Relevance-Based Pruning

Narrowing down $ALT$ to $A$ is allowed only if no relevant alternative is left out.
Brevity-Based Pruning

Narrowing down $ALT$ to $A$ is allowed only if the enriched meaning that this derives could not have been expressed simpler.
Pruning

: The act of deleting elements from the set $ALT$ of formal, potential alternatives

usually done in order to get the set of alternatives $A$ that are actually used to compute the scalar implicatures of $\sigma$ in $C$
Alternatives $ALT(\sigma)$ used in implicature computation come from:

- the lexicon
- sub-constituents of $\sigma$
- the context
(1) John drank some \textsc{All} of the beers

(2) Everybody knows a song or a poem

(3) Mary must reject some but not all papers. Bill only has to reject some
Structural Alternatives $\mathcal{ALT}$

$\alpha \in \mathcal{ALT}(\sigma)$ iff $\alpha$ can be derived from $\sigma$ by replacing sub-constituents in $\sigma$ with

- elements from the lexicon
- sub-constituents of $\sigma$
- constituents uttered in $C$

(Katzir 2007)
Innocently Excludable Alternatives $\mathcal{IE}$

The set $\mathcal{IE} \subseteq ALT(\sigma)$ is the intersection of all sets $Max \subseteq ALT$ s.t.

1. all elements in $Max$ can be negated together without contradicting $\sigma$

2. there is no element in $ALT(\sigma)$ which could be added to $Max$ and 1. still be met

(Fox 2007)
An Example for $\mathcal{IE}$

(4) A or B

- $ALT = \{A, B, A \text{ and } B, C\}$
- $Max_1 = \{A, A \text{ and } B, C\}, \ Max_2 = \{B, A \text{ and } B, C\}$
- $\mathcal{IE} = Max_1 \cap Max_2 = \{A \text{ and } B, C\}$

Predicted Implicature:

$(A \lor B) \land \neg (A \land B) \land \neg C$
Notation

\( exh \ [ALT] \ [A \ or \ B] \)

Assumption

\( exh \) and the set it quantifies over (here: \( ALT \)) are represented syntactically
Practice \( ALT \)

C: John drank exactly three beers

\[ ALT(\phi) = \{ \text{three, exactly three, four} \} \]

\( ALT(\phi) \):
- lexicon: substitute \( \tau \) with item \textit{four}
- context: substitute \( \tau \) with \textit{exactly three}
Back to Pruning

Why narrow down the set of structural alternatives $\text{ALT}$?

“Pruning : The act of deleting elements from the set $\text{ALT}$ of formal, potential alternatives” [from earlier]
(5) Mary liked the costumes in Swan Lake

\[ ALT = \{ \text{Mary loved the costumes in S.L.,} \]
\[ = \{ \text{Mary invented Cheerios,} \]
\[ = \{ \text{Mary ordered the invasion of Poland, ...} \} \]

\[ \rightarrow \text{Pruning to } A \subset ALT \]
Example of a possible pruning

\[ ALT = \{ \text{Mary loved the costumes in S.L.} \]
\[ \text{Mary invented Cheerios,} \]
\[ \text{Mary ordered the invasion of Poland, } \ldots \} \]
\[ \cap \]
\[ C = \{ \text{Mary loved the costumes in S.L.} \} \]

\[ = \mathcal{A}: \text{the pruned set of active alternatives} \]
Why narrow down the set of structural alternatives $ALT$ to $A \subset ALT$?

To derive the implicatures actually observed in a given context $C'$.
The puzzle: Pruning is not always possible
Pruning: A Puzzle

Example of an impossible pruning

(6) (John drank **some but not all** of the beers. What about Mary?)
She drank **some** of the beers

\[
ALT = \{\text{SOME, SBNA, ALL}\}
\]

\[
A = \{\text{SOME, SBNA}\}
\]

\[
exh [A] [\text{SOME}] = \text{SOME} \land \neg \text{SBNA} = \text{ALL}
\]

\[\text{x no pruning}\]

