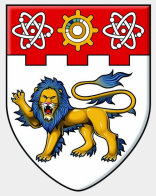
Embedded questions as definite descriptions

An insight from Japanese

Haoze Li [1] · Jun Tamura [2]



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Road of map

- A long-standing puzzle
- A relatively informal presentation of our proposal
- Sketching our analysis
- Appendices
  - Identity question vs. Polar question
  - Embedded multiple-wh questions
  - Exhaustiveness
  - Language universals and variations
  - Deriving non-propositional answers

Japanese embedded questions

Case marking in Japanese

Japanese is a typical nominative-accusative language.

1. Hanako-ga kuruma-o katta.

   Hanako-NOM car-ACC bought

   'Hanako bought a car.'

Embedded declarative clauses cannot bear case markers.

2. John-wa [**Taro-ga siken-ni ukatta-to-(*o)**] sitteiru.

   John-TOP Taro-NOM exam-DAT passed-that-ACC know

   ' John knows Taro passed the exam.'

Nominalized embedded clauses

Embedded declaratives can bear case markers only when they are nominalized. The same pattern is also observed in Korean and Turkish.

3. John-wa [**Taro-ga** **siken-ni** **ukatta-no-o**] sitteiru.
   John-TOP Taro-NOM exam-DAT passed-NMZ-ACC know
   'John knows Taro passed the exam.'

Nominalized declaratives refer to propositional contents.

John knows **the proposition** that Taro passed the exam.

Compare with: *John knows the fact that Taro passed the exam*.

Bogal-Allbritten & Moulton (2018); Elliott (2020); Ozyildiz (2021); Bondarenko (2022)

Embedded questions and case

Embedded questions can bear case markers. Nominalization is not needed.

4. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] sitteiru.
   John-TOP who-NOM exam-DAT passed-Q-ACC know
   'John knows who passed the exam.'

It indicates that embedded questions function as nominals themselves.

Fukui (1986)

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   'John knows who passed the exam.'

It indicates that embedded questions function as nominals themselves.

A possible analysis: A question is transformed into its propositional answer, which provides a propositional content like a nominalized declarative clause.

John knows **the propositional answer** to who passed the exam.

Fukui (1986)

Embedded *wh*-questions (EWHQ) and numeral-classifiers

In Japanese, an EWHQ can be modified by a numeral-classifier.

Responsive verbs

5. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] san-nin-(gurai) sitteiru.
   John-TOP who-NOM exam-DAT pass-Q-ACC three-CL-about know
   'For three of the people who passed the exam, John knows whether they did.'

Japanese is a typical classifier language.

6. Hanako-ga **hon-o** ni-satu katta.
   Hanako-NOM book-ACC two-CL bought
   'Hanako bought two books.'

A classifier usually co-occurs with a numeral expression, forming a unit called 'numeral-classifier', which typically modifies a nominal expression.

Kitagawa (2009); Tomioka (2020); Noguchi (2024)

Sound like “a definite description”

5. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] san-nin-(gurai) sitteiru.

John-TOP who-NOM exam-DAT pass-Q-ACC three-CL-about know

‘For three of the people who passed the exam, John knows whether they did.’

people	pass the exam
Aiko	✓
Bekki	✓
Chiya	✓
Daiki	✓
Hanako	✗

Did **Aiko** pass the exam?	YES
Did **Bekki** pass the exam?	YES
Did **Chiya** pass the exam?	YES
Did **Daiki** pass the exam?	?

Rogative verbs

Context: Hanako and Taro are working for an undergraduate division. 10 people passed this year's undergraduate exam, but Hanako and Taro doesn't know who they are. So, they need to review the students who took the exam to determine who passed. Hanako is responsible for checking three of them.

7. Hanako-wa [**dara-ga siken-ni ukatta-ka-(o)**] san-nin sirabeta.
   Hanako-TOP who-NOM exam-DAT passed-Q-ACC three-CL checked
   'For three of the people who took the exam, Hanako checked whether they did.'

contra. Tomioka (2020)

Long distance WH-CL agreements

By analyzing EWHQs as definite descriptions, the WH-CL agreements can be captured straightforwardly.

"satu" must be used to classify books

8. Mari-wa [**dono-hon-ga** **mada** **kaes-arete-inai-ka**] zyu(s)-satu-wa age-rareru.
   Mari-TOP which-book-NOM yet return-PASS-not-Q ten-CL-TOP list-can
   'For ten of the books that have not been returned, Mari can list what they are.'

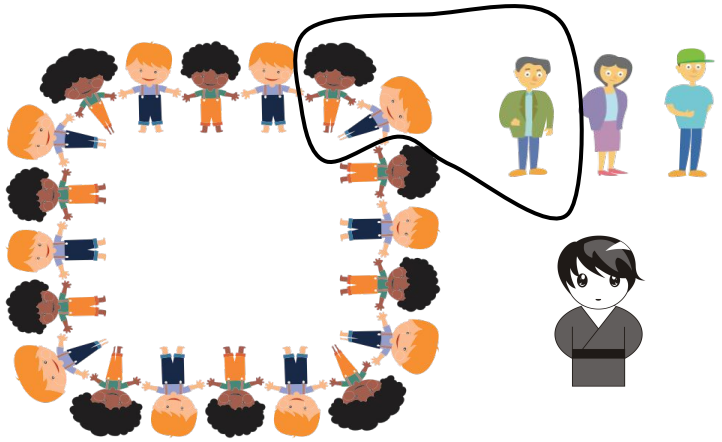
"kakoku" must be used to classify nations

9. Mari-wa [**dono-kuni-ga** **NATO-no menbaa-dearu-ka**] yon-kakoku-sika sir-anai.
   Mari-TOP which-nation-NOM NATO-GEN member-be-Q four-CL-only know-NEG
   'Only for four of the nations that belong to NATO, Mari knows what they are.'

Wh-coordination

10. John-wa [**dare-ga** **kaigi-ni** **sankasi**]-te [**dare-ga** **kaigi-ni**
John-TOP who-NOM meeting-DAT attend-and who-NOM meeting-DAT
sankasi-sinakatta-ka] san-nin sitteiru.
attend-not-Q three-CL know
'For three of the people who attended the meeting and the people who didn't attend the meeting, John knows if they did/n't.'

Intuitively, the numeral-classifier counts the sum of the plural individuals.



Mismatch

5. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] san-nin-(gurai) sitteiru.
   John-TOP who-NOM exam-DAT pass-Q-ACC three-CL-about know
   'For three of the people who passed the exam, John knows whether they did.'

Given that Aiko, Bekki, Chiya, and Daiki passed the exam, …

three $x \in \{$ a, b, c, d $\}$: John knows whether x passed the exam

Long standing puzzle: Why does an EWHQ have a clausal form while exhibiting hallmarks of a nominal expression?

- Case marking
- Modified by numeral-classifiers ⇒ sound like "definite descriptions"

Proposal

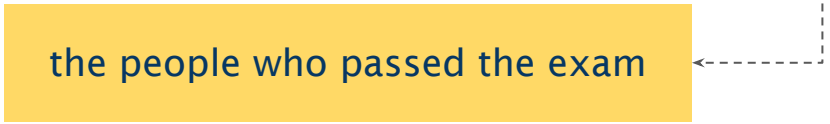
Take-home message

In Japanese, when a question is embedded, it is transformed into a definite description.

4. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] sitteiru.

   John-TOP who-NOM exam-DAT passed-Q-ACC know

   ‘John knows who passed the exam.’



nominal expression

Two types of answers

Propositional vs. Non-propositional answers

11. Who passed the exam?

    a. Aiko, Bekki, Chiya, and Daiki passed the exam. (propositional answer)

    b. Aiko, Bekki, Chiya, and Daiki. (non-propositional answer)

Non-propositional answers are independent to propositional answers and are directly derived from the meaning of a question.

Jacobson (2016); Weir (2018); Xiang (2020); Li (2021)

Note: We won't dive into the issue if a non-propositional answer is transformed from a propositional answer via ellipsis (Merchant 2004; Gary 2016).

Embedding questions

Embedded clauses do not always have truth values.

12. Peter knows who passed the exam.

13. Peter asks who didn't attend today's meeting.

The sentence with the form⌈*x V Q*⌉expresses the subject *x*'s attitude towards the propositional answer to the question *Q*.

⌈*x* know/ask *Q*⌉ means: *x* know/ask-about **the answer** to *Q*

In the standard theory, the involved answer to an embedded question is a proposition. The propositional meaning matches the clausal form.

Karttunen (1977); Dayal (1996); Lahiri (2000); Spector & Egre (2015); Theiler et al (2018); Uegaki (2022); a.o.

Answerhood operator

$$[\![\text{who passed the exam}]\!] = \{\ \text{passed-exam}'(x) \mid x \in \text{people}'\ \}$$

$$= \left\{ \begin{array}{c} \text{a+b+c passed the exam,} \\ \text{b+c+d passed the exam,} \\ \text{a+b+c+d passed the exam} \end{array} \right\}$$

$\mathbf{A}(Q) = \lambda w.\ p$ such that $p \in Q$,

$p(w) = 1$, and

p is maximally informative in w relative to Q

Dayal (1996); Fox (2013); Xiang (2020, 2022); Uegaki (2021); a.o.

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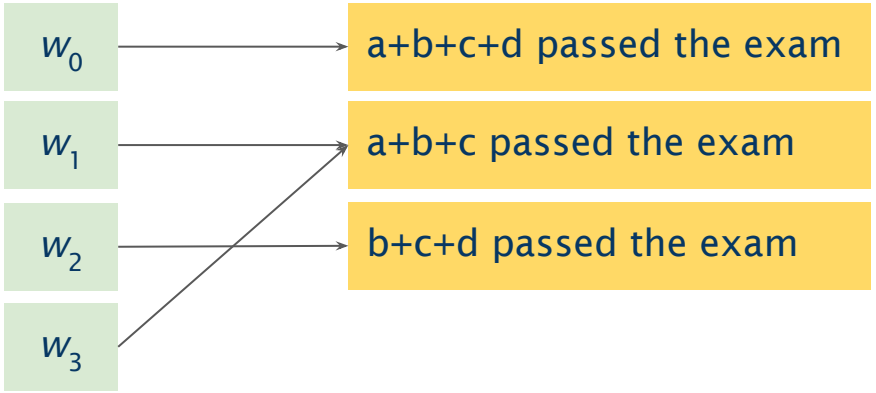
A [[who passed the exam]] = the intension of the propositional answer

w_0 a+b+c+d	w_1 a+b+c
w_2 b+c+d	w_3 a+b+c

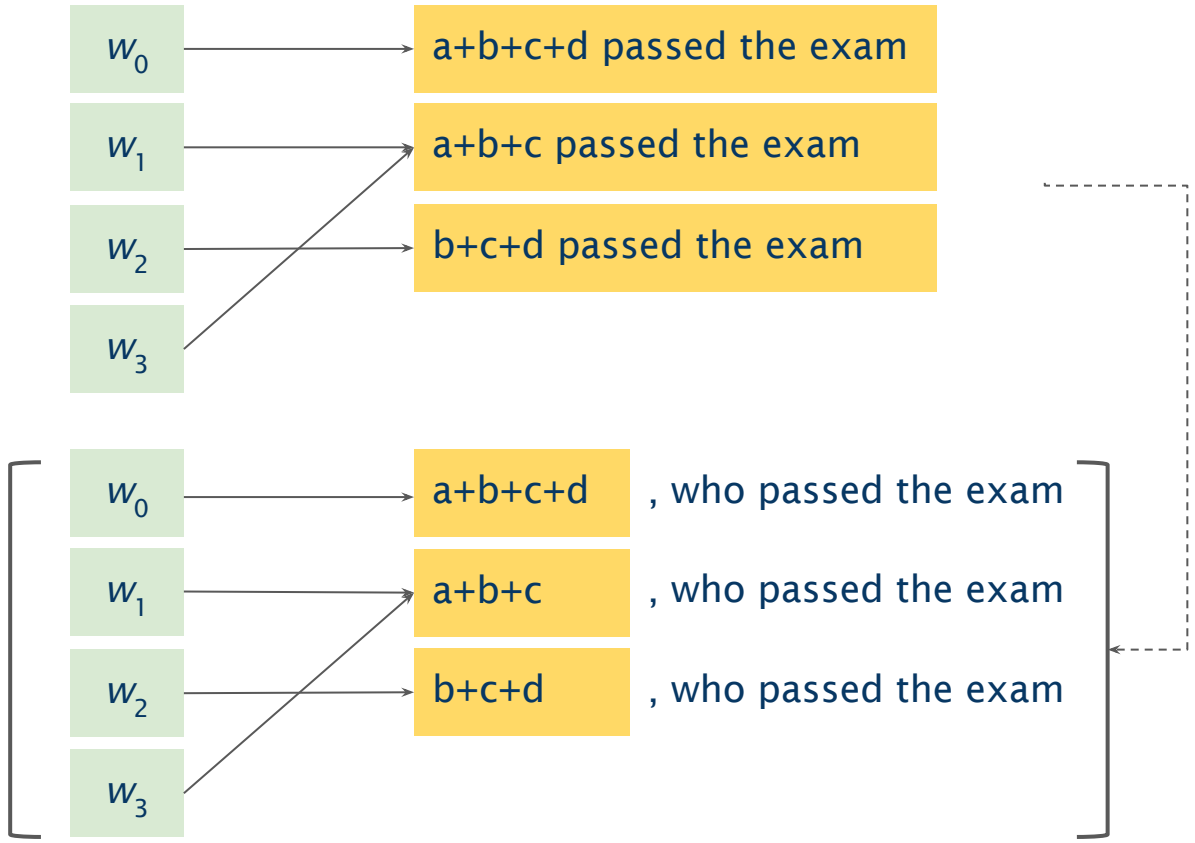


Dayal (1996); Fox (2013); Xiang (2020, 2022); Uegaki (2021); a.o.

