Conceptual alternatives: Motivations, prospects, and caveats

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Joint work with Manuel Križ (Univ. of Vienna) & Emmanuel Chemla (CNRS)

Outline

Outline

Background

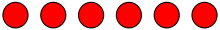
Motivations for moving beyond language

Prospects for conceptual alternatives

Caveats to keep in mind

Alternatives and competition

A classic example:



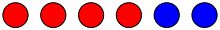
- S = **Some** of the dots are red.
- A = **All** of the dots are red.

A is an *alternative* to S; S and A *compete*. Two consequences:

1. S is suboptimal in the situation above. ✓
2. S typically implies (*implicates*) that A is not true. ✓

Alternatives and competition, cont'd

Another example:

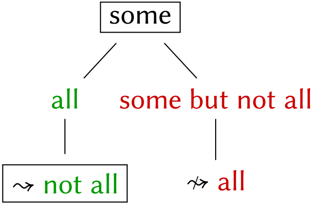


- S = **Some** of the dots are red.
- A = **Some but not all** of the dots are red. (???)

If A could be an alternative to S, then:

1. S would be suboptimal in the situation above. ✗
2. S would typically implicate that A is not true. ✗

Symmetry problem (Kroch 1972; Fox 2007; Fox & Katzir 2011)



Symmetry problem, cont'd

If α implicates 'not β', then a theory of alternatives must explain why β is the alternative to α, rather than *not* β (or α *and not* β).

Towards a theory of alternatives

Alternatives are powerful, hence dangerous.

We need restrictions on alternatives.

- S = **Some** of the dots are red.
- A = **All** of the dots are red. ✓
- A = ~~**Some but not all** of the dots are red.~~ ✗

Katzir's algorithm (Katzir 2007)

The alternatives of a structure S are obtained by:

1. deleting a part of S
2. replacing a part of the structure with an individual lexical item
3. replacing a part of S by a piece of structure made available in the current discourse

Success 1: Solving the symmetry problem*

- S = **Some** of the dots are red.
- A = ~~**Some**~~ **All** of the dots are red. ✓
- A = ~~**Some**~~ **Some but not all** of the dots are red. ✗

* at least in direct cases (Romoli 2013)

Success 2: Explaining lexical constraints/variation

Japanese (Matsumoto 1995):

- S = Kochira wa Takashi-kun no **kyoodai** no Michio-kun desu.
  'This is Takashi's **brother** Michio.'
  $\rightsquigarrow$ speaker uncertainty about age
- A_1 = …**ani** (= older brother) …✓
- A_2 = …**otooto** (= younger brother) …✓

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English:

- S = This is Gale's **brother** Fred. $\not\rightsquigarrow$ speaker uncertainty
- A_1 = This is Gale's **older brother** Fred. ✗
- A_2 = This is Gale's **younger brother** Fred. ✗

Interim (exaggerated) summary

The lexicon (mostly) determines the alternatives.

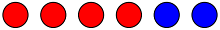
- *all* vs. *some but not all*
- sibling example (English vs. Japanese)

Outline

Challenges to the algorithm

1. Hierarchy of logical vs. content words
2. Alternatives may be ungrammatical or uninterpretable
3. Alternatives may be inexpressible
4. Why are lexicons the way they are?

Challenge 1: Hierarchy of logical/content words



- S = Some of the dots are red.
- A = **All** of the dots are red. ✓
- A = Some of the dots are **blue**. ✗

Challenge 2: Alts may be ungrammatical/uninterpretable

- S = Every dad$_i$ photographed [his$_i$ daughter]$_j$ or her$_j$ mother.
- A_1 = Every dad$_i$ photographed his$_i$ daughter. ✓
- A_2 = Every dad$_i$ photographed her$_j$ mother. ???

Somehow we need alternatives equivalent to:

- A = Every dad$_i$ photographed his$_i$ daughter. ✓
- A = Every dad$_i$ photographed his$_i$ daughter's mother. ✓

(Buccola & Chemla 2019)

Challenge 3: Alternatives may be inexpressible

Q: Who passed the exam?
A: Alice and Bob passed.

- implicates that no one except A and B passed, even in a context where there's no way to refer to alternative students

Challenge 3, cont'd: Alternatives may be inexpressible

English:

- S = John broke **all** of his arms.
- A = John broke **both** of his arms.

Challenge 3, cont'd: Alternatives may be inexpressible

English:

- S = John broke **all** of his arms.
- A = John broke **both** of his arms.

French:

- S = Jean s'est cassé **tous** les bras.
- A = Jean s'est cassé **both** les bras.

(Chemla 2007)

Challenge 3, cont'd: Alternatives may be inexpressible

Charlow 2019:

- S = John repeated the rumor that Mary **or** Bill was expelled.
  $\rightsquigarrow$ not(Mary **and** Bill are ***each*** such that John repeated the rumor that he or she was expelled)
- A ≠ John repeated the rumor that Mary **and** Bill were expelled.

