A manner adverbial analysis of clausal embedding

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1 Introduction

- There are two types of analyses of clausal embedding.

(1) a. The clausal strategy: V [$_{S}$ ...]
b. The nominal strategy: V [$_{NP/DP}$ [$_{S}$ ...]]

- We argue for a manner adverbial analysis of clausal embedding, adopting independently motivated ingredients, i.e., manner modification with *event-kind* (Landman and Morzycki (2003)) and the *content* function (Kratzer (2006))

(2) The manner adverbial analysis of clausal embedding
V [Adv [$_{S}$ ...]]

(3) Empirical topics of our talk
a. Manner expressions as propositional anaphors
b. The Japanese manner adverb *soo* and its intrasentential and intersentential anaphoric uses

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The abbreviations are as follows: ACC = accusative; ASP = aspect; C = complementizer; COP = copular; GEN = genitive; NEG = negation; NOM = nominative; PRS = present tense; PST = pst tense; Q = question particle; SFP = sentence-final particle; TOP = topic marker.

2 Data

- Manner expressions can function as quotative markers or propositional anaphors, cross-linguistically.

(4) German (König (2015: 49))
Er hat das so formuliert: "..."
he have DEM so formulate
'He put it this way: ". . . "'

(5) Polish (Guz (2024: 556))
on mówi tak "to już wychodzisz?"
he says TAK then already leave-2.SG
'He says like this, "Are you leaving already?"'

(6) Anderson (1976: 172)
Your mother was under the impression that you would be away tonight, and as you can see, I imagined so too.

(7) Intersentential *zheme* 'so' in Mandarin Chinese (Wei and Li (2016: 193))
Zhangsan renwei Mali hen congming, Lisi ye zheme renwei.
Zhangsan think Mary very smart Lisi also so think
'Zhsangsan thinks Mary is smart; Lisi also thinks so.'

(8) Intrasentential *zheme* in Mandarin Chinese (Yangyu Sun and Muyi Yang, p.c.)

a. [Lisi lai le], Zhangsan zheme renwei.
Lisi come ASP Zhangsan so think
Lit. 'Lisi came, Zhagsan thinks so.'

b. Zhangsan zheme renwei, [Lisi lai le].
Zhangsan so think Lisi come ASP
Lit. 'Zhagsan thinks so, Lisi came.'

2.1 *Soo* 'so' in Japanese

- The Japanese mannder adverbial *soo* 'so' can be used in intersentential or intrasentential anaphra.

(9) Intersentential *soo* in Japanese

a. Taro-wa [Jiro-ga kita to] omot-teiru.
Taro-TOP Jiro-NOM came C think-ASP.PRS
'Taro thinks that Jiro came.'

b. Aiko-mo soo omot-teiru.
Aiko-also so think-ASP.PRS
'Aiko also thinks so.' (so = Jiro came)

(10) Intrasentential *soo* in Japanese[1]
Taro-wa [Jiro-ga kita to] soo omot-teiru.
Taro-TOP Jiro-NOM came C so think-ASP.PRS
'Taro thinks that Jiro came.'

- *Soo* is an adverbial expression and never be followed by a case particle, as in (10b) and (11).

(10) a. Taro-wa [Jiro-ga kita to] omot-teiru.
Taro-TOP Jiro-NOM came C think-ASP.PRS
'Taro thinks that Jiro came, and Aiko also thinks so.'

b. *Aiko-mo soo-o omot-teiru.
Aiko-also so-ACC think-ASP.PRS
'Aiko also thinks so.' (so = Jiro came)

(11) *Taro-wa [Jiro-ga kita to] soo-o omot-teiru.
Taro-TOP Jiro-NOM came C so-ACC think-ASP.PRS
'Taro thinks that Jiro came.'