Propositional answers ⇒ Non-propositional answers

Mapping possible worlds to the alternative individuals introduced by the *wh*-expression

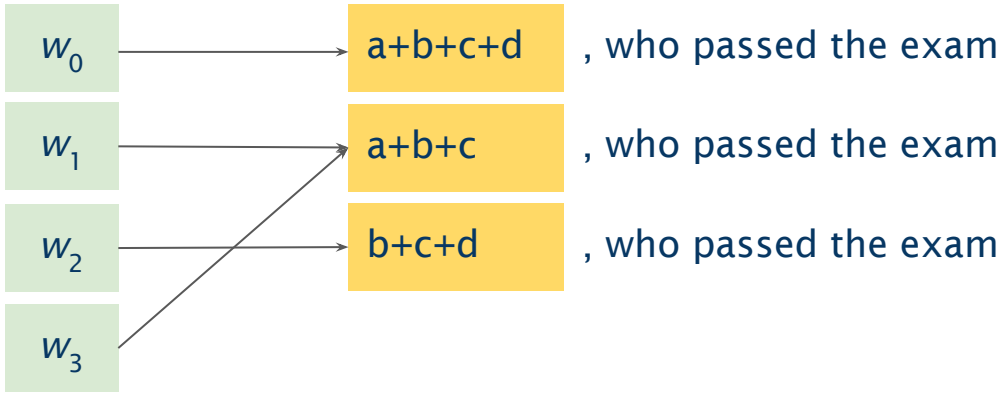
w_0 a+b+c+d	w_1 a+b+c
w_2 b+c+d	w_3 a+b+c



Li (2020, 2021); see also Enguehard (2023); Zhang (2024)

Non-propositional answers ⇒ Definite descriptions

The intension of the non-propositional answer to *who passed the exam*:



Individual concept

the people who passed the exam ⇨ Nominal expression

definite descriptions

Nominal embedded questions

Proposal: Japanese embedded questions are transformed to non-propositional answers.

⌈*x* know/ask *Q*⌉ ⇒ *x* know/ask **the intension of non-propositional answer** to *Q*

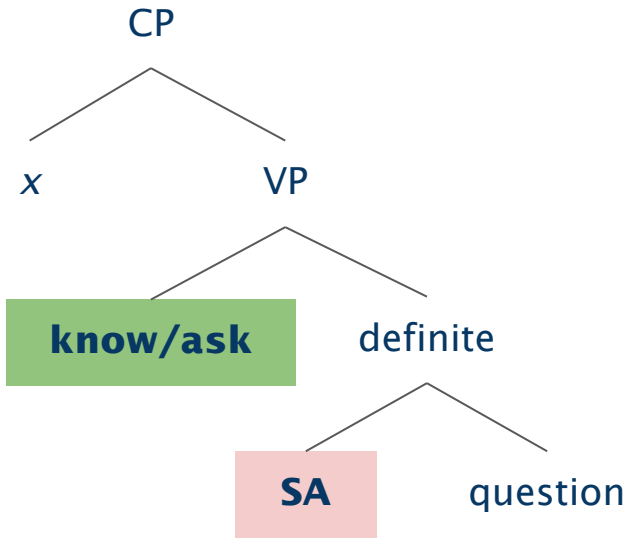
x know/ask⌈**definite description**⌉

SA [[who passed the exam]]

= [[the people who passed the exam]]

At the sentential level, the answerhood operators (**A** and **SA**) apply only when a question is embedded.

Contra. Nicolae (2013)



Nominal embedded questions

Proposal: Japanese embedded questions are transformed to non-propositional answers.

⌈*x* know/ask *Q*⌉ ⇒	*x* know/ask **the intension of non-propositional answer** to *Q*
	x know/ask⌈**definite description**⌉

In Japanese, only nominal expressions can bear case markers. Embedded questions, but not embedded declaratives, can bear case markers.

14. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] sitteiru.

    John-TOP who-NOM exam-DAT passed-Q-ACC know

    ⇒ John knows the intension of the non-propositional answer to *who passed the exam*.

    ⇒ John knows the people passing the exam.

    Is the resultant meaning the same as "John knows who passed the exam"?

Embedding definite descriptions

Question-embedding verbs can embed definite descriptions, leading to concealed question (CQ) interpretations..

15. John knows the time. ⇒ John knows what the time is.

16. Emily asked Fred's age. ⇒ Emily asked what is Fred's age.

Definite descriptions are lifted to identity question meanings.

⌈*x* know/ask *DP*⌉ means: *x* know/ask **wh *DP* is**

Heim (1979) Romero (2005); Nathan (2006); Aloni & Roelofsen (2011); Frana (2013); Barker (2016); a.o.

CQ interpretation

A definite description universally receives a CQ interpretation when being embedded by a question-taking verb. Hence, it is reasonable to assume that a nominal embedded question is re-interpreted as a CQ.

17. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] sitteiru.

John-TOP who-NOM exam-DAT passed-Q-ACC know

⇒ John knows the intension of the non-propositional answer to *who passed the exam*.

⇒ John knows the people that passed the exam

⇒ John knows who are the people that passed the exam.

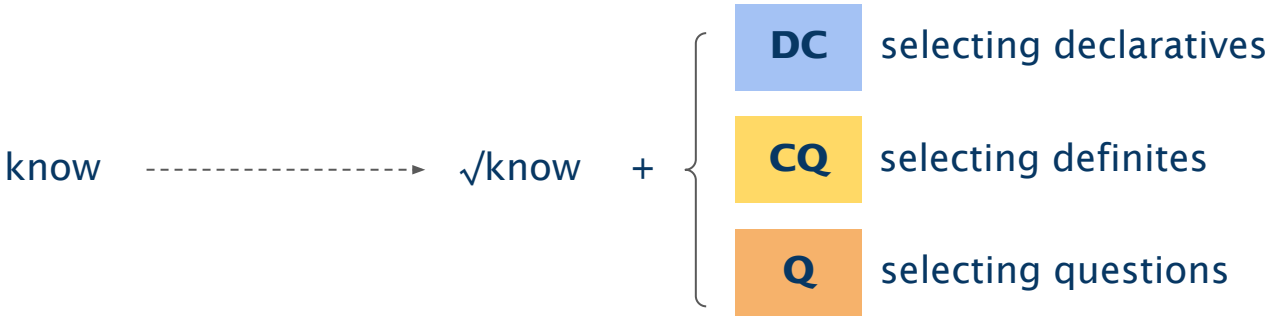
Identity question

⇒ John knows who passed the exam

Tomioka (2020)

Decomposing attitude verbs

An attitude verb may be decomposed into a predicate of eventualities and a complementizer (in the spirit of Distributive Morphology).



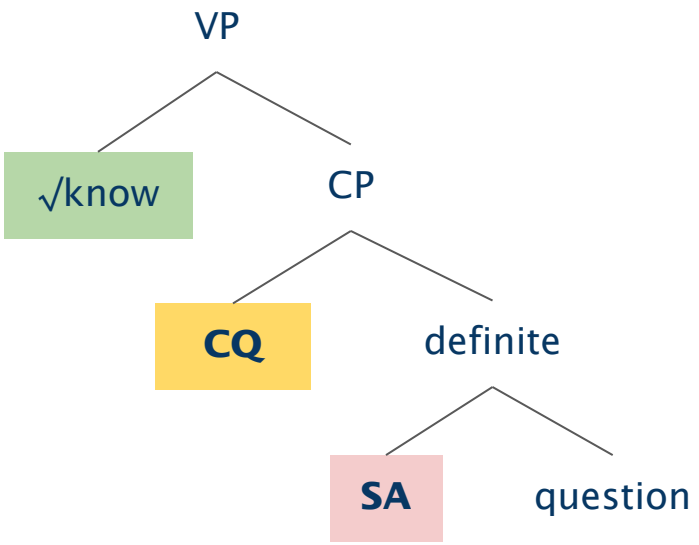
There are different kinds of complementizers that select different linguistic expressions.

Kratzer (2006); Moulton (2009); Elliott (2020); Ozyildiz (2021); Bondarenko (2022); a.o.

Japanese: A language with CQ and SA

In Japanese, a question embedding verb can be decomposed into:

- a verbal root (i.e., a predicate of eventualities)
- **CQ**, exclusively



In addition, the non-propositional answerhood operator **SA** is available.

SA

- Answerhood operator: Transforming a question to a definite description
- **Assumption**: It applies only when a question is embedded.

Quantifying over definite descriptions

EWHQs and numeral-classifiers (again)

In Japanese, an EWHQ can be modified by a numeral-classifier.

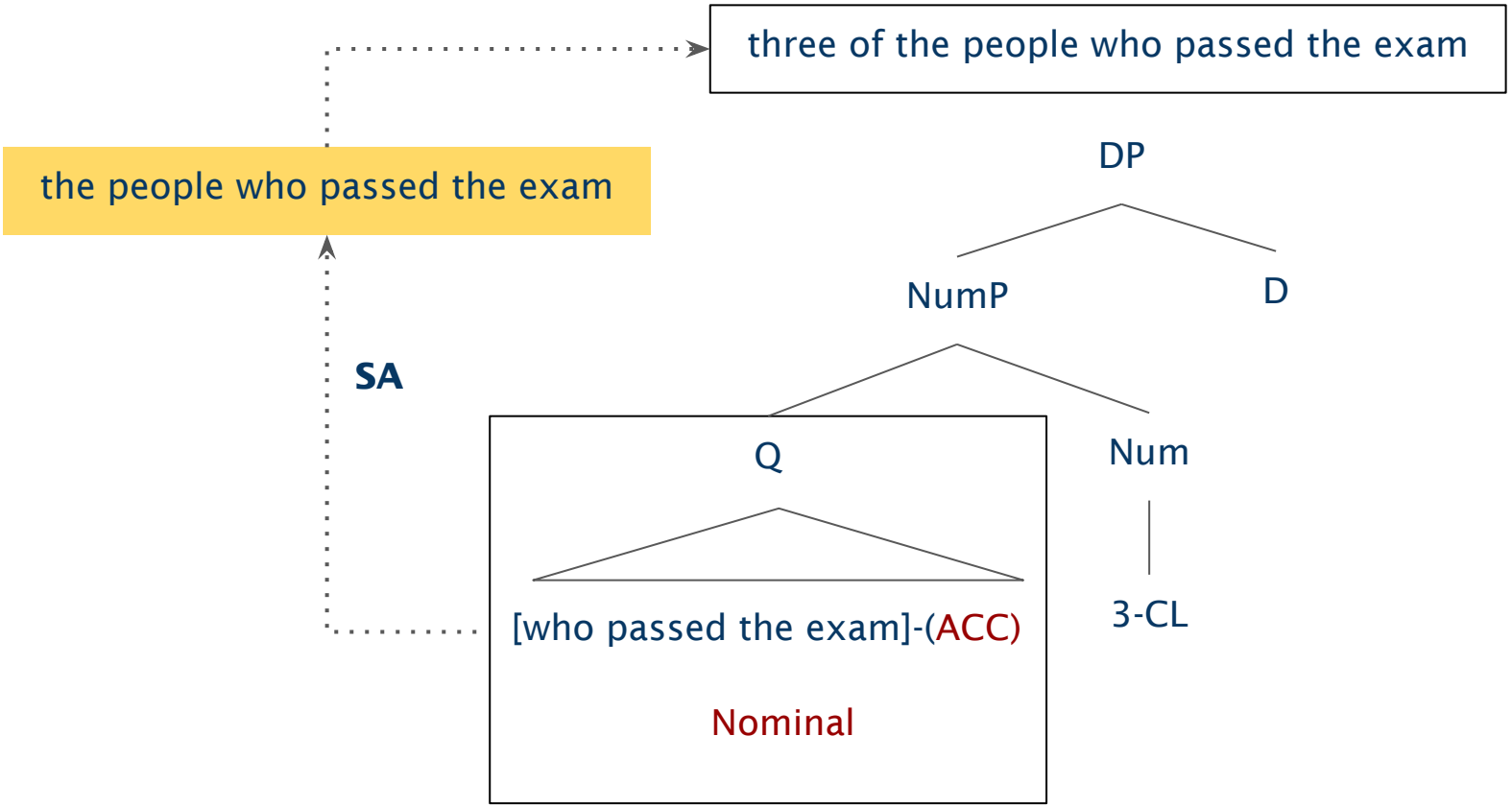
18. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] san-nin-(gurai) sitteiru.
    John-TOP who-NOM exam-DAT pass-Q-ACC three-CL-about know
    'For three of the people who passed the exam, John knows whether they did.'

