?
- Which sets and operations do quantifier meanings highlight?
- Do those highlighted sets and operations bias participants to use certain verification strategies over (superior) alternatives?

Case study: proportional vs. largest subset *most*
- English ***the most*** vs. ***most*** [1, 6, 8]
- Polish ***najwięcej*** vs. ***większość*** [3]
- Cantonese ***zeoi-do*** vs. ***daai-do-sou***

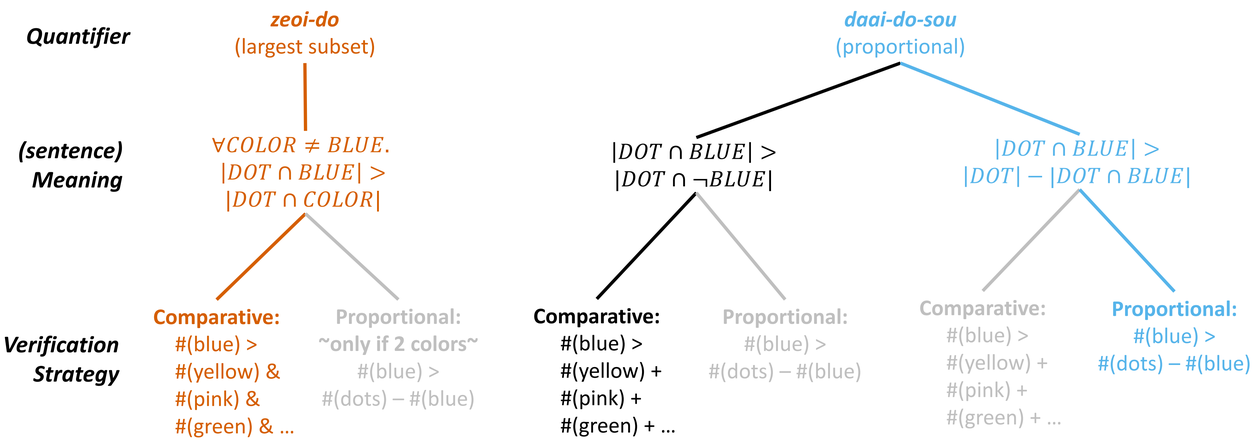


Linking hypothesis: Interface Transparency
- People are biased toward verification strategies that transparently reflect the meaning under evaluation [1]
  - e.g., one-to-one strategies [2] or direct comparison strategies [6] **aren't** used to evaluate ***most***-statements even when they are cognitively available and would be faster or more accurate (given the display)
- **Methodological Strategy:** Variation in verification **that can't be otherwise explained** is due to the meaning

Current Case: Proportional vs. Largest Subset *most* in Cantonese

(1) **zeoi-do** ge dim hai laam-sik
superlative-many POSS dot is blue
"the blue dots are the largest subset"

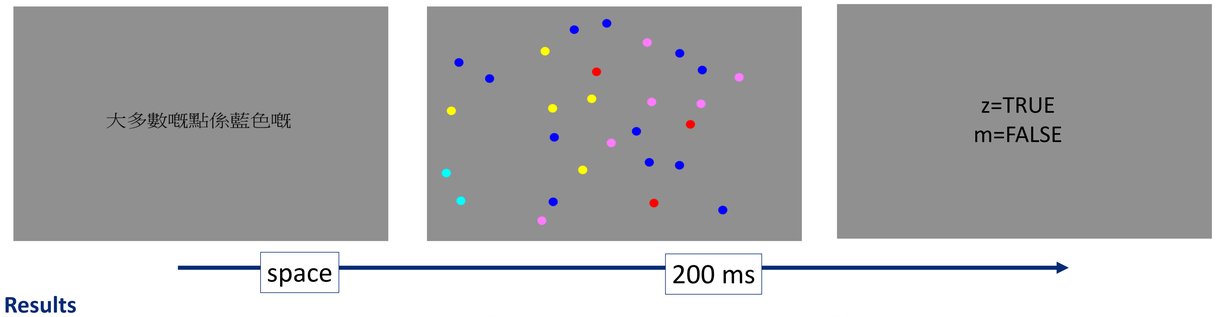
(2) **daai-do-sou** ge dim hai laam-sik
big-many-number POSS dot is blue
"most of the dots are blue"



- Visual system cannot select negation of a visual feature directly (it can't select the non-blue dots) [7]
  → #(non-blue) requires subset selection instead (#(yellow) + #(pink) + #(green) + ...)
- Visual system can enumerate only two subsets (and the superset) in parallel [4]
  → Prediction: Comparative strategy (required for ***zeoi-do***) will fail as # of distractor colors increases
  → Prediction: If ***daai-do-sou***'s meaning highlights non-blue, performance will likewise suffer