Challenge 3, cont'd: Alternatives may be inexpressible

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Charlow:

- S involves **existential** quantification (∃) over choice functions
- A involves **universal** quantification (∀) over choice functions
- such universal alternatives "are more abstract than we might have thought", "do not seem to correspond to any expressible lexical items" (in English)

Challenge 3, cont'd: Alternatives may be inexpressible

- Smith 2020: similative plurality in Persian and Japanese
  - proposes conceptual alternatives, which are inexpressible, to capture implicatures associated with similative plurals
- Carcassi & Szymanik 2021: *most* vs. *more than half*
  - propose that *most* and *more than half* are truth-conditially equivalent but have different conceptual representations, hence evoke different conceptual alternatives
- …

Challenge 4: Quest for a deeper explanation

Why are lexicons like this?

Why are *some* and *all* lexicalized in language after language, but not *some but not all*?

New algorithm: Conceptual alternatives (to be revised)

- Take the conceptual representation of the sentence.
- Replace one primitive element with another primitive element.

A sense of what primitive elements may be

Intuitive contrasts among different options:

- **birds**: well-formed natural class
- **red**: well-formed natural class

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- **red <u>xor</u> birds**: not a well-formed natural class

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and > **or** > **xor**

Proposal: 'All' is primitive; 'some but not all' is not — or some gradient version of this.

Challenge 1 revisited: Hierarchy of logical/content words

- S = Some of the dots are red.
- A = **All** of the dots are red. ✓
- A = Some of the dots are **blue**. ✗

Main idea: 'All' is relatively primitive, while color terms like 'blue' are not — or some more graded version of this idea.

Thus, 'all' is more likely to used in a replacement than 'blue'.

Challenge 2 revisited: Ungrammatical/uninterpretable alts

- S = Every dad$_i$ photographed [his$_i$ daughter]$_j$ or her$_j$ mother.

Main idea: The required alternatives are available at the conceptual level, possibly something corresponding to:

- A_1 = Every dad$_i$ called [his daughter]$_j$ **L** her$_j$ mother.
- A_2 = Every dad$_i$ called [his daughter]$_j$ **R** her$_j$ mother.

(Sauerland 2004)

Challenge 3 revisited: French and 'both'

Main idea: The concept 'both' is relatively primitive, thus is used by French speakers to build the relevant alternative, despite not being lexicalized.

Challenge 3 revisited, cont'd: Charlow's exceptional scope

Main idea: Existential quantification (∃) over choice functions is replaceable by universal quantification (∀) at the level of thought.

Challenge 4 revisited: Lexicalization

Main idea: The concepts 'some' ($\exists$) and 'all' ($\forall$) are relatively primitive, while the concept 'some but not all' is not: it's composed of other primitives, like $\exists$, $\wedge$ (conjunction), $\neg$ (negation), and $\forall$.

Natural hypothesis: Lexical items, across languages, are more likely to be primitive elements than non-primitive elements.

Outline

What is the relevant level of representation?

Assume that a sentence structure can always be translated into the so-called Language of Thought.

This conceptual representation may be similar to classical LF, but potentially with more lexical items (e.g., conceptual primitives that may or may not be lexicalized in the given language).

Neo-Katzirian algorithm for conceptual alternatives

There is a single operation to (recursively) transform a conceptual structure: replacement of a part by a lexical item of the Language of Thought.

Lexical items may be:

1. a special empty element
2. other elements that may or may not be lexicalized in the actual language
3. a special pronoun capable of pointing at structures

A more nuanced view: Costs

Rather than define what is or is not an alternative, we may say that alternatives come at different **costs** (Bergen et al. 2016).

For example:

- the larger the material being replaced, the cheaper
- the more complex the replacement material, the more costly
- the more primitive the replacement material, the cheaper
- …

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Other factors that may play into cost:

- lexicalization in the given language
- frequency of the given lexical item (if it exists)
- contextual salience
- …

Costs, cont'd

Sketching the general idea:

- 'both' is relatively primitive, hence can replace 'all' at the level of thought relatively cheaply, even if not lexicalized
- 'some' ($\exists$) and 'all' ($\forall$) are relatively primitive, hence can replace one another cheaply at the level of thought
- 'some but not all' is not primitive (is relatively complex), hence is costly to replace 'some' (more so than 'all' is)

Breheny et al.'s (2018) 1st challenge

4.1 Too few lexical alternatives

One potential problem is that of undergeneration, where the needed formal alternative cannot be generated under the assumptions of the structural approach to alternatives. For instance, in Japanese, deontic possibility and necessity are expressed by constructions that are structurally clearly different. Consider the following examples.