19. John-wa [**Mary-ga** **nani-o** **tabeta-ka-(o)**] zen-bu wakatta.
    John-TOP Mary-NOM what-ACC ate-Q-ACC all-CL found.out
    'For all of the food that Mary ate, John found out whether they were eaten by M.'

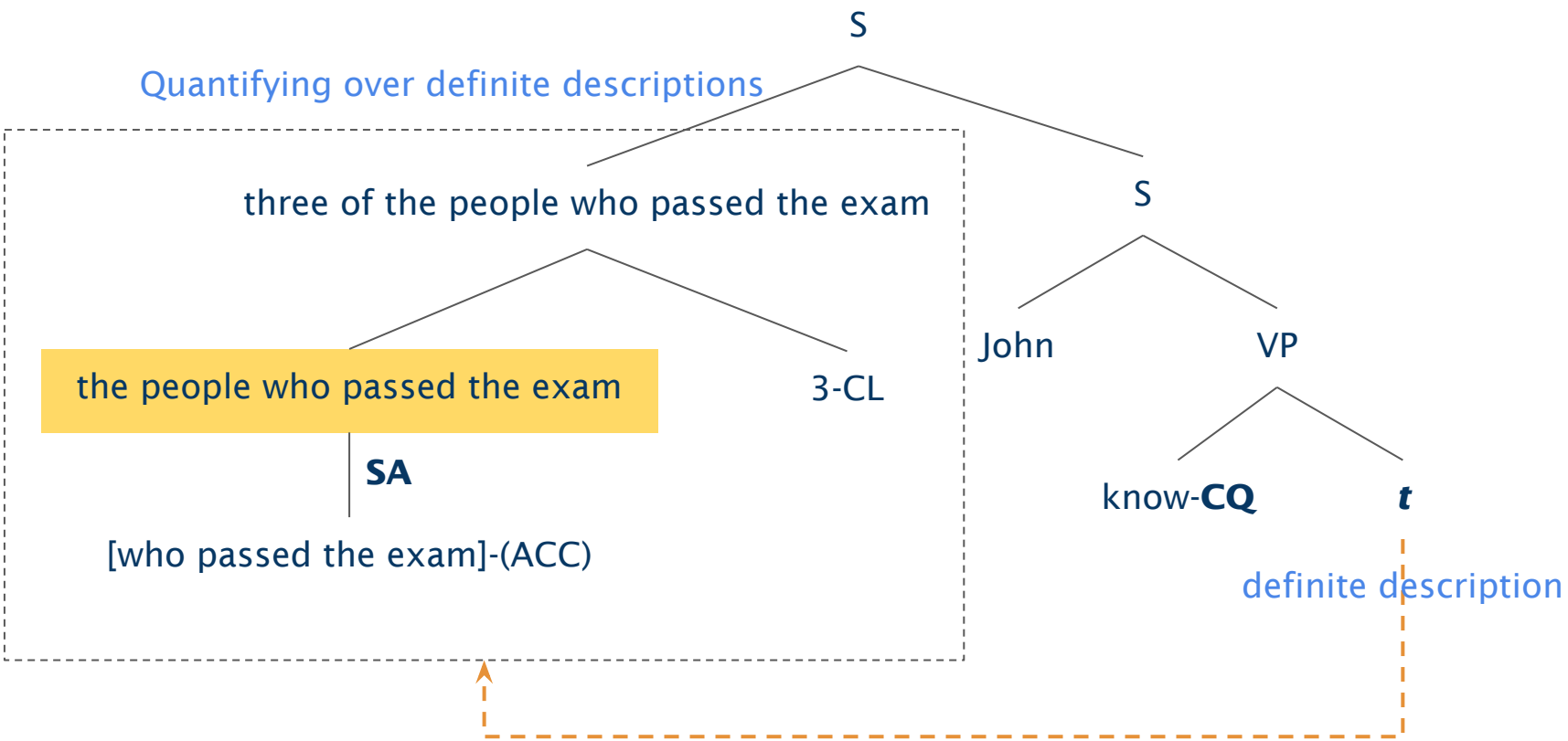
Kitagawa (2009); Tomioka (2020)

From a question to a definite description

The nominal properties of an embedded question in Japanese can be explained if the question is shifted to a definite description.



Quantifying over definite descriptions



there are 3 *x* such that *x* is an exam passer in w_0:

John know-**CQ** (THE *y*. *y* = *x* and x is an atomic exam passer)

Quantified CQs

Quantifiers can induce CQ interpretations when they are selected by question-taking verbs.

20. John knows every phone number.

    ⇒ For every phone number, John knows whether it is a phone number.

21. John knows most of the code.

    ⇒ For the most digits that the code has, John knows if they are included in the code.

Nathan (2006); Romero (2010); Aloni & Roelofsen (2011); Frana (2013); a.o.

Bridges of embedding

Embedding declaratives

In human languages, embedding is universally employed to express cognitive relations people bear to the truth of embedded clauses.

21. Peter knows Mary passed the exam.

    ⇒ In Peter's knowledge, it is true that Mary passed the exam.

22. Peter believes Mary passed the exam.

    ⇒ In Peter's belief, it is true that Mary passed the exam.

Embedding questions

Embedded clauses do not always have truth values.

23. Peter knows who passed the exam.

24. Peter asks who didn't attend today's meeting.

The sentence with the form⌈*x V Q*⌉expresses the subject *x*'s attitude towards the propositional answer to the question *Q*.

⌈*x* know/ask *Q*⌉ means: *x* know/ask-about **the answer** to *Q*

In the standard theory, the involved answer to an embedded question is a proposition. The propositional meaning matches the clausal form.

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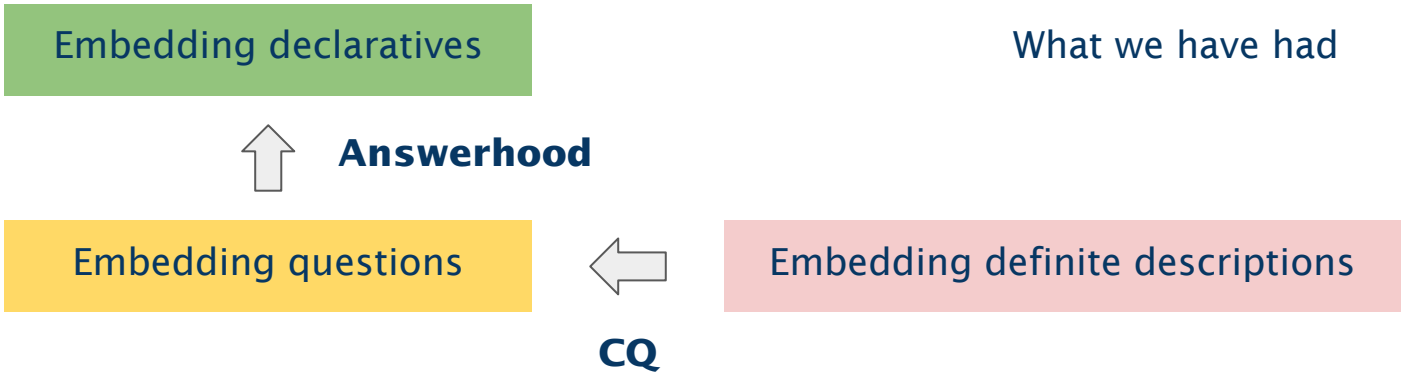
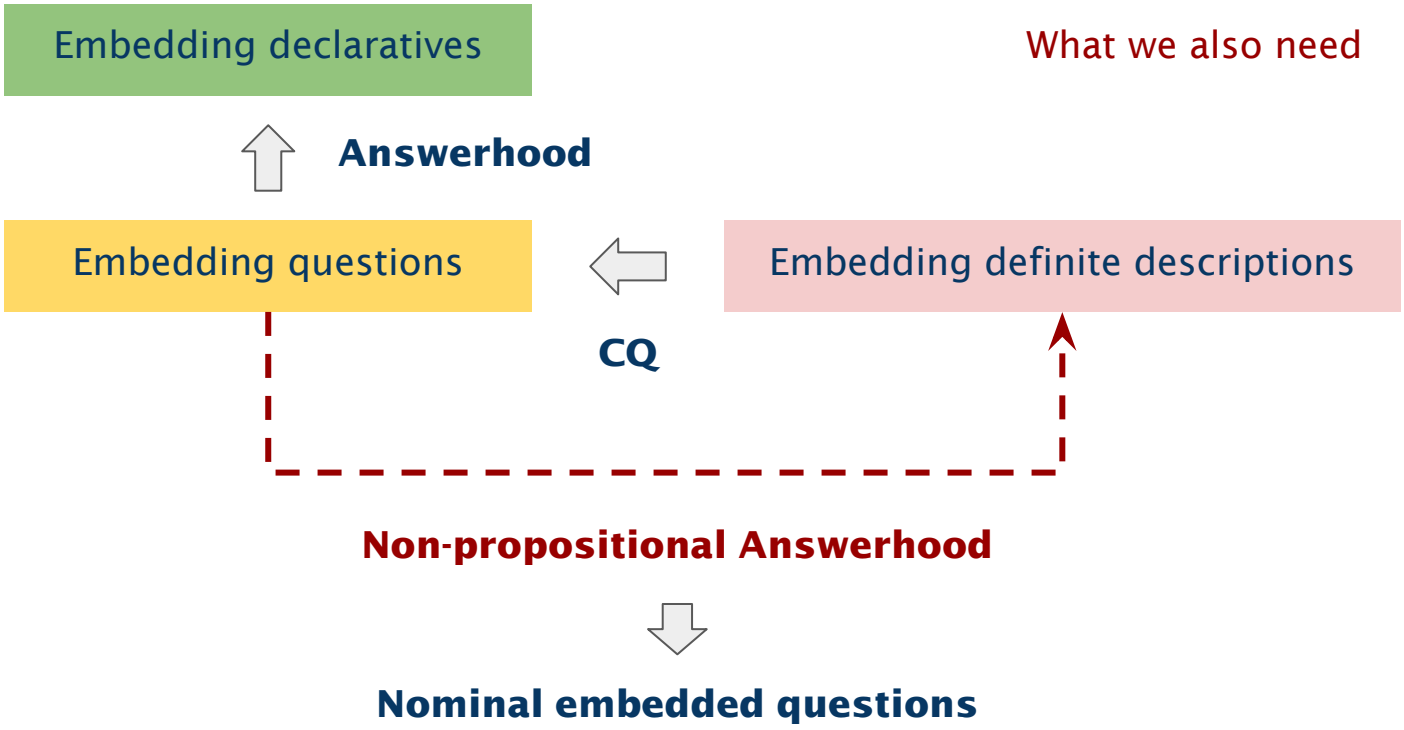


Bridges of embedding

The present study argues that, in human languages, there exists an alternative way of embedding questions, wherein …



Thank you

Identity questions vs. polar questions

Two types of interrogative interpretations

26. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] sitteiru.

John-TOP who-NOM exam-DAT passed-Q-ACC know

⇒ John knows the intension of the non-propositional answer to *who passed the exam*.

⇒ John knows the people who passed the exam

⇒ John knows who are the people that passed the exam.

Identity-Q

27. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] san-nin-(gurai) sitteiru.

John-TOP who-NOM exam-DAT pass-Q-ACC three-CL-about know

'For three of the people who passed the exam, John knows whether they did.'