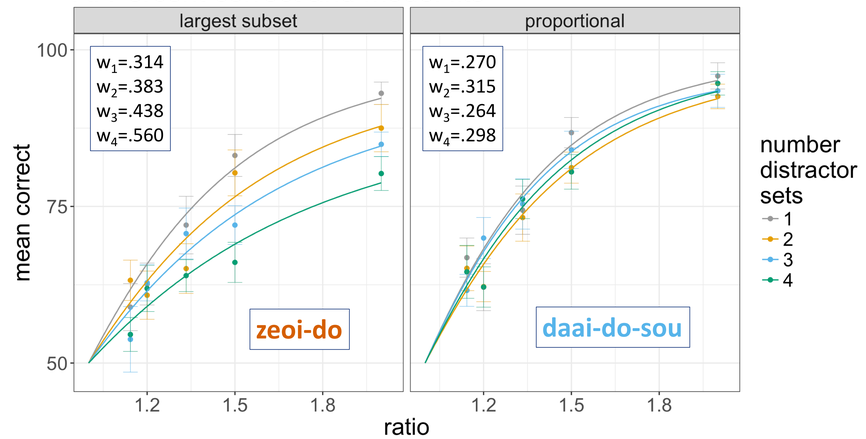
Speeded Judgement Task

Method
- 14 native Cantonese-speaking participants judged truth of (1) and (2) with respect to briefly flashed dot-displays
- Number of distractor colors (non-blues) varied from 1 to 4 (yellow, red, cyan, magenta)
- Ratios varied from 2:1 to 8:7 (blues : largest non-blue subset for ***zeoi-do***; blues : non-blues for ***daai-do-sou***)

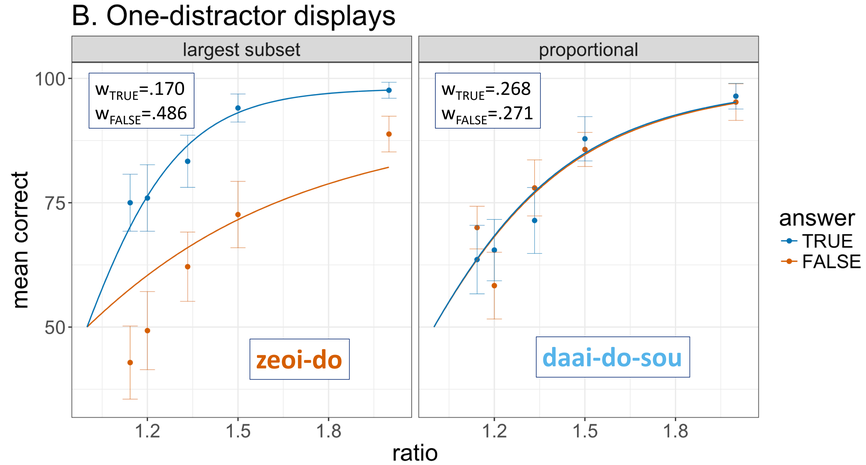


Results
- Both determiners bias strategies relying on approximate number
  → ratio-dependence [5]
- Largest subset *most* (***zeoi-do***) biases subset-selection
  → worse performance as # of distractor colors increases (A)
- Proportional *most* (***daai-do-sou***) biases superset-subtraction
  → performance unaffected by # of distractor colors (A)
- Evidence of distinct strategies even on one-distractor displays (where either could be used)
  → different response pattern on TRUE and FALSE trials following ***zeoi-do*** but not ***daai-do-sou*** (B)

A. Percent correct and model fits



B. One-distractor displays



Future directions
- Comparative strategy is superior in **spatially-separated 2-color** contexts, but still isn't used for English ***most*** (though it is used for English ***more***) [6]
  → Similar task in Cantonese (***daai-do-sou*** predicted to lead to worse performance than ***zeoi-do***)
- What factors lead to cross-linguistically shared meaning of proportional determiners?
  → Grammatical? Conceptual?

Upshot: quantifier meanings highlight certain sets/operations and carry weight in determining verification
- Both quantifiers bias approx. number-based strategies that are transparently related to their meanings
  → Cross-linguistically, **proportional** quantifiers bias **cardinality-based superset subtraction** strategies
  → Cross-linguistically, **largest subset** quantifiers bias **cardinality-based subset comparison** strategies
- Quantifiers even bias distinct strategies on identical displays, where either strategy is cognitively available!

References: [1] Lidz et al., 2011, *Nat. Language Semantics* [2] Pietroski et al., 2009, *Mind & Language* [3] Tomaszewicz 2011, *Sinn und Bedeutung* [4] Halberda et al., 2006, *Psych. Sci.* [5] Feigenson et al., 2004, *TICS* [6] Lidz et al., *in prep* [7] Treisman & Souther 1985, J. Exp. Psychol. Hum. Percept. Perform. [8] Odic et al., *in prep* **Big thanks to:** Alexander Williams, Ellen Lau, Darko Odic, Mina Hirzel, & Josh Langfus **Funding:** NSF #1449815 & Maryland Language Science Center **Contact:** tzknowlton@gmail.com