The dynamic turn in questions

A case study of Quantificational variability effects

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Introduction

Dynamic meaning

The meaning of a declarative sentence is a dynamic proposition, i.e., a context change potential.

(1) a. Annie went to the party. She danced. (cross-sentential)
b. If a farmer owns a donkey, he feeds it. (donkey)
c. A wolf might walk in. It would growl. (subordinate)

Karttunen (1976); Heim (1982); Groenendijk and Stokhof (1991); a.o.

Compositional issues

Discourse referents not only support anaphora, but also help resolve sentence-internal compositional issues.

- Pseudo cummulative readings — Brasoveanu (2013)
- Scope of indefinites — Brasoveanu and Farkas (2011)
- Dependent indefinites — Henderson (2014)
- Constraints on distributivity — Law (2019)
- Negative concord — Kuhn (2021)

Questions

The meaning of questions is also dynamic. *Wh*-expressions introduce discourse referents.

(2) Who went to the party? I hope they didn't get covid.

Dynamic semantics of questions has been used to shed light on:

- Anaphora to *wh*-expressions — van Rooy (1998); Haida (2007); Li (2021)
- Intervnetion effects — Honcoop (1998); Haida (2007)
- Information structure — Aloni and van Rooy (2002)
- Discourse dynamics — Murray (2010)
- Multiple-*wh* questions — Dotlačil and Roelofsen (2020); Li (2021)

Today

Two classical views of question meaning:

- The meaning of a question is a set of propositional answers;
- The meaning of a question is a set of short answers.

Proposal:
The meaning of a question is a set of dynamic propositions, which represents both propositional and short answers.

Empirical contribution:
Quantificational variability effects (QVE) of embedded *wh*-questions

Question meaning

Two approaches to question meaning

(3) A: Who danced?
B: Annie. (short answer)
B': Annie danced. (propositional answer)

Hamblin approach ~ possible propositional answers

Hamblin (1973); Karttunen (1977)

$$[\![\text{who danced}]\!] = \{[\![\text{Annie danced}]\!], [\![\text{Becky danced}]\!], [\![\text{Cindy danced}]\!]\}$$

Categorial approach ~ possible short answers

Hausser and Zaefferer (1979)

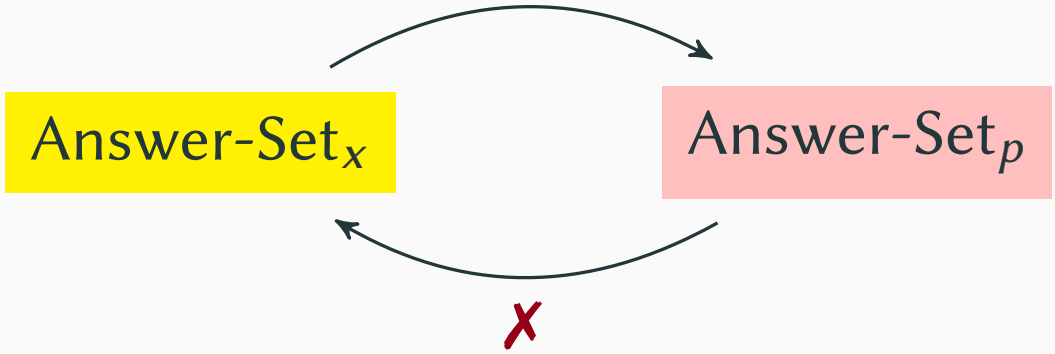
$$[\![\text{who danced}]\!] = \{x \in \{[\![\text{Annie}]\!], [\![\text{Becky}]\!], [\![\text{Cindy}]\!]\} \mid \textbf{danced}(x)\}$$

(Partition approach Groenendijk and Stokhof (1984))

Expressiveness

The categorial approach is more expressive than the Hamblin approach.

$$\pi := \lambda A.\{p \mid \exists x.p = x \in A\}$$



Propositional answers can be derived from short answers semantically.

$$\pi\{x \mid \mathbf{danced}(x)\} = \{\mathbf{danced}(x) \mid x \in D_e\}$$

Short answers cannot be derived from propositional answers semantically.