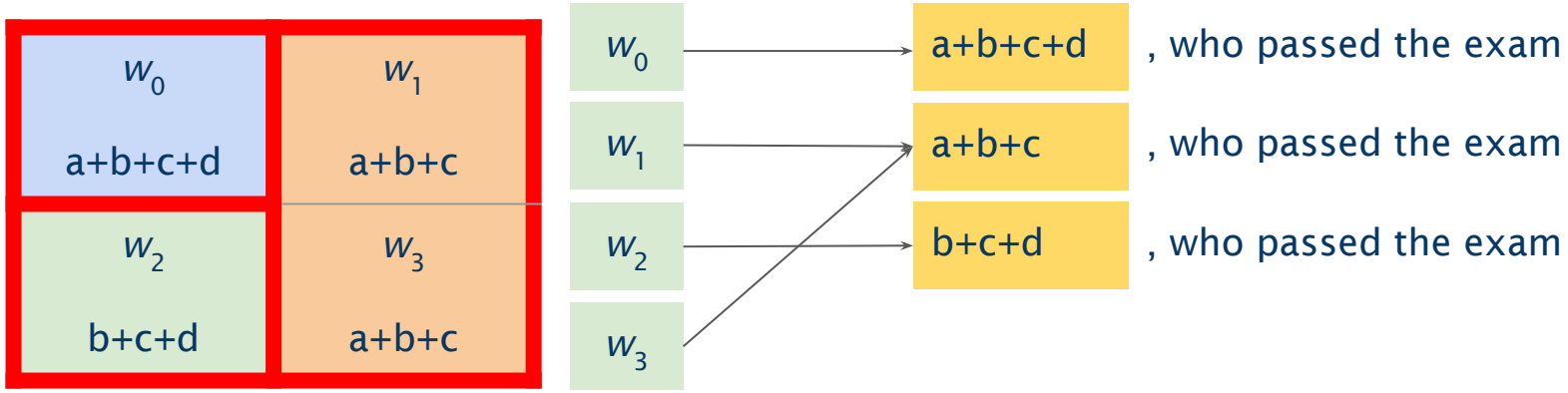
Polar-Q

Lifting definite descriptions to questions

$$[\![\text{CQ [SA Q]}]\!] = \{\, \{\, \boldsymbol{w'} \mid [\![\text{SA Q}]\!](\boldsymbol{w}) = [\![\text{SA Q}]\!](\boldsymbol{w'}) \,\} \mid \boldsymbol{w} \in W \,\}$$

Groenendijk & Stokhof (1984) Partition of worlds

John knows the people who passed the exam.



$$[\![\text{CQ [SA who passed the exam]}]\!] = \{\, \{w_0\},\ \{w_1, w_3\}, \{w_2\} \,\}$$

Heim (1979); Romero (2005); Aloni & Roelofsen (2011); Frana (2013); a.o.

Quantifiers over definite descriptions

$[\![\text{three of the NP}]\!] = \lambda P$. there are 3 x such that x is an atomic part of $[\![\text{the NP}]\!](w_0)$:

$$P\,(\,\lambda w.\, \iota y\,.\; y = x \wedge x \text{ is an atomic part of } [\![\text{the NP}]\!](w)\,)$$

Note: P is a function mapping a definite description to a proposition

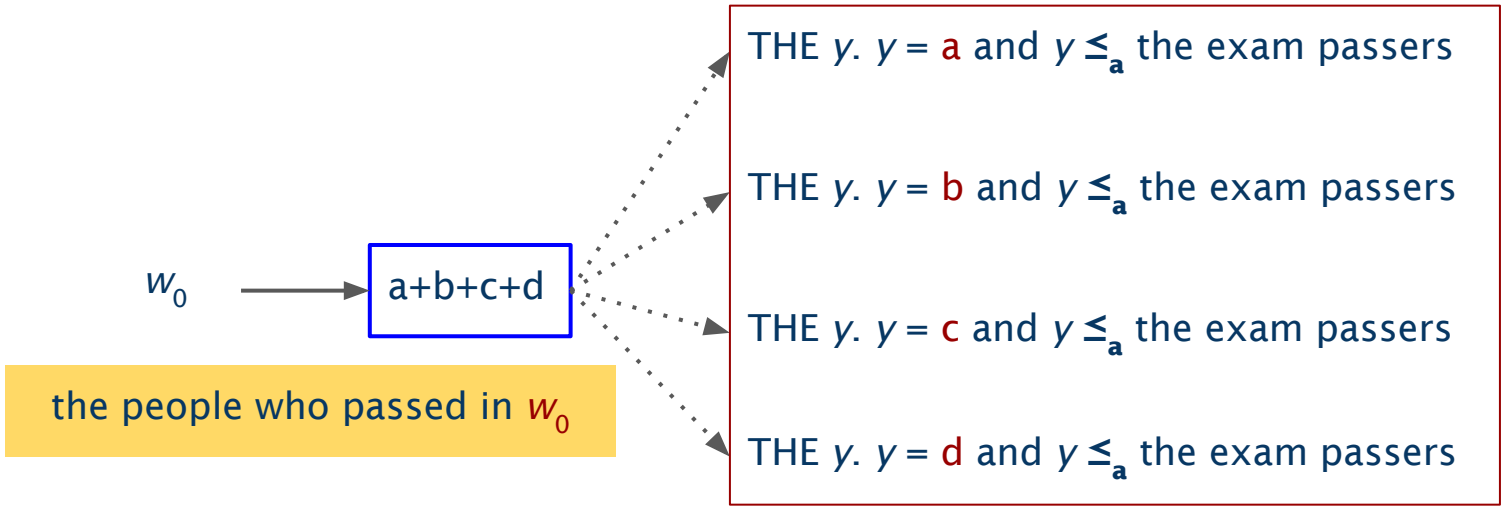
See also Romero (2010)

Quantifiers over definite descriptions

[[three of the NP]] $= \lambda P$. there are 3 x such that x is an atomic part of [[the NP]](w_0):

P ($\lambda w.\ \iota y\ .\ y = x \wedge y$ is an atomic part of [[the NP]](w))

Note: P is a function mapping a definite description to a proposition



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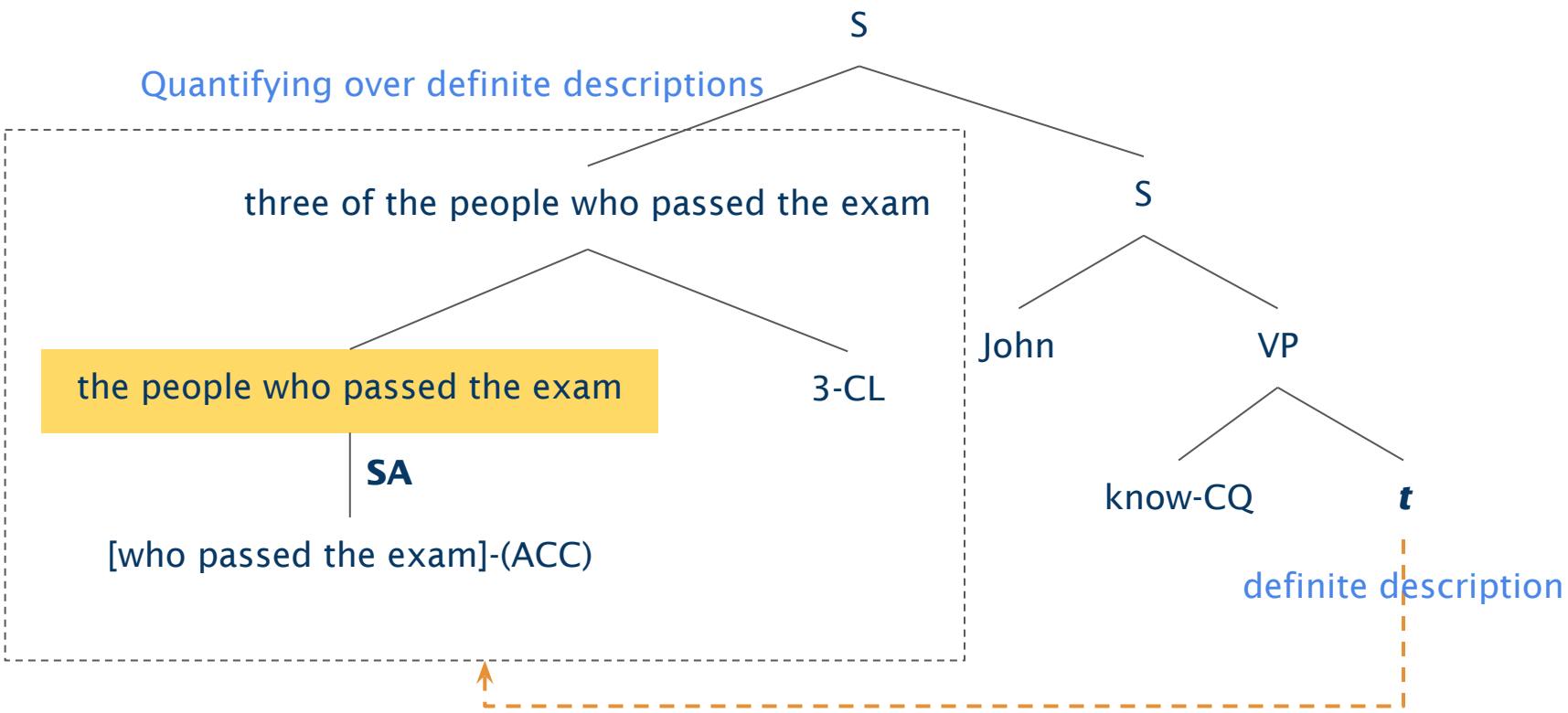
Quantifying over definite descriptions



[[three-CL]] (**SA** [[who passed the exam]]) (λd. John know-CQ (d))

Quantifying over definite descriptions

[[three-CL]] (**SA** [[who passed the exam]]) (λd. John know-**CQ** (d))

= there are 3 x such that x is an atomic part of [**SA** [[WH]]](w_0):

John know-**CQ** ($\lambda w. \iota y$. $y = x \wedge x$ is an atomic part of [**SA** [[WH]]](w))

= there are 3 x such that x is an exam passer in w_0:

John know-**CQ** (THE y. $y = x$ and x is an atomic passer)

Suppose x = a, then John know-**CQ** (THE y. y = a and x is an atomic passer)

{ {w' | [THE y. y = a and …] (w) = [THE y. y = a and …] (w') } | $w \in W$

}

w_0 a+b+c+d	w_1 a+b+c
w_2 b+c+d	w_3 a+b+c

the worlds where a is an exam passer

the worlds where a is not an exam passer

Embedded multiple-wh questions

Embedded MWHQs modified by numeral-classifiers

28. [uti-no gakka-no dono-gakusei-ga nan-ni-tuite kenkyuu-site-iru-ka]
our-GEN department-GEN which-student-NOM what-DAT-about research-do-PRG-Q
san-nin-gurai-sika sir-anai.
three-CL-about-but know-NEG

'For only three or so of our students, I know what they are working on.'

29. ? [uti-no gakka-no dono-gakusei-ga nan-ni-tuite kenkyuu-site-iru-ka]
our-GEN department-GEN which-student-NOM what-DAT-about research-do-PRG-Q
mit-tu-gurai-sika sir-anai.
three-CL-about-but know-NEG

'For only three or so of ou research topics, I know which of our students are working on.'

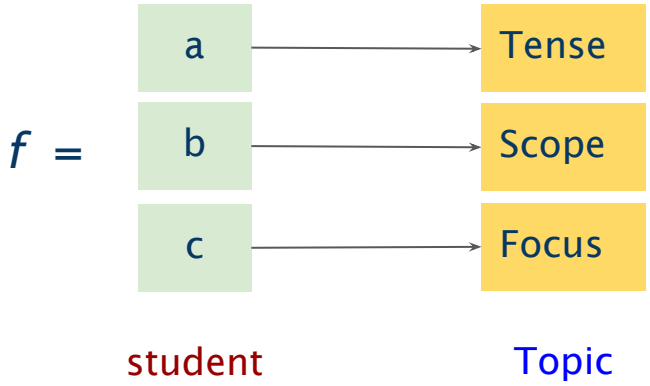
Tomioka (2020)

Functional answers

30. Which of our students are working on what?

Answer: Annie are working on Tense; Becky on Scope; and Cindy on Focus.