(41) John-wa ki-te yoi.
John-TOP come-GERUND good
'John is allowed to come.'

(42) a. John-wa ko-naku-te-wa nar-anai/ike-nai.
John-TOP come-NEG-GERUND-TOP become-NEG/go-NEG
'John must come.'

b. John-wa kuru hitsuyoo-ga aru.
John-TOP come necessity-NOM exist
'John needs to come.'

. . .

A possible response to this might be to assume that there actually is a grammatical alternative to (41) that expresses deontic necessity (e.g. **[John-wa] [ki-te [**doi**]]*) but is made unacceptable and practically unusable for some independent reasons, to which computation of scalar implicatures is somehow oblivious.[22] Then, the desired scalar implicature could be generated based on this unacceptable sentence. However, a solution like this commits one to nontrivial assumptions about the theory of the lexicon and the acquisition of lexical items (cf. Schlenker 2008).

Breheny et al.'s (2018) 2nd challenge (Swanson 2010)

4.2 Too many lexical alternatives

For the symmetry problem created by *some but not all*, the solution under the structural approach to alternatives crucially relies on what is and is not lexicalised. In particular, it is important that there be no constituent in the lexicon of the same or less structural complexity as *some* and *all* and with the meaning 'some but not all'.

...

Swanson (2010), however, points out that there do appear to be other scalar items whose symmetric alternative *is* lexicalised. He raises examples like the following, where the scalar items are *permitted* and *sometimes*.

(44) a. Going to confession is permitted.
b. ⇝ *Going to confession is optional*
c. $\not\rightsquigarrow$ *Going to confession is required*

(45) a. The heater sometimes squeaks.
b. ⇝ *The heater intermittently/occasionally squeaks*
c. $\not\rightsquigarrow$ *The heater constantly squeaks*

...

As Swanson (2010) himself suggests, one could try to supplement the theory with a constraint that excludes the problematic lexical items in some principled way, e.g., by resorting to their relative low frequency. However, it appears not obvious to us how to integrate these other factors into the structural approach.

Beyond scalar implicatures

Although motivated primarily by classic scalar implicature cases, conceptual alternatives may play a broader role, wherever alternatives crop up:

- non-scalar (e.g., manner) implicature (Rett 2015)
- Maximize Presupposition! (Heim 1991)
- interrogative/inquisitive semantics
- domain alternatives
- other “scalar” phenomena beyond implicature
- …

It remains to be seen what role they may play in such cases.

Outline

Exploding the space of alternatives?

Mascarenhas (2021) shows that the cardinality of set of Katzirian alternatives grows exponentially, at the rate of $(2n-1)^n \cdot 2^{n-1}$ for a source with n atoms.

Moving to a conceptual level would seem to make things even worse, insofar as the substitution source is presumably much larger.

…or would it? *Maybe* conceptual primitiveness (or cost more generally) can help prevent this explosion at the *algorithmic* level, but this remains to be investigated more seriously.

Independent evidence for conceptual alternatives

Moving from alternatives as linguistic objects to alternatives as conceptual objects is potentially dangerous.

We may lose **predictive power**: without any independent measure of 'primitiveness', we have little way of predicting which inferences should arise.

Ideally, we should be able to make it an empirical question that can be tested.

For example, can we **show** that 'all' is more primitive than 'some but not all'? And similar for any other claim about conceptual alternatives.

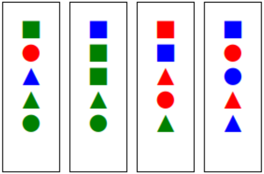
Proof-of-concept experiment (pun intended)

Inspired by Piantadosi et al. 2016 (“The logical primitives of thought”) and others, we ran an experiment to establish preferences between concepts at the level of thought.

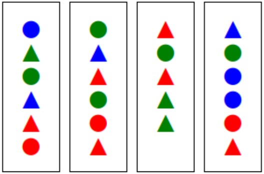
Can we find an intrinsic preference for ‘all’ over ‘some but not all’?

Rule discovery task: Example target item

Each of these boxes satisfies the rule.



None of these boxes satisfies the rule.



Does this box satisfy the rule?

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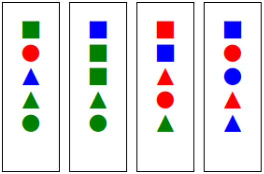
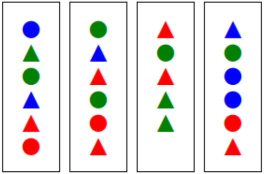


Some objects are squares.
Some but not all objects are squares.

None of these boxes satisfies the rule.



Some objects are squares.
Some but not all objects are squares.

Does this box satisfy the rule?

Some objects are squares.
Some but not all objects are squares.

Comparing rules

How can we directly compare two quantificational rules?