Suppose *Who danced* is answered by *Annie danced*:

$$[\![\text{Annie danced}]\!] = \left\{ \begin{array}{ll} w_1, & w_2, \\ w_3, & w_4 \end{array} \right\}, \text{ in these worlds Ada danced}$$

The individual a denoted by *Annie* is not available.

$$[\![\text{Annie danced}]\!] \not\longrightarrow [\![\text{Annie}]\!] \quad \left| \quad \left\{ \begin{array}{l} [\![\text{Annie danced}]\!] \\ [\![\text{Becky danced}]\!] \\ [\![\text{Cindy danced}]\!] \end{array} \right\} \not\longrightarrow \left\{ \begin{array}{l} [\![\text{Annie}]\!] \\ [\![\text{Becky}]\!] \\ [\![\text{Cindy}]\!] \end{array} \right\} \right.$$

Zimmermann (1985); Groenendijk and Stokhof (1989)

The dynamic turn

Wh-expressions introduce discourse referents

Wh-expressions support cross-sentential anaphora.

(4) Who went to the party? I hope they didn't get covid.

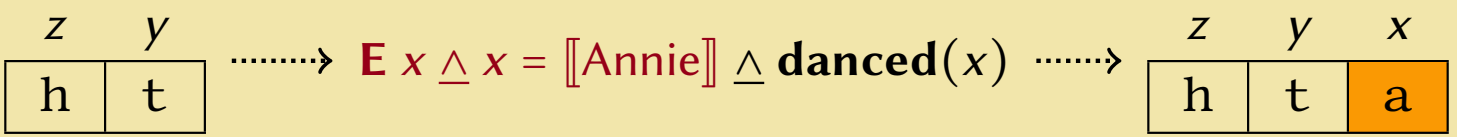
(5) Which linguists did you talk to and when did you talk to them?

Dynamicizing the Hamblin approach

Questions denote sets of dynamic propositions.

$$[\![\text{who danced}]\!] = \left\{ \begin{array}{l} \mathbf{E}\, x \mathbin{\underline{\wedge}} x = [\![\text{Annie}]\!] \mathbin{\underline{\wedge}} \mathbf{danced}(x) \\ \mathbf{E}\, x \mathbin{\underline{\wedge}} x = [\![\text{Becky}]\!] \mathbin{\underline{\wedge}} \mathbf{danced}(x) \\ \mathbf{E}\, x \mathbin{\underline{\wedge}} x = [\![\text{Cindy}]\!] \mathbin{\underline{\wedge}} \mathbf{danced}(x) \end{array} \right\}$$

Suppose the true answer is 'Annie danced':



The short answer 'lives inside' the propositional answer

Retrieving discourse referents

We can refer to x in the output and get its value

Existential disclosure Dekker (1993)

$$\mathbf{ED}(\mathbf{E}\ x \underline{\wedge} P(x)) = \lambda y.\mathbf{E}\ x \underline{\wedge} P(x) \underline{\wedge} x = y$$

Given an input i, **ED** gives us a set of entities introduced as discourse referents:

$$\{y \mid [\mathbf{ED}(\mathbf{E}\ x \underline{\wedge} P(x))](y) = \mathbf{TRUE}_i\}$$

(6) $$\{y \mid [\mathbf{ED}(\mathbf{E}\ x \underline{\wedge} x = [\![\text{Annie}]\!] \underline{\wedge} \mathbf{danced}(x))](y) = \mathbf{TRUE}_i\} = \{\text{a}\}$$