(Fox & Katzir 2011)
Example of an impossible pruning

(7)  (John drank some but not all of the beers, Bill drank all.)
And Mary (also) drank some of the beers

\[ ALT = \{ \text{SBNA, ALL, SOME} \} \]
\[ A = \{ \text{ALL, SOME} \} \]
\[ exh [A] [\text{SOME}] = \text{SOME} \land \neg \text{ALL} = \text{SBNA} \]

\(\times\) no pruning

(Fox & Katzir 2011)
Example of an impossible pruning

(8)  (Mary likes cats. What about John?)
He likes cats or dogs

\[ ALT = \{ \text{Cats, Dogs, Cats and Dogs} \} \]
\[ A = \{ \text{Cats} \} \]
\[ \text{exh} [A] [\text{Cats or Dogs}] = (\text{Cats} \lor \text{Dogs}) \land \neg \text{Cats} \]
\[ = \text{Dogs} \land \neg \text{Cats} \]

\[ \times \text{ no pruning} \]
Example of an impossible pruning

(9) (Mary owns exactly three cats. What about John?) He owns three cats

\[ ALT = \{ \text{EXACTLY THREE, FOUR} \} \]

\[ A = \{ \text{EXACTLY THREE} \} \]

\[ \text{exh} [A] [\text{THREE}] = \text{THREE} \land \neg \text{EXACTLY THREE} \]

\[ = \text{FOUR} \]

\[ \times \text{ no pruning} \]
What is the difference between the possible and the impossible prunings?
Fox & Katzir (2011): Exhaustively relevant alternatives cannot be deleted from $ALT$

\[(10)\quad \text{A pruning } \mathcal{A} \subset ALT(\sigma) \text{ is licensed iff there is no element } \phi \in ALT - \mathcal{A} \text{ s.t. } \phi \text{ is relevant when exhaustified w.r.t. } \mathcal{A}\]

\[(11)\quad \phi \text{ is relevant when exhaustified w.r.t. } \mathcal{A}\text{ iff } exh[\mathcal{A}][\phi] \text{ is in the Boolean Closure of } \mathcal{A}\]
Proposal

What blocks the impossible prunings is a more general constraint against redundancy

F&K’s condition (10) doesn’t need to be stipulated
Efficiency

An LF $\phi$ is ruled out if there is a competitor $\psi$ such that

- $\psi < \phi$
- $[\psi] \equiv [\phi]$

$\psi < \phi$ iff $\psi \in ALT(\phi) \land \phi \notin ALT(\psi)$

Notation $COMP(\phi) = \{\psi \mid \psi < \phi\}$

Efficiency – in simple words

ψ blocks φ if ψ is strictly simpler* than φ but the two are semantically equivalent

*in the sense of Katzir (2007)
**Practice** COMP:

```
        φ
       / \   
  __exh A__   μ
    /  \     /  \  
  Mary   drank τ
    /     /  
  exactly three
```

**COMP(φ):**
- sub-constituents: substitute φ with μ
- sub-constituents: substitute τ with *three*
- lexicon & sub-constituents: substitute *three* with *four* and then φ w μ
Practice $COMP$:  

$\phi$

- $exh\ A$
- Mary
- drank
  - $\mu$
  - $\tau$
    - exactly
    - three

$COMP(\phi)$:

- sub-constituents: substitute $\phi$ with $\mu$
- sub-constituents: substitute $\tau$ with $three$
- lexicon & sub-constituents: substitute $three$ with $four$ and then $\phi$ with $\mu$

$COMP(\phi) = \{ exh [A] [THREE], ex. THREE, exh [A] [FOUR], ... \}$
Proposal: Pruning through Brevity

Back to impossible pruning:

(12) (John drank some but not all of the beers...) Mary drank some of the beers

\[ \text{exh} \ [\mathcal{A}] [\text{SOME}] = \text{SOME} \land \neg \text{SBNA} = \text{all} \]

\[ \mathcal{A} = \{\text{SOME}, \text{SBNA}\} \]

\[ \text{COMP}(12) = \{\text{SOME, SBNA, all}\} \]