$[\![30]\!] = \{ \boldsymbol{f} \mid \text{each student } x \text{ is working on } \boldsymbol{f}(x) \}$

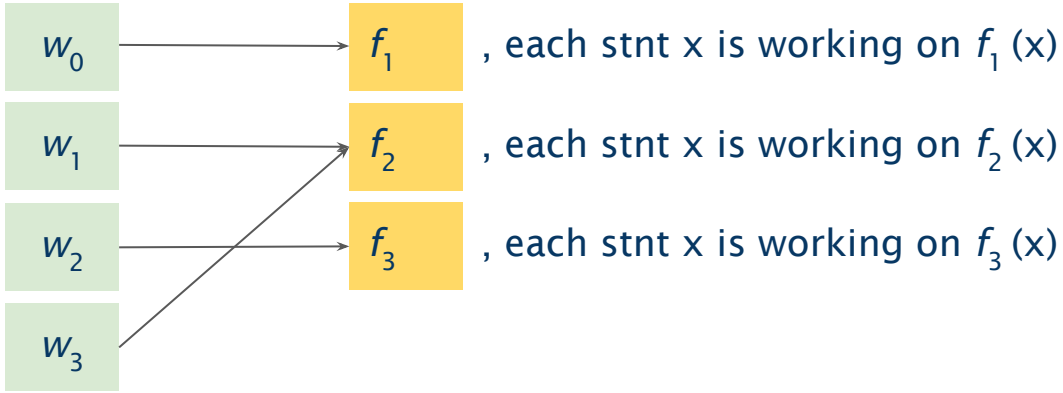


Engdahl (199) Chierchia (2020)

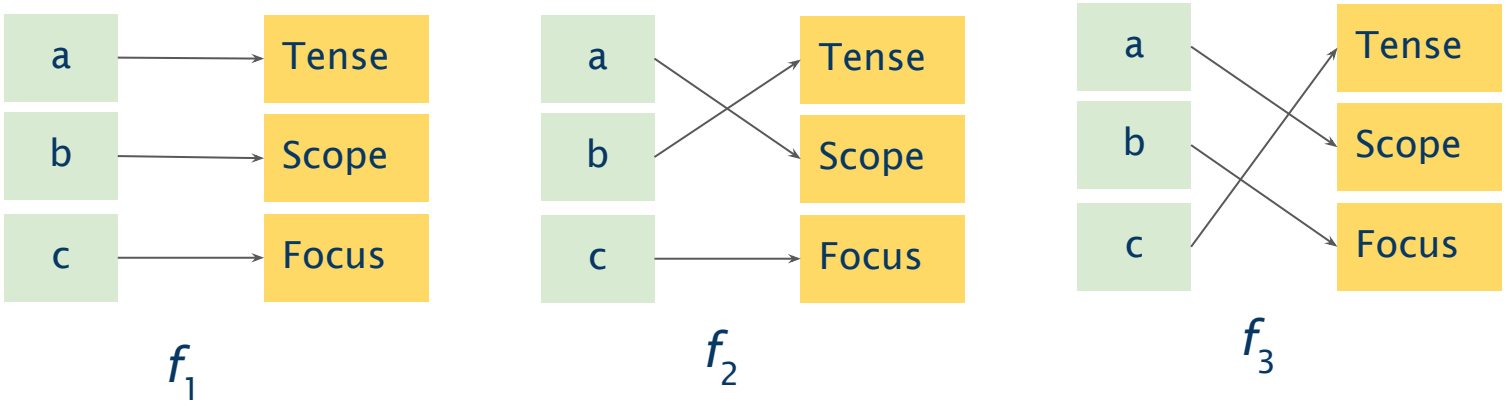
Short functional answers = definite descriptions

$[\![30]\!]$ = { ***f*** **:** each student *x* is working on ***f*** (*x*) }

SA $[\![30]\!]$ =



The function *f* : *student* → *topic* such that each student is working on *f*(x)



Quantifying over definite descriptions

28. [uti-no gakka-no dono-gakusei-ga nan-ni-tuite kenkyuu-site-iru-ka]
our-GEN department-GEN which-student-NOM what-DAT-about research-do-PRG-Q
san-nin-gurai-sika sir-anai.
three-CL-about-but know-NEG

'For only three or so of our students, I know what they are working on.'

[[only-three-CL]] (**SA** [[which student work on what]]) (λd. John know-CQ (d))

= there are 3 x such that x is an atomic part of the domain of ***f*** in w_0 :

John know-**CQ** ($\lambda w. \iota y . y = f(w)(x)$)

= there are 3 x such that x is a student in w_0:

John know-**CQ** (THE y. y = the topics that x is working on)

Given that **SA** [[which student work on what]] =

The function *f* : *student* → *topic* such that each student is working on f(x)

Exhaustiveness

Various exhaustive readings

1. Sam predicted which children sang.

   ⇒ For all children who sang, Sam predicted that they did. (weak exhaustive)

   ⇒ For all children who sang, Sam predicted that they did, and
   he didn't predict that any other children sang. (Intermediate exhaustive)

   ⇒ For all children who sang, Sam predicted that they did, and
   he predicted that no other children sang. (strong exhaustive)

2. Sam knows where we can buy coffee.

   ⇒ There is one place such that Sam knows we can buy coffee from there.
   (non-exhaustive)

Heim (1979); Romero (2005); Aloni & Roelofsen (2011); Frana (2013); a.o.

Weak exhaustive reading

Weak exhaustive readings play the pivotal role in deriving other exhaustive readings.

Klinedinst & Rothschild (2011)

Dayal's answehood operator **A** generates the weak exhaustive answer.

- Sam predicted [**A** who sang] ⇒ weak exhaustive
- Sam **EXH** predicated [**A** who sang] ⇒ intermediate exhaustive
- Sam predicated **EXH** [**A** who sang] ⇒ strong exhaustive

Xiang (2022)

Dayal's answehood operator **A** may generate multiple weak exhaustive answers.

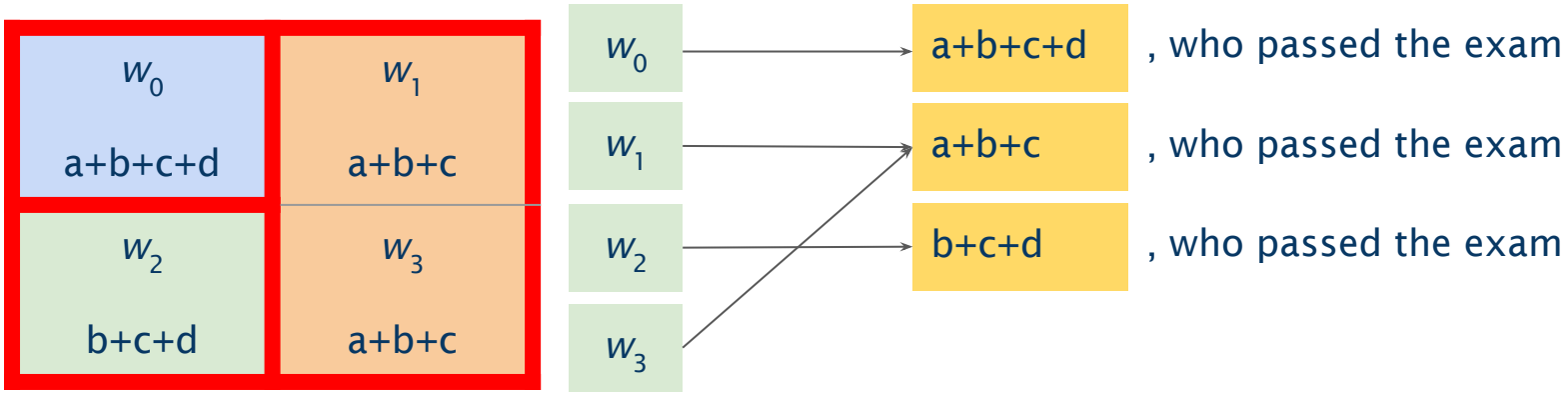
- Sam knows [**A** where_1 can **EXH** we buy coffee at *t*_1] ⇒ non-exhaustive

Issue: Exhaustiveness

CQ leads to a strong exhaustive reading. Then, how to derive the following readings?

- Weak exhaustive readings
- Intermediate exhaustive readings
- Non-exhaustive readings

John knows the people who passed the exam.

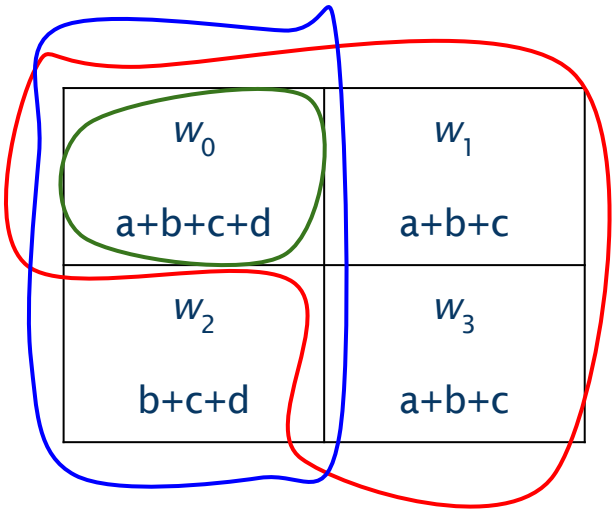


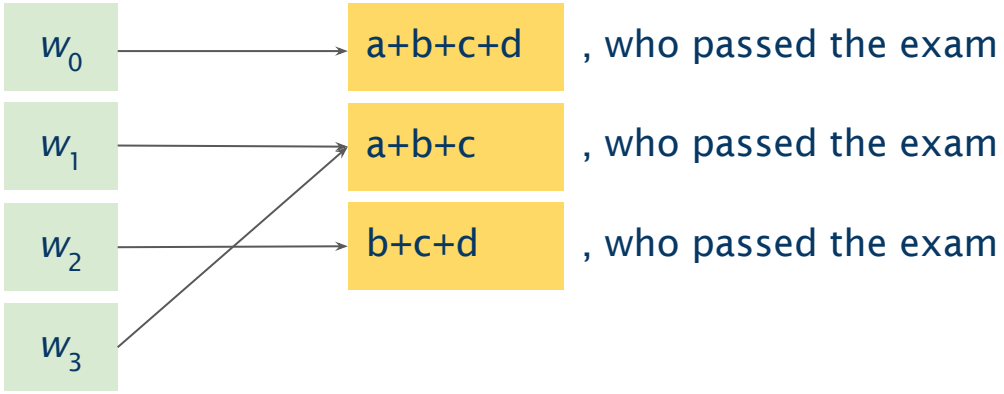
George (2011); Cremers (2018); Xiang (2022); Uegaki (2022); a.o.

Deriving weak exhaustive answers

$[\![\mathbf{CQ}\ [\text{SA Q}]]\!] = \{\{\ \boldsymbol{w'} \mid [\![\text{SA Q}]\!](w) \leq [\![\text{SA Q}]\!](\boldsymbol{w'})\ \} \mid w \in W\ \}$

John knows the people who passed the exam.





$[\![\mathbf{CQ}\ [\text{SA who passed the exam}]]\!] = \{\{w_0\},\ \{\boldsymbol{w_1}, \boldsymbol{w_3}, \boldsymbol{w_0}\},\ \{\boldsymbol{w_2}, \boldsymbol{w_0}\}\}$

Embedded questions

In Japanese, embedded questions must bear a question marker *-ka*.

10. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] sitteiru.
    John-TOP who-NOM exam-DAT passed-Q-ACC know
    'John knows who passed the exam.'

The particle *ka* as an alternative marker can be attached to disjunctive expressions and indefinites, in addition to questions.

$$[\![[\text{who passed the exam}]\text{-ka}]\!] = \{ \text{passed-exam}'(x) \mid x \in \text{people}' \}$$

$$= \left\{ \begin{array}{c} \text{a+b+c+d passed the exam,} \\ \text{b+c+d+e passed the exam,} \\ \text{a+c+e+g passed the exam} \end{array} \right\}$$

Szabolcsi (2015); Uekagi (2018); cf. Hagstrom (1998); Alsop & Champollion (2019)

Quantificational Variability (QV)

In English, EWHQs can be quantified by quantificational adverbs.

15. Eva mostly knows **who passed the exam**.
    ⇒ For most of the people who passed the exam, Eva knows whether they did.
    [Responsive verb]

16. **Who will be admitted** depends for the most part on the this committee.
    ⇒ For most people, whether they will be admitted depends on this committee.
    [Rogative verb]

Berman (1990); Lahiri (2000); Beck & Sharvit (2002); a.o.

Quantifying over sub-questions

who passed the exam

most $Q \in$ { Did Annie pass the exam; Did Becky pass the exam; Did Cindy pass the exam } John knows Q

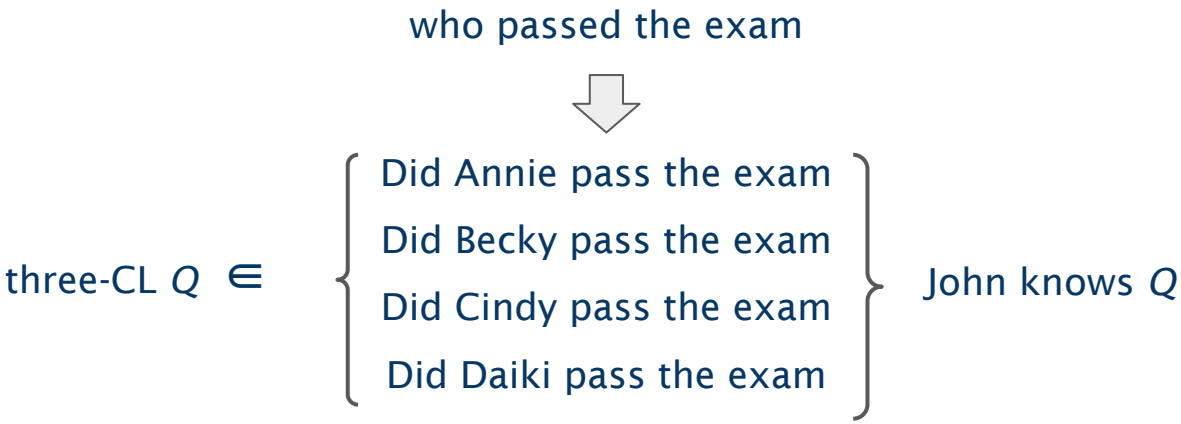
who will be admitted

most $Q \in$ { Will Annie be admitted; Will Becky be admitted; Will Cindy be admitted } Q depends on the cmt

Beck & Sharvit (2002)

Application to Japanese?

12. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] san-nin-(gurai) sitteiru.
John-TOP who-NOM exam-DAT pass-Q-ACC three-CL-about know
'For three of the people who passed the exam, John knows whether they did.'



Embedded polar questions

In Japanese, an embedded polar question cannot be modified by a numeral-classifier.

17. Ken-wa [**korera-no gengo-ka muzikasi-i kadoo-ka**]-**(o)** (*mit-ttu) tazune-ta.
    Ken-TOP these-GEN language-NOM difficult C-Q-ACC three-CL asked
    'Ken asked whether these languages are difficult.'

It is challenging for the analysis of quantifying over sub-questions to explain the incompatibility of numeral-classifiers and polar questions.

Are these languages difficult

three-CL Q $\in$ { Is English difficult, Is German difficult, Is Chinese difficult, Is Arabic difficult } Ken asked Q

Numeral-classifiers can float

It is well known that the distribution of Japanese numeral-classifiers is very flexible.

20. John-wa **hon-o** san-satu katta.
    John-TOP book-ACC three-CL bought
    'John bought three books.'

- John-wa san-satu-(no) **hon-o** katta.
- **Hon-o** gakusei-ga san-satu katta.

Numeral-classifiers may combine with *wh*-expressions, at least to some native speakers.

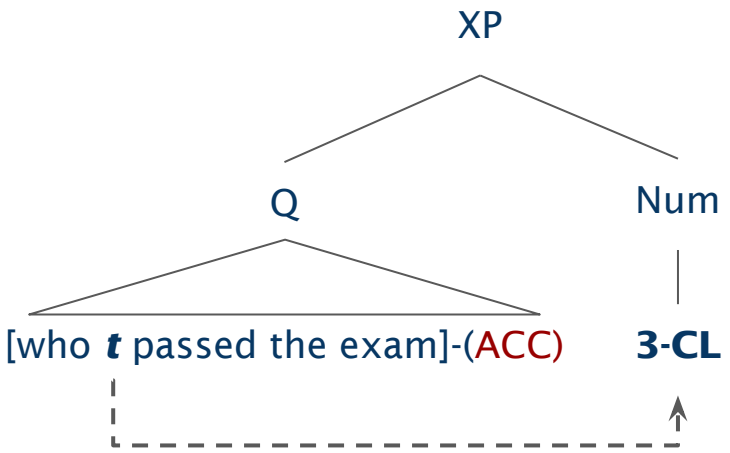
21. (?)? John-ga **dare-ni** san-nin atta-no?
    John-NOM who-DAT three-CL met-Q
    'Who were the three people that John met?'

Kuroda (1980); Miyagawa (1989); Nakanishi (2006); Watanabe (2006);
Kobuchi-Philip (2007); a.o.

Movement of a numeral-classifier?

A numeral-classifier may modify a *wh*-word at DS but undergo movement at SS

22. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] san-nin-(gurai) sitteiru.
    John-TOP who-NOM exam-DAT pass-Q-ACC three-CL-about know
    'For about three of the students who passed the exam, John knows if they did.'



see also Tomioka (2020)

No movement

Internal and external numeral classifiers trigger different inferences.

22. John-wa [**dare-ga** **siken-ni** **ukatta-ka-(o)**] san-nin-(gurai) sitteiru.

John-TOP who-NOM exam-DAT pass-Q-ACC three-CL-about know

'For about three of the people who passed the exam, John knows if they did.'

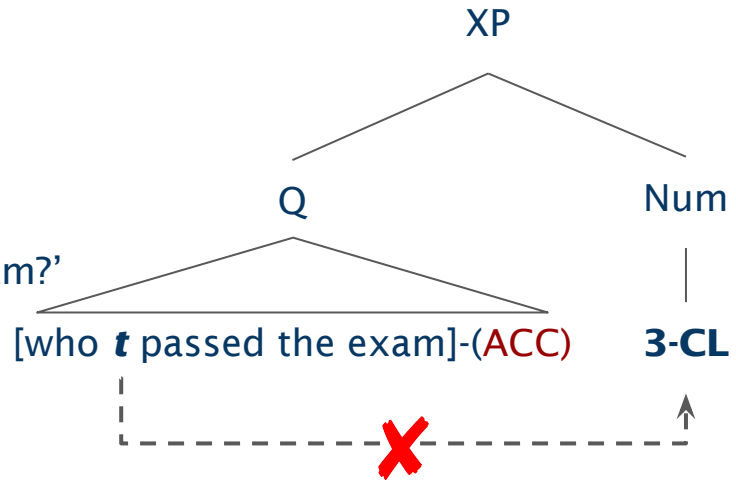
⇒ <u>More than three people</u> passed the exam.

23. (?)? **Dare-ga** san-nin siken-ni ukatta-no?

who-NOM three-CL exam-DAT passed-Q

'Who were the three people that passed the exam?'

⇒ <u>Just three people</u> passed the exam.



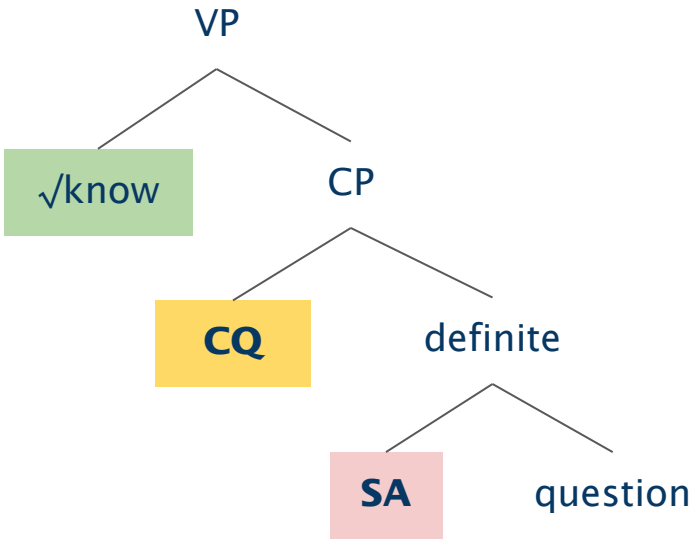
see also Tomioka (2020)

Language universals and variations

Our proposal (again)

In Japanese, a question-taking verb can be decomposed into:

- A verbal root (i.e., a predicate of eventualities)
- **CQ**, exclusively



In addition, the non-propositional answerhood operator **SA** is available.

SA

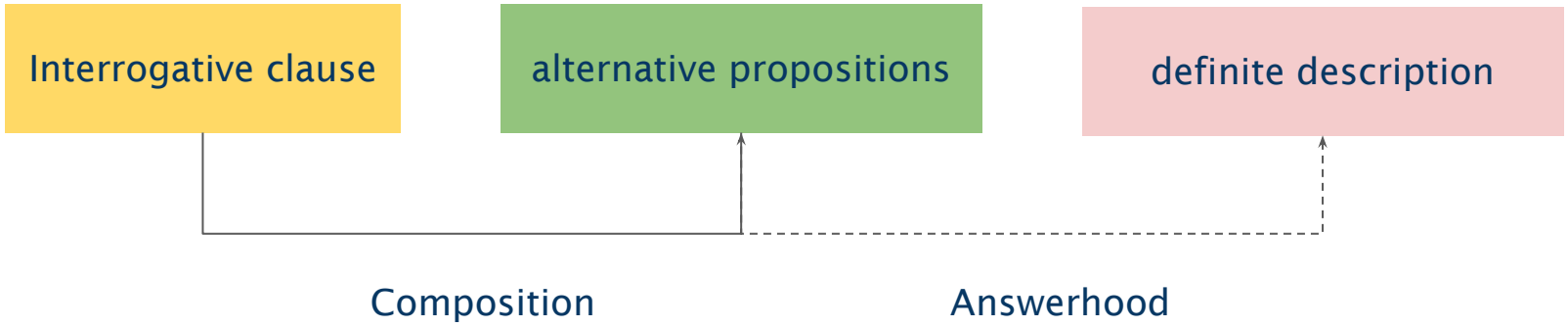
- Answerhood operator: Transforming a question to a definite description
- **Assumption**: It applies only when a question is embedded.

Language universals

In natural languages, clausal meaning can be transformed to nominal meaning.

As a consequence, it is observed cross-linguistically that a clausal form may receive a nominal interpretation.

Japanese EWHQs



Internally headed relative clauses (IHRC)

Japanese (and many other languages) have IHRCs, which refer to a kind of relative clauses whose head nouns are embedded within.

28. Taro-wa [**Hanako-ga** ***ringo-o*** **mui-ta-no**]-(o) mi-ttu tabe-ta.
    Taro-TOP Hanako-NOM apple-ACC peel-PST-NMZ-ACC three-CL eat-PST
    'Taro ate three of the apples that Hanako peeled.'

Similar to a EWHQ, an IHRC can also …

- bear a case marker.
- be modified by a numeral-classifier, which agrees with the internal head noun.

IHRCs are also derived by transforming declarative clauses to definite descriptions.

Shimoyama (1999); Grosu (2010); Grosu & Landman (2012); Erlewine & Could (2016); a.o.

Free relatives

In English and many other languages, *wh*-clauses can be used as free relatives.

29. Jane ate what Kyle cooked. (English)

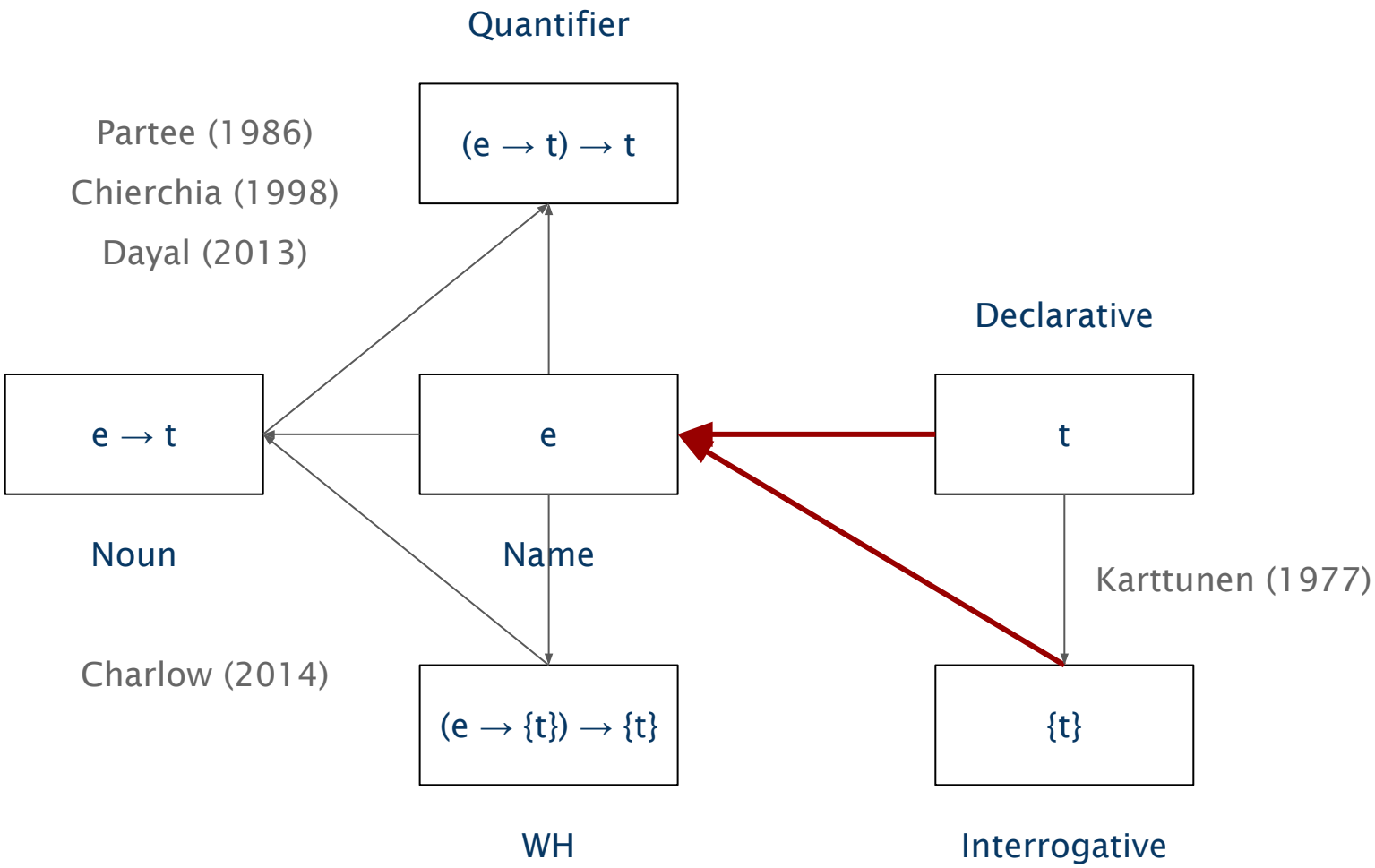
30. Ich aß, was Maria kochte. (German)
    I ate what Mari cooked
    'I ate what Maria cooked.'