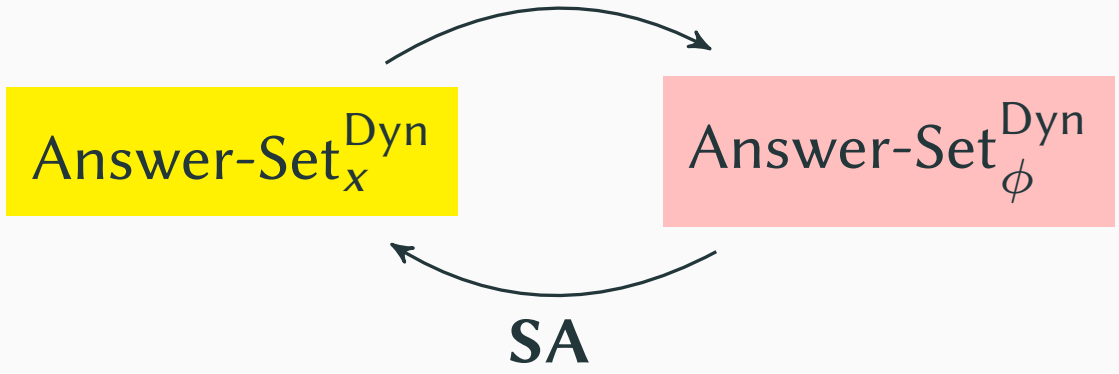
A shifter

(7) $\mathbf{SA}_i(Q) = \bigcup_{\phi \in Q} \{y \mid \mathbf{ED}(\phi)(y) = \mathbf{TRUE}_i\}$

$$\mathbf{SA}_i[\![\text{who danced}]\!] = \bigcup \left\{ \begin{array}{l} \{y \mid [\mathbf{ED}(\mathbf{E}\ x \mathbin{\underline{\wedge}} x = \text{a} \mathbin{\underline{\wedge}} \mathbf{danced}(x))](y) = \mathbf{TRUE}_i\} \\ \{y \mid [\mathbf{ED}(\mathbf{E}\ x \mathbin{\underline{\wedge}} x = \text{b} \mathbin{\underline{\wedge}} \mathbf{danced}(x))](y) = \mathbf{TRUE}_i\} \\ \{y \mid [\mathbf{ED}(\mathbf{E}\ x \mathbin{\underline{\wedge}} x = \text{c} \mathbin{\underline{\wedge}} \mathbf{danced}(x))](y) = \mathbf{TRUE}_i\} \end{array} \right\}$$

$$= \{\text{a}, \text{b}, \text{c}\} \text{ (possible short answers)}$$

$$\pi := \lambda A\{\phi \mid \exists x.\phi = A(x)\}$$



Quantificational variability effects (QVE)

Adverbial quantifiers and embedded questions

(8) Sarah knows, for the most part, who cheated.
⇝ For most students who cheated, Sarah knows they cheated.

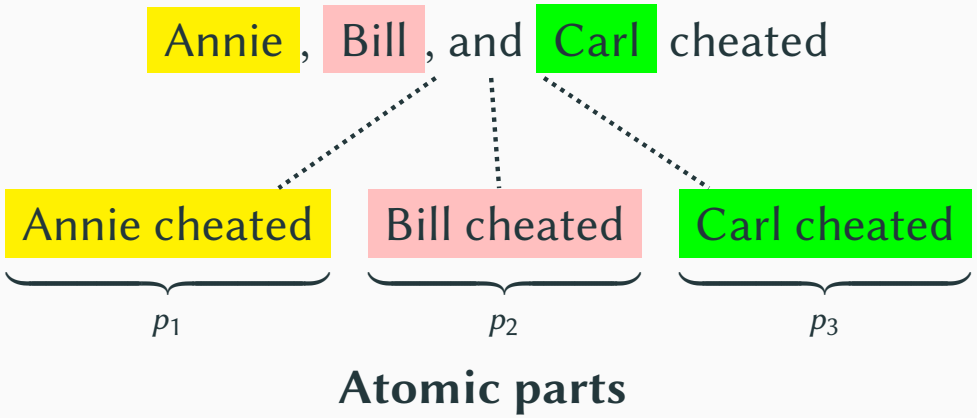
(9) The school paper recorded, in part, who made the dean's list.
⇝ For some people on the dean's list, the school paper recorded they made the dean's list.

(10) For few exceptions John knows who likes Mary.
⇝ For few people who likes Mary, John knows they like Mary.