\(\times\) blocked
(13) \[ \text{exh} [\mathcal{A}] [\text{SOME}] = \text{SOME} \& \neg \text{ALL} = \text{sbna} \]

\[ \mathcal{A} = \{\text{SOME, ALL}\} \]

\[ \text{COMP}(15) = \{\text{SOME, sbna, ALL}\} \]

× blocked
(14) (Mary likes cats. What about John?)
He likes cats or dogs

\[
\text{exh } [\mathcal{A}] \text{ [CATS OR DOGS]}
= (\text{CATS} \lor \text{DOGS}) \land \neg \text{CATS} = \text{DOGS} \land \neg \text{CATS}
\]

\[\mathcal{A} = \{\text{CATS}\}\]

\[
\text{COMP}(14) = \{\text{exh}[\text{ALT}][\text{DOGS}], \ldots\}
= \text{DOGS} \land \neg \text{CATS}
\]

\[\textbf{x} \quad \text{blocked}\]
(Mary owns \textbf{exactly three} cats. What about John?)
He owns \textbf{three} cats

\begin{equation}
\text{exh } [\mathcal{A}] \text{ [THREE]}
= \text{THREE} \& \neg \text{EXACTLY THREE} = \text{four}
\end{equation}

\[ \mathcal{A} = \{\text{EXACTLY THREE}\} \]

\[ \text{COMP}(15) = \{\text{four}, \ldots\} \]

\[ \times \text{ blocked} \]
Intermediate Summary

- context can provide set $ALT$ with particular properties:
  - $ALT_1 = \{\text{SOME, SBNA, ALL}\}$
  - $ALT_2 = \{\text{EXACTLY THREE, THREE, FOUR}\}$

- no SI possible, but pruning would re-introduce unattested SI’s:
  - SOME $\Rightarrow$ ALL
  - THREE $\Rightarrow$ FOUR

- The relevant restriction was formalized as a Brevity-based constraint

  cf. Meyer (2015b)
Surprising Pruning Patterns
Symmetric Alternatives

Two alternatives $\alpha_1, \alpha_2$ of $\sigma$ are *symmetric* if the following holds:

- $\sigma = \alpha_1 \lor \alpha_2$
- $\alpha_1 \land \alpha_2 = \bot$
Symmetric Alternatives

Two alternatives $\alpha_1, \alpha_2$ of $\sigma$ are *symmetric* if the following holds:

- $\sigma = \alpha_1 \lor \alpha_2$
- $\alpha_1 \land \alpha_2 = \bot$

(16) $ALT = \{\text{SOME, SBNA, ALL}\}$

- $\text{SOME} = \text{SBNA} \lor \text{ALL}$
- $\text{SBNA} \land \text{ALL} = \bot$
A problem

Recall: no SI and no pruning predicted

(17) (John drank some but not all of the beers...)  
\textit{exh} Mary drank some of the beers

\[ A = ALT \text{ (no pruning)} \]
\[ ALT = \{\text{SBNA, SOME, ALL}\} \]
\[ Max_1 = \{\text{SBNA}\}, \, Max_2 = \{\text{ALL}\}, \, Max_1 \cap Max_2 = {} \]

\[ \text{exh} [ALT] [\text{SOME}] = \text{SOME} \]

Fox & Katzir (2011)
A problem

Recall: no SI and no pruning predicted

(18) \# John only/exh talked to some of the girls, and Mary talked to some but not all
≠ John talked to some & ¬ sbna girls yesterday

(19) \# John ate exactly three cookies, and Mary only/exh ate three cookies
≠ Mary ate three & ¬ exactly three cookies

\( I\mathcal{E} = \{ \} \)

exh and only predicted to be vacuous

Katzir (2007)
Unpredicted pruning possible with ✓ MaxPS

(20)  (John drank some but not all of the beers.)  
# Mary only drank some of the beers

but:

(21)  (John drank some but not all of the beers.)  
 ✓ Mary also only drank some of the beers
Unpredicted pruning possible when $\checkmark$ MaxPS:

(22) John drank \textbf{some but not all} of the beers. Mary \textit{also} only drank some of the beers