- tell subjects they have to extract a rule
- present positive and negative examples simultaneously
- positive examples satisfy both rules
- negative examples satisfy neither rule
- **target** items: subjects judge an item that satisfies only **one** of the rules

This methodology works only when there are cases that satisfy both rules and cases that satisfy neither.

Comparing rules, cont'd

Because there must be cases that satisfy both rules (and neither rule),

- cannot directly compare *all* and *some but not all*
- can compare *some* and *all*
- can compare *some* and *some but not all*

Therefore, can indirectly compare *all* and *some but not all.*

Conditions

Three comparisons, all indirect via a pivot, total of 6 quantifier pairs.

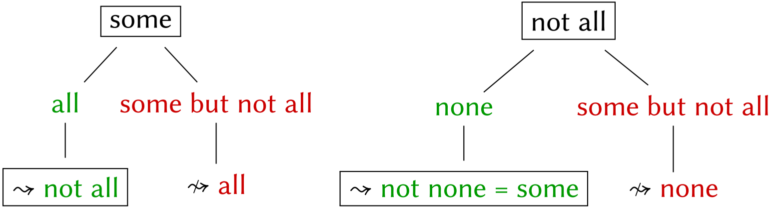
- *all* vs. *some but not all* via *some*
- *none* vs. *some but not all* via *not all*
- *at least n* vs. *at most n* via *exactly n*

Three item types:

- YES: both rules are true of the box to be judged
- NO: both rules are false
- TARGET: only the logically **weaker** rule is **true**

Motivations (reminder)

(A)symmetry of alternatives with direct and indirect implicatures:

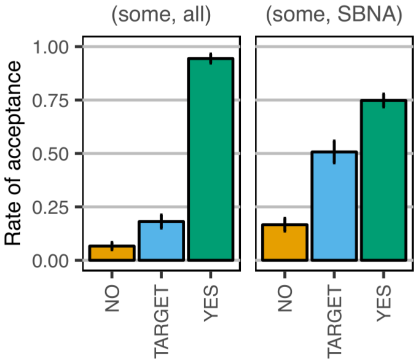


(Let's set aside the numeral quantifiers.)

Experiment details

- 45 participants on Amazon Mechanical Turk
- items varied on # of positive boxes (3 or 4), # of negative boxes (3 or 4), and # of items per box (5 or 6)
- relevant property was either color (red, blue, or green) or shape (triangle, square, or circle)
- numeral quantifier conditions occur twice, once with *three* and once with *four*
- 6 items per condition (12 for numerical), total 144
- 4 practice items (non-numerical quantifier, non-TARGET) without feedback

Results



- TARGET can be anywhere between NO and YES bar
- the lower it is within this range, the more the stronger item (e.g. *all* or *SBNA*) is preferred to the weaker item (e.g. *some*)
- if TARGET is relatively lower within that range for (some, all), than for (some, SBNA), then *all* is preferred to *SBNA*

Conclusion

- think about alternatives with an open mind, allowing non-lexicalized alternatives to play a role
- seek **independent evidence** that these alternatives are indeed "primitive"
- evidence could come from cross-linguistic investigations (e.g., regularities across lexicons), experimental psychology, and more

THANK YOU!

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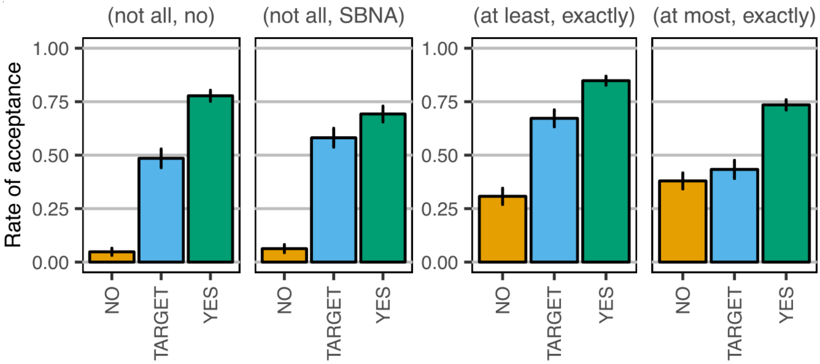
More results



Modeling results

	SOME	NOT ALL	NUM
Δ_{elpd}	−32.0	−3.8	−11.7
$se(\Delta_{elpd})$	7.9	3.1	7.2

Differences in estimated log pointwise predictive likelihood and their standard errors for models with one or two γ parameters for sets of quantifier pairs sharing a weaker member. Negative values of Δ_{elpd} indicate evidence in favor of the two-γ model.

- strong evidence for a difference b/w *all* vs. *SBNA*
- weaker evidence for *at least* vs. *at most*
- weakest evidence for *SBNA* vs. *none*

Difference in strength of evidence probably due to difference in intra-subject variability.