Berman (1990); Lahiri (2002); Beck and Sharvit (2002); Cremers (2018); a.o.

Quantification over parts of propositional answers

Suppose that Annie, Bill, and Carl cheated in the exam, the propositional answer to *Who cheated* would be:

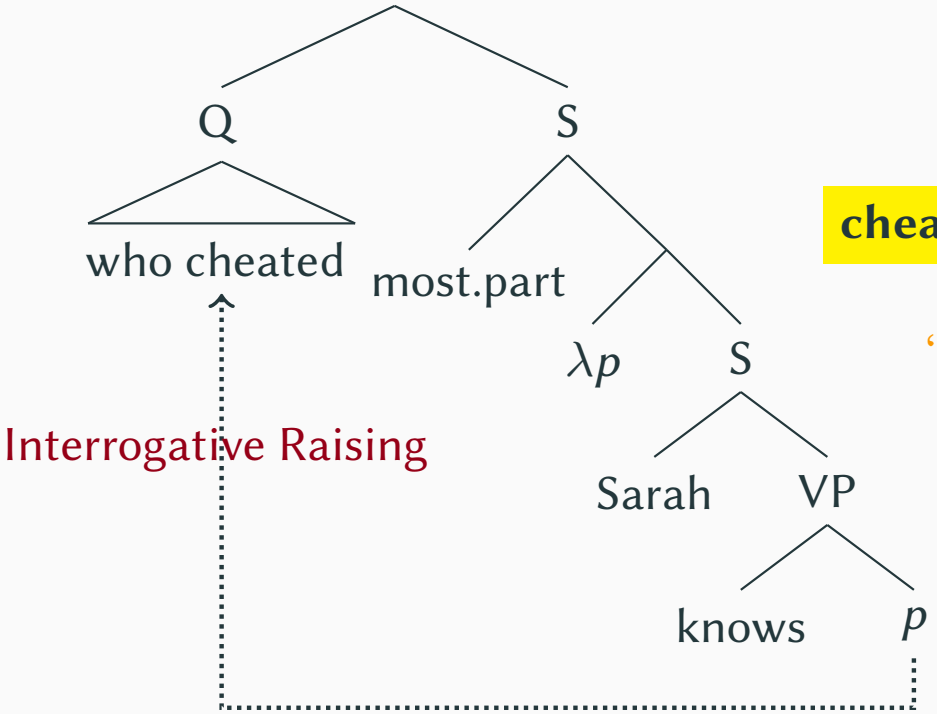


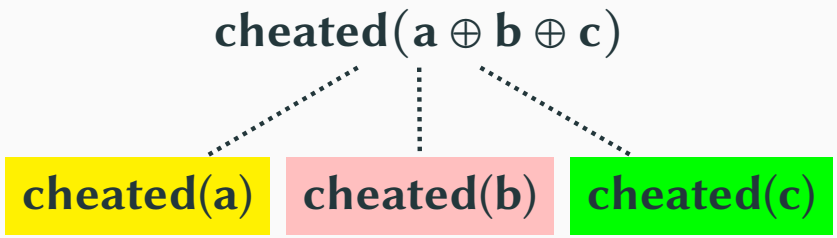
If Sarah knows two of the three parts are true, the following sentence is true:

Sarah knows, for the most part, who cheated.

Lahiri (2002); cf. Cremers (2016); a.o.

$$\textbf{most}\ p.\ p \in \textbf{Part}_{\text{atom}}(\textbf{Ans}\ \overbrace{[\![\text{who cheated}]\!]}^{\{\textbf{cheated}(x)|x\in\textbf{human}\}}): \textbf{know}(p)(\textbf{s})$$





'cheat' is a distributive predicate

Lahiri (2002)

QVE and collective predicates

(11) For the most part, Sarah knows who formed the committee.
↝ For most people who formed the committee, Sarah knows they were part of the committee.

(12) For the most part, Annie knows which soldiers surrounded the fort.
↝ For most soldiers who surrounded the city, Annie knows they participated in the surrounding of the fort.