\textit{only} $[A] \{\text{SOME}\} = \text{SOME} \& \neg \text{ALL}$

$= \text{SBNA}$

$ALT = \{\text{SOME, SBNA, ALL}\}$

$A = \{\text{SOME, ALL}\}$

$\Rightarrow \textbf{Deleting SBNA possible?}$
A problem

But only into one direction:

\[(23)\]  Sue drank all of the beers, John drank some but not all. Mary also only drank some of the beers

\[\times\] only \( [A] \) \[SOME\] = SOME \& \neg SBNA

= ALL

\[ALT = \{SOME, SBNA, ALL\}\]
\[A = \{SOME, SBNA\}\]

\[\times\] Deleting ALL not possible
A problem

A related observation:

(24) John is brilliant, but he is not organized.
Mary is also only brilliant

⇒ ¬ (Mary is organized)

\( ALT = \{\text{brilliant, organized, not organized}\} \)
\( A = \{\text{brilliant, organized}\} \)

⇒ \( A \) is possible
A problem

Attempt at a generalization:
It is the alternative containing the negation that can be deleted

\[ \text{\textit{ALT}} = \{A, \text{not } B, B\} \]
\[ \checkmark \, \mathcal{A} = \{A, B\} \]
A problem

It’s not about negation:

(25) John went to Japan; he missed out on Korea
Mary also only went to Japan

⇒ ¬ (Mary went to Korea)

\[ ALT = \{ \text{go Japan, miss Korea, go Korea, ...} \} \]
\[ A = \{ \text{go Japan, go Korea} \} \]

cf. Trinh & Haida (2011)
A problem

It’s not about negation:

(26) Mary loves pandas, but she hates cats.
      John also only loves pandas

⇒ ¬ (John loves cats)

\[ ALT = \{ \text{love pandas, hate cats, love cats, ...} \} \]
It's not about negation:

(27) John is brilliant, but he is not organized. Mary is also only brilliant

⇒ ¬ (Mary is organized)

\[ ALT = \{\text{brilliant, not organized, organized}\} \]

versus

(28) John is polite, and he doesn’t swear. Mary is (≠ also) only polite

⇒ ¬ (Mary does not swear)

\[ ALT = \{\text{polite, not swear, swear}\} \]
Contrast as predictive factor?

(29) John drank some **but** not all of the beers
    #John drank some and not all of the beers

\[ ALT = \{ \text{some, all, sbna} \} \]

(30) Mary went to Japan, **but** she missed out on Korea
    # Mary went to Japan, and she missed out on Korea

\[ ALT = \{ \text{go Japan, go Korea, miss-Korea} \} \]
**A problem**

**Contrast as predictive factor?**

(31) John is brilliant, **but** he is not organized

# John is brilliant, and he is not organized

\[ ALT = \{ \text{brilliant, organized, not organized} \} \]

(32) John is polite, **and** he doesn’t swear

# John is polite, but he doesn’t swear

\[ ALT = \{ \text{polite, not swear, swear} \} \]
Contrast as predictive factor?

(33) John is brilliant, but he not organized.
(34) John went to Japan; but he missed Korea.
(35) Mary loves pandas, but she hates cats.
(36) John is polite, and he doesn’t swear.

e.g., Lakoff (1971), Toosarvandani (2014)
Contrast as predictive factor?

(37) Mary is only brilliant

= Mary is brilliant but not organized

\( ALT = \{\text{brilliant, organized}\} \)

“In excluding an alternative, *but* is closely related to the adverb *only*. (...) the alternatives presented in the *but*-conjuncts are excluded via negation.* [The two versions] (...) differ in two respects: First, in the case of *only* there may be more than one excluded alternative (...). Secondly, in the case of *only* the alternatives (...) need not be given explicitly, whereas in the case of *but* the alternative is presented in the second conjunct.

* if there is no explicit negation [*think negative antonyms*], the hearer has to reconstruct the appropriate alternative”

Umbach (2004), s. also Al Khatib (2013)
A problem

Contrast as predictive factor?