31. Včera, David sledoval, co dàvali na HBO. (Czech)
    yesterday David watched what gave on HBO
    'Yesterday, David was watching what they were showing on HBO.'

Free relatives are widely analyzed as definite descriptions.

Bresnan & Grimshaw (1978); Jacobson (1998); Caponigro (2003, 2023); Cecchetto & Donati (2015); a.o.

Type shifts


Quantifier
Partee (1986)
Chierchia (1998)
Dayal (2013)
(e → t) → t
Declarative
e → t
e
t
Noun
Name
Karttunen (1977)
Charlow (2014)
(e → {t}) → {t}
{t}
WH
Interrogative

Language variations

The transformation from clausal meaning to nominal meaning is encoded in specific manners across different types of languages.

In Japanese, nominal *wh*-clauses are only allowed in embedding environments. Free relatives are not available.

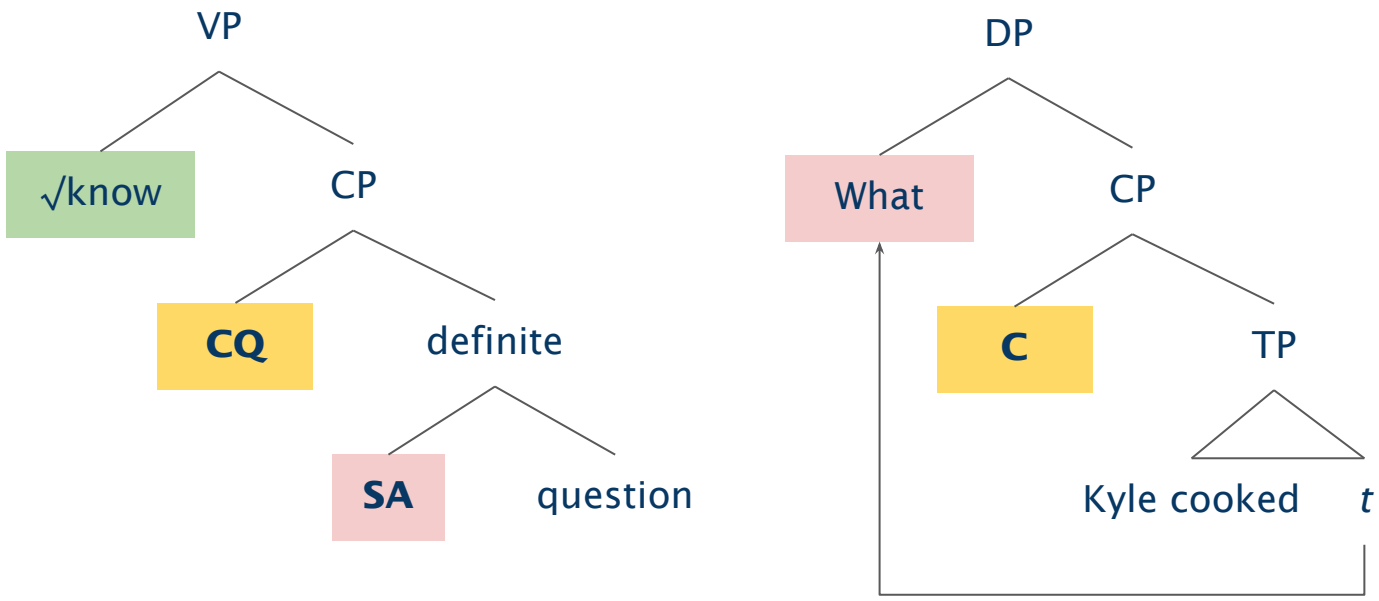
33. *John-wa [**Hanako-ga nani-o tsukutta-ka-(o)**] tabeta.
    John-TOP Mary-NOM what-ACC made-Q-ACC ate
    Intended 'John ate what Hanako cooked.'

In English, can free relatives be modified by quantificational determiners?

34. I read **most of what he has written**.
35. I have **twenty of what you're looking for in stock**.
36. She bought **three of what she considers her favorite dresses**.

Chat GPT's answers

Answerhood vs. Relabeling



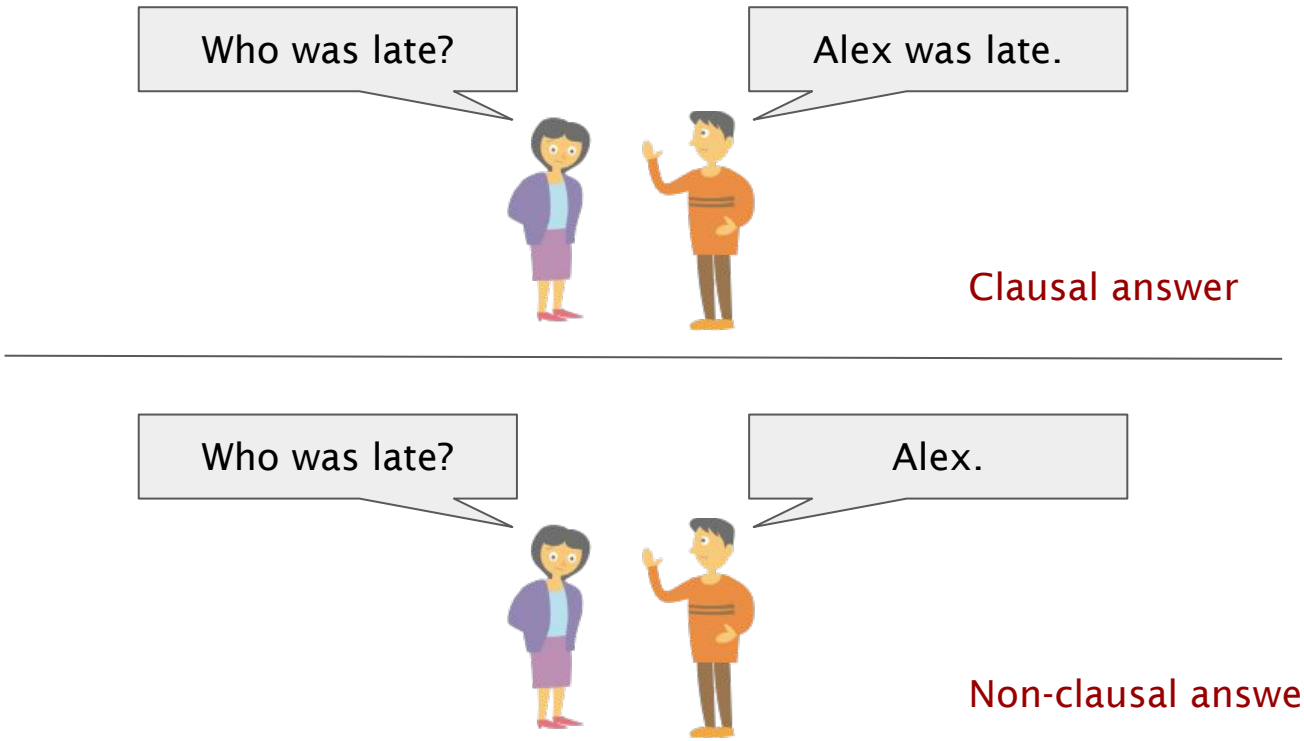
- In Japanese, a *wh*-in-situ language, a *wh*-clause is nominalized by the answerhood operator SA, which only appears in an embedding environment.
- In English, a *wh*-movement language, a *wh*-clause is normalized by re-labeling, which is only available when a *wh*-expression moves and merges with CP (Cecchetto & Donati 2015; Caponigro 2023; see also Bresnan & Grimshaw 1978)

Deriving non-propositional answers

Clausal vs. Non-clausal answer

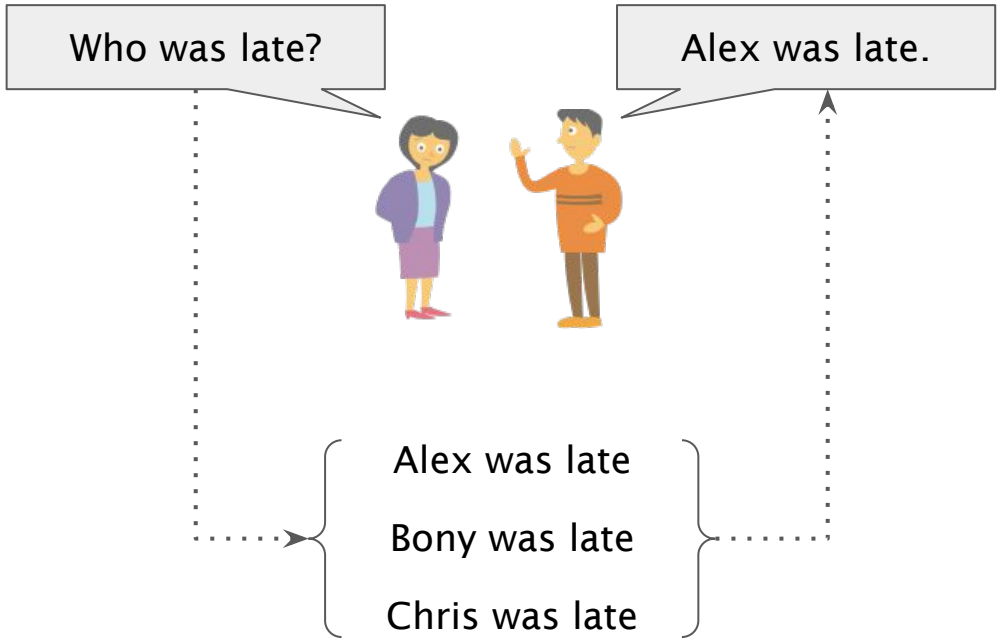
Knowing the meaning of a question is knowing how to answer the question.

But there are **two** types of answers!



Clausal vs. Non-clausal answer

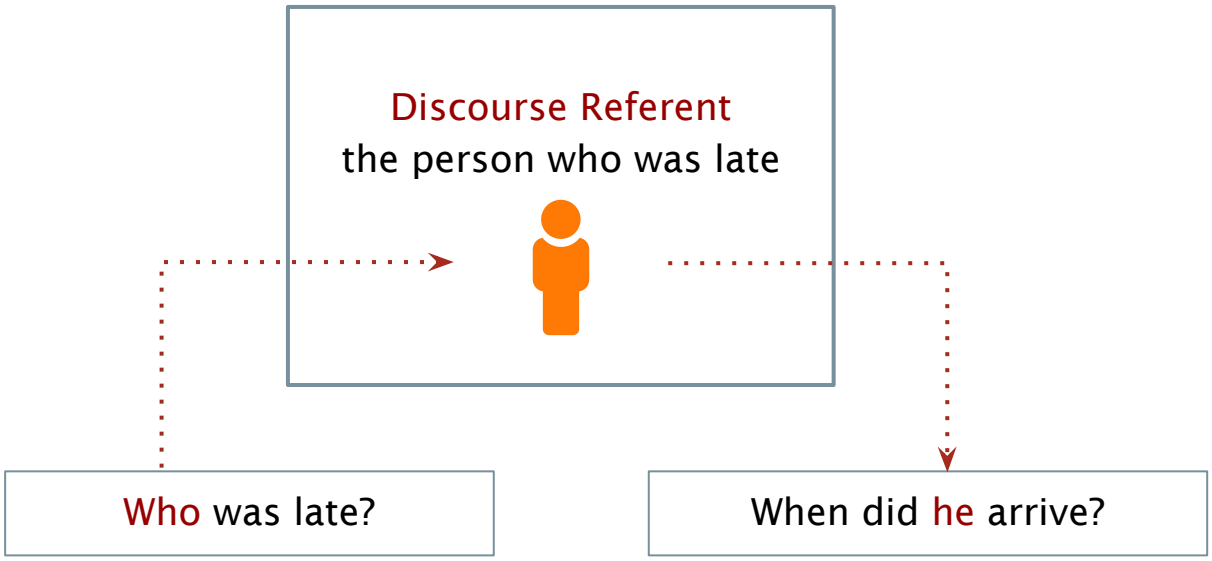
A clausal answer is derived from the sentence meaning of a wh-question.



What about non-clausal answers?