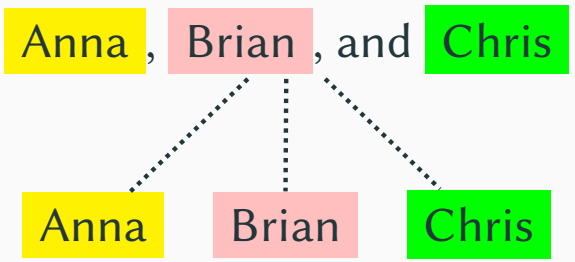
Suppose that the answer to *Who formed the committee* is

formed.cmt(a ⊕ b ⊕ c) ····· no atomic parts ·····› **formed.cmt(a)** ✗, **formed.cmt(b)** ✗, **formed.cmt(c)** ✗

Williams (2000); Xiang (2020); Cremers (2018)

Quantification over parts of short answers

Suppose that Anna, Brian, and Chris formed the committee, the short answer to *Who formed the committee* would be:



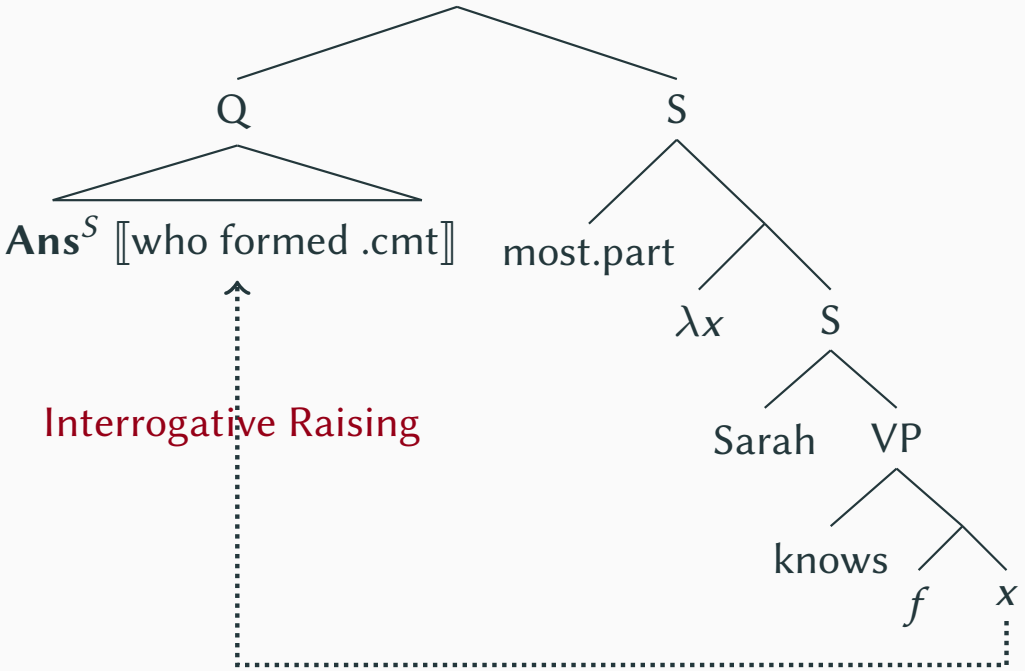
Atomic parts

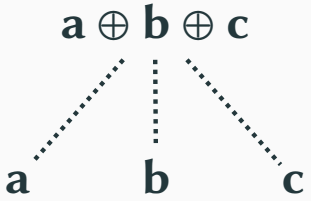
If Sarah knows two of the three people are part of the committee, the following sentence is true:

For the most part, Sarah knows who formed the committee.

Xiang (2020); Cremers (2018)

$$\textbf{most}\ x.\ x \in \textbf{Part}_{\text{atom}}(\textbf{Ans}^S\ \overbrace{[\![\text{who form.cmt}]\!]}^{\{x \mid \textbf{formed.cmt}(x)\}})\text{: }\textbf{know}(\ x \leq \textbf{cmt}\ )(\textbf{s})$$





$f := \lambda y.\ y \leq \textbf{Ans}^S(Q)$

f (as an E-type pronoun) refers to *Who formed.cmt.*

Cremers (2018)

Can f be independently justified?