John is brilliant, **but** he *not* organized
not + *but*-ALT: organized

(38) Mary is also only brilliant
⇒ ¬ (Mary is organized)

ALT = \{brilliant, organized\}
Contrast as predictive factor?

John went to Japan; but he missed Korea
not + reconstructed but-\textit{ALT}: went to Korea

(39) Mary also only went to Japan
⇒ ¬ (Mary went to Korea)

\textit{ALT} = \{went to Japan, went to Korea\}
Contrast as predictive factor?

Mary loves pandas, **but** she **hates** cats
**not** + reconstructed **but**-ALT: **loves** cats

(40) John also only loves pandas
⇒ ¬ (John loves cats)

\[ALT = \{\text{loves pandas, loves cats}\}\]
Contrast as predictive factor?

**Descriptive Generalization (tentative)**
Negation (explicit or implicit) that is used to create 
*but*-contrast is not included in the substitution source for \( ALT \)
Intermediate Summary II

- *but* data are not necessarily evidence for problematic pruning

- Rather, the seemingly deleted alternative might have never been in $ALT$ in the first place

- $ALT$ is sensitive to independent constraints on contrastiveness e.g. in *but*-coordination

- Structural approach needs to be modified to allow for this sensitivity

- Not all negation is created equal when it comes to $ALT$
Why does oddness only disappear with *only*, but not with *exh*?
A contrast in felicity:

(41) John drank some but not all of the beers.
✓ Mary also only drank some of the beers
⇒ ¬ (Mary drank all of the beers)

(42) John drank some but not all of the beers.
# Mary (also) drank some of the beers
⇔ ¬ (Mary drank all of the beers) ✗
John drank some but not all of the beers.

Possible structure:

\[ exh \text{ Mary (also) drank some of the beers} \]

Possible alternatives (cf. only data)

\[ ALT = \{\text{SOME, ALL}\} \]

Prediction

\[ exh [ALT] [\text{SOME}] = \text{SOME} \& \neg \text{ALL} \]
1. We know that \( A = \{\text{SOME, ALL}\} \) is possible in the presence of \textit{but} (here: \textit{some but not all})

2. Therefore, the problem cannot be a vacuous (obligatory) \textit{exh}: The SI should be possible

3. The non-\textit{exh} reading with uncertainty implicatures should be possible \textit{a fortiori}

\( \text{The problem must be independent of ALT} \)
A parallel?

(Mary has 43 CDs and John has 50

(under approximate reading of 50)
Strategic Encoding

Let $\mu_1 = \text{SBNA}$, $\mu_2 = \text{SOME}$. If a sentence $S$ is ambiguous between $\mu_1$ and $\mu_2$, then the speaker should use $S$ only if one of $\mu_1, \mu_2$ is more likely than the other in the given context. Otherwise, she should use an alternative sentence $S'$ which only maps to one of $\mu_1, \mu_2$.

Parikh (2001), Krifka (2009)
An a-symmetric context

(45) Mary drank some of the beers

\[ \mu_1 = exh \left[ \{ \text{SOME, ALL} \} \right] [\text{SOME}] = \text{SBNA} \]
\[ \mu_2 = \text{SOME} = \text{SOME} \lor \text{ALL} \]

Quantity, Opinionatedness, and COMP make \( \mu_1 \) more likely in default context \( C \)

Speaker uses (45) to encode \( \mu_1 \)
A symmetric context

(46) (John drank exactly three beers.)
  # Mary drank three beers

\[\text{COMP(TWO)} = \{\text{exactly two, two}\}\]

\[\mu_1 = \text{exh} \{\text{three, four}\} \text{ [three]} = \text{exactly three}\]
\[\mu_2 = \text{three}\]

Contextual COMP makes \(\mu_1\) no longer likely than \(\mu_2\)
Intermediate Summary III

- $exh$ differs from *only* in being covert
- Structures are ambiguous wrt the presence of $exh$
- $\mu_1 = exh[\sigma]$ no longer more likely when unambiguous equivalent structure enters $COMP$
- Encoding choice sensitive to contextual standard of complexity $COMP$