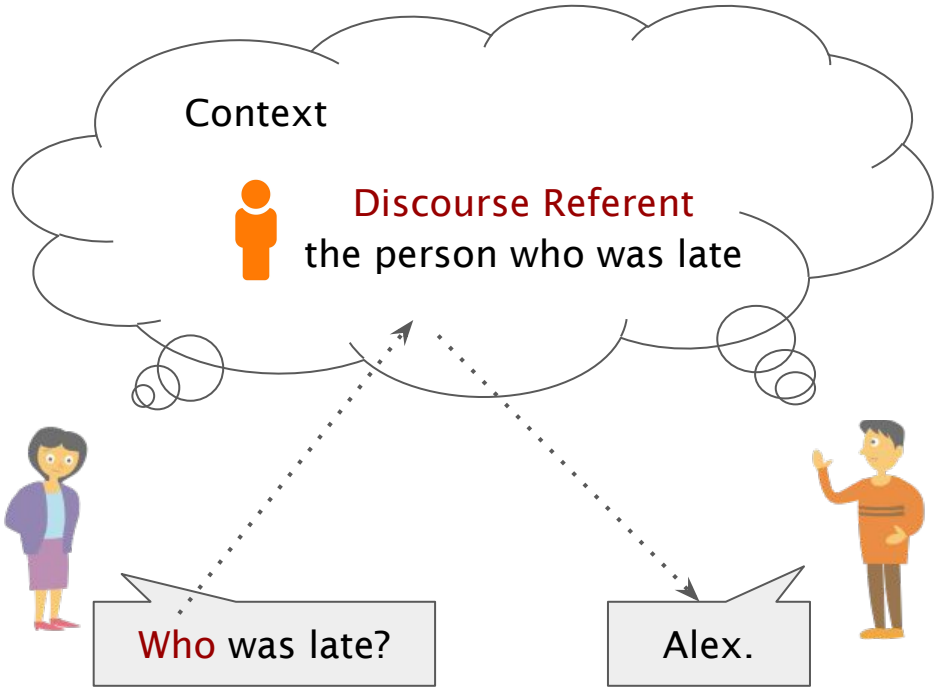
A hint from discourse: anaphora to wh

1. Who was late? When did he arrive?
2. Who attended the party? I hope they didn't get Covid.
3. Who bought which book? How much did he pay for it?

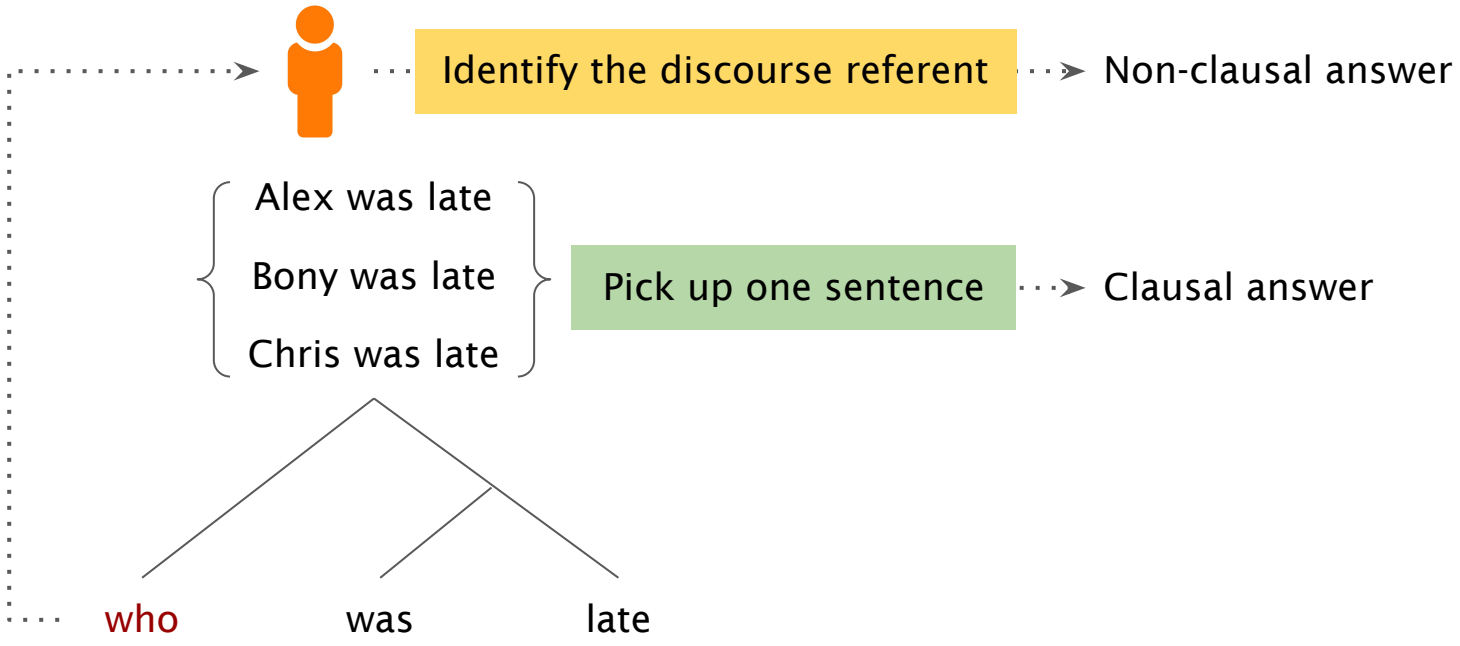


Discourse referents and non-clausal answers

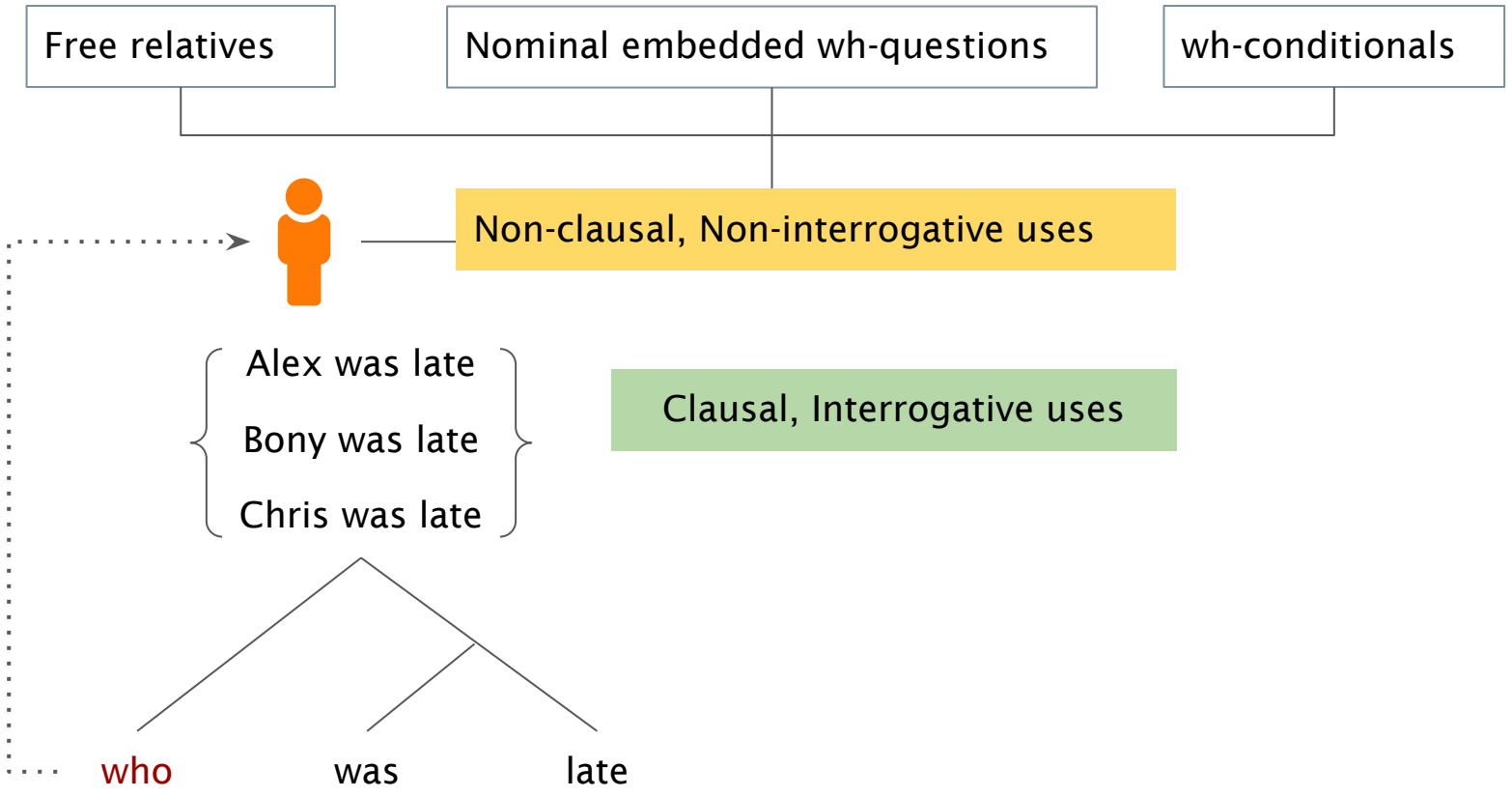
Identifying the discourse referent introduced by wh → non-clausal answer



Utterance meaning of wh-questions



Sentence meaning vs. discourse referent



(57) ϕ entails ψ w.r.t i iff $\forall j \forall w.\phi(w)(i)(j) \rightarrow \exists k.\psi(w)(j)(k)$.

Let's take the *wh*-question in (58) as a concrete example to see how **Ans** works. According to Dayal (1996), a number-neutral *wh*-expression like *who* can range over singular and plural individuals. The latter are formed via the sum operation $\oplus$ (Link 1983). In dynamic Hamblin semantics, *wh*-drefs introduced by *who* may include singular individuals and their sums. Because of the existence of the plural individual, I assume that the static properties and relations on which dynamic meanings are built are closed cumulatively. For example, given a world w, if $\mathsf{late}_w(x)$ and $\mathsf{late}_w(y)$, then $\mathsf{late}_w(x \oplus y)$; if $\mathsf{see}_w(x)(y)$ and $\mathsf{see}_w(x')(y')$, then $\mathsf{see}_w(x \oplus x')(y \oplus y')$.

(58) $[\![\text{who was late}]\!]_d$

$= \{\lambda w \lambda i \lambda j.\mathsf{late}_w(x) \wedge j = \langle \top_i, \bot_i \cdot x \rangle \mid x \in \{\mathsf{a}, \mathsf{b}, \mathsf{a} \oplus \mathsf{b}\}\}$

$= \{[\![\textsc{Ada} \text{ was late}]\!]_d, [\![\textsc{Bob} \text{ was late}]\!]_d, [\![\textsc{Ada and Bob} \text{ were late}]\!]_d\}$

Applying **Ans** to the *wh*-question in (58) yields the maximally informative dynamic proposition ϕ relative a possible world w and an input info-state i; that is, ϕ is true in w and i and entails other true answers. Given the actual world w_0 and an input info-state i, if Ada and Bob were both late in w_0, then $[\![\textsc{Ada and Bob} \text{ were late}]\!]_d$ is maximally informative relative to w_0 and i. This dynamic proposition is the complete propositional answer to the question.

Combining ED with Ans With ED in hand, we can retrieve the values of *wh*-drefs. The retrieval process is depicted in Fig. 3. Let's consider the question *Who won* in a small model that only contains two people {a(nn), b(ob)} and two possible worlds $\{w_1, w_2\}$. The *wh*-expression *who* denotes a set of dynamic individuals containing $[\![\textsc{Ann}]\!]_d$ and $[\![\textsc{Bob}]\!]_d$, which introduce the individuals a and b as drefs respectively. Suppose that only Ann won in w_1 and only Bob won in w_2, then the complete propositional answer to the question is $[\![\textsc{Ann won}]\!]_d$ in w_1 and $[\![\textsc{Bob won}]\!]_d$ in w_2, according to the definition of **Ans** given in the last subsection. Each complete propositional answer is associated with a dref introduced by *who*. $\mathbf{ED}^{\perp}$ applies to each of these complete answers and retrieves the values of the drefs stored in the output bottom lists, i.e., the drefs introduced by *who*.

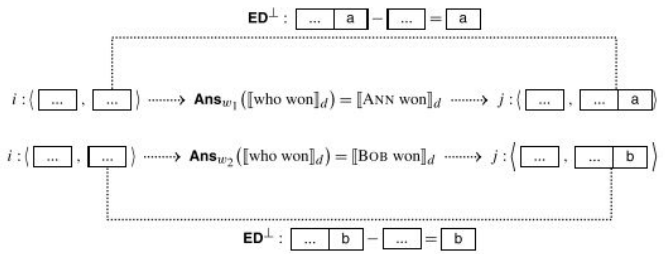


Fig. 3 The process of retrieving values of *wh*-drefs

- Li, H (2020) *A dynamic semantics for wh-questions*. PhD dissertation, NYU.
- L, H (2021) Mandarin wh-conditionals: A dynamic question approach. *Natural Language Semantics*
- Li. H (Accepeted) Reference to dependencies established in multiple-wh questions. *Linguistics & Philosophy*.