(13) A: Who formed John's committee?
B: You can ask Annie. She also knows who attended his celebration party.

Suppose that the embedded question is analyzed as follows:

(14) She knows $f\ (\mathbf{Ans}^S\ [\![\text{who formed.cmt}]\!])$

If f refers to the first question, then ...

$$\mathbf{Ans}^S\ [\![\text{who attend.pt}]\!] \leq \mathbf{Ans}^S\ [\![\text{who formed.cmt}]\!]$$

It means that the people attending John's celebration party must be part of his committee members, and Annie knows this.

Where is the problem

To analyze QVE with collective predicates, we need both short answers and answer-related propositions.

$$\textbf{most}\ p.\ p \in \textbf{Part}_{\text{atom}}([\![\text{who formed.cmt}]\!]) : \textbf{know}(p)(\textbf{s})$$

1. We need the short answer to get the atomic parts.
2. We need a proposition to feed the verb *know*.

Hamblin approach

The short answer is not derivable semantically.

Categorial approach

There is a challenge to get the propositional argument for *know*.

A dynamic approach

Dynamic Hamblin

A question Q can be transformed into a set of propositions, each of which states that an individual is an atomic part of the short answer to Q.

(15) $\mathbf{Part}_{\text{atom}}(Q) = \{\phi \mid \exists x.\phi = [x \leq_{\text{atom}} \mathbf{the}(\mathbf{SA}(Q))]\}$

Step 1: pick up the true short answer

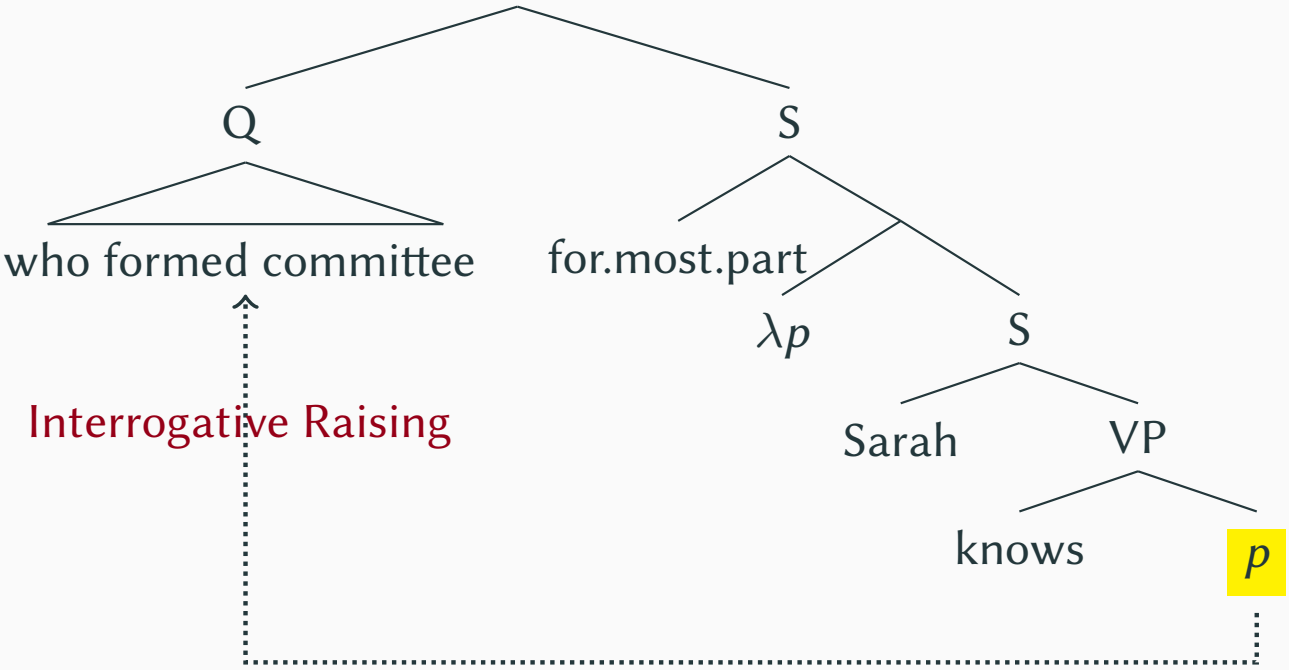
$\mathbf{the}(\mathbf{SA}_i[\![\text{who formed.cmt}]\!])$ =the unique x s.t. $x \in \mathbf{SA}_i[\![\text{who formed.cmt}]\!]$ and x formed the committee in the actual world

Step 2: get the atomic parts of the true short answer

$$\lambda x.x \leq_{\text{atom}} \mathbf{the}(\mathbf{SA}_i[\![\text{who formed.cmt}]\!])$$

Step 3: shift the property to a set of propositions

$$\pi(\lambda x.x \leq_{\text{atom}} \mathbf{the}(\mathbf{SA}_i[\![\text{who formed.cmt}]\!])) = \mathbf{Part}_{\text{atom}}[\![\text{who formed.cmt}]\!]$$



Suppose that the true answer is 'Anna, Brian, and Chris formed the committee'

$$\mathbf{most}_{\phi} : \phi \in \underbrace{\mathbf{Part}_{\text{atom}}(\llbracket \text{who formed.cmt} \rrbracket}_{\left\{ \begin{array}{l} \mathbf{a} \text{ is an atomic part of } \mathbf{a}\oplus\mathbf{b}\oplus\mathbf{c}, \\ \mathbf{b} \text{ is an atomic part of } \mathbf{a}\oplus\mathbf{b}\oplus\mathbf{c}, \\ \mathbf{c} \text{ is an atomic part of } \mathbf{a}\oplus\mathbf{b}\oplus\mathbf{c} \end{array} \right\}} . \mathbf{know}(\phi)(\mathbf{s})$$

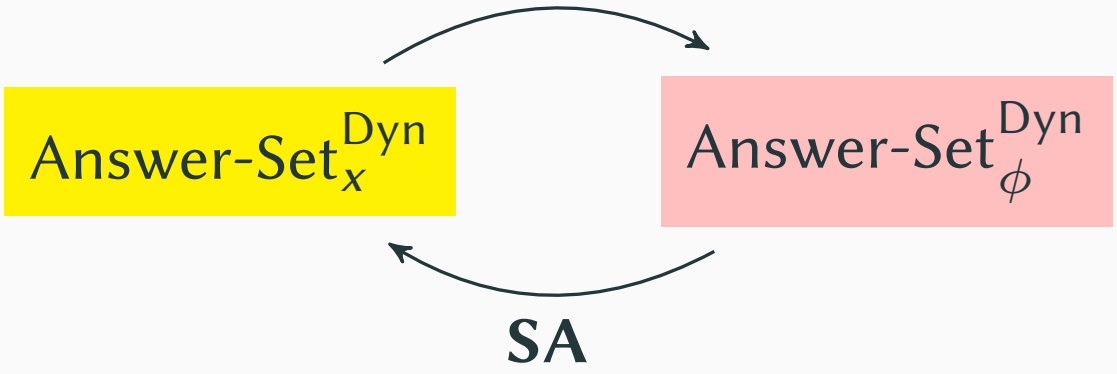
Conclusion

Summary

Dynamic Hamblin approach
Wh-expressions introduce discourse referents and *wh*-questions denote sets of dynamic propositions.

One can easily transform between proportional and short answers to satisfy compositional needs.

$$\pi := \lambda A\{\phi \mid \exists x.\phi = A(x)\}$$



The dynamic turn extends the empirical coverage of our theories of question meaning.

	Categorial	Hamblin	Dynamic Hamblin
short answers [SA]	✓	✗	✓
free relatives	✓	✗	✓
Q and *Q*	✗	✓	✓
wh-conditionals	✗	✗	✓
QVE	✗	✗	✓

Li (2020)

Thank you

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