2.2 The anti-factive property of *soo*

(12) Kiparsky and Kiparsky (1970: 362)

a. *John regretted that Bill had done it, and Mary regretted {it | *so}, too.*

b. *John supposed that Bill had done it, and Mary supposed {it | so}, too.*

(13) Mandarin Chinese (Wei and Li (2016: 193))
Zhangsan {zhidao | houhui} ta mei zuo shenme,
Zhangsan know regret he not do anything,

*Lisi ye zheme {zhidao | houhui}.
Lisi also so know regret
'Zhangsan {knows | regrets} that he did not do anything; *Lisi {knows | regrets} so, too.'

[1] When both an intersentential antecedent and an intrasentential antecedent are preset, *soo* refers only to the intrasentential antecedent as in (i). This may be caused by some sort of the lifespan effect of *soo*.

(i) a. Hanako-wa Aiko-ni [Taro-ga shigoto-o yame-ta to] it-ta.
Hanako-TOP Aiko-to Taro-NOM job-ACC quit-PST C say-PST
'Hanako told Aiko that Taro quit his job.'

b. Aiko-wa [Taro-no kaisha-wa brakku-kigyoo dat-ta to] soo shinzi-teiru.
Aiko-TOP Taro-GEN company-TOP black-corporation COP-PST C so believe-ASP.PRS
'Aiko believes that Taro's company has terrible working conditions.'
Impossible: 'Aiko believes that Taro quit his job, by (metnally) saying that his company has terrible working conditions.'

- *Soo* exhibits the anti-factive behavior as exemplified in (14b) and (15).[2]

(14) a. Taro-ga kaisya-o yameta.
Taro-NOM company-ACC quit
'Taro quit the company.'

b. *Hanako-wa soo sit-teita.
Hanako-TOP so know-ASP.PST
Lit. 'Hanako knows so.'

(15) *Taro-wa [kare-ga uwaki-o sita to] soo kuyan-deiru.
Taro-TOP he-NOM affiar-ACC did C so regret-ASP.PRS
Lit. 'Taro$_1$ regretted so that he$_1$ had an affair.'

2.3 The anti-interrogative property of *soo*

- *Soo* exhibits the anti-interrogative behavior as exemplified in (16b) and (17).

(16) a. Taro-wa naitei-ga toreta no?
Taro-TOP job.offer-NOM got.can Q
'Did Taro get a job offer?'

b. ima Aiko-ga {sore-o | *soo} tashikame-teiru yo.
now Aiko-NOM it-ACC so confirm-ASP.PRS SFP
Lit. 'Aiko is confirming {it | so} now.'
Int. 'Aiko is confirming whether Taro got a job offer or not.'

(17) *ima Aiko-ga [Taro-ga naitei-ga toreta ka] soo tashikame-teiru yo.
now Aiko-NOM Taro-NOM job.offer-NOM got.can Q so confirm-ASP.PRS SFP
'Aiko is confirming whether Taro got a job offer or not.'

3 Formal analysis

- We construct a manner modification approach to propositional anaphora with two ingredients, both of which receive independent empirical motivation.

[2]The quotative construal does not exhibit the anti-factive property, as in (i).

(i) Taro-wa [zibun-wa uwaki-o suru-beki-de-wa nakatta to] soo kuyan-deiru.
Taro-TOP self-TOP affiar-ACC did-MOD-COP-TOP NEG.PST C so regret-ASP.PRS
'Taro$_1$ was regretful by (mentally) saying "I$_1$ should not have had an affair."'

(18) a. There is a function from events to their propositional content.
b. Manner modification makes reference to a contextually salient event-kind.

• First, we adopt that the CONT function, which maps an individual x and a world w onto the propositional content of x in w (Kratzer 2006, Moulton 2015:among many others).

- We assume that CONT is also defined for the domain of events (D_v) (Elliott 2020:*et seq*).[3]

- The eventive-CONT (E-CONT) function is defined as in (19).

(19) E-CONT maps a world $w \in D_s$ and an event $e \in D_v$ to e's unique content $p \in D_{\langle s,t \rangle}$.

- Note that its inverse function is not always defined. This will be crucial later.

• Second, we assume that manner modifiers make reference to the contextually salient event-kinds (Landman and Morzycki 2003) as exemplified in (35) with English *so*.

(20) $[\![so_i]\!]^w = \lambda e.[\ e \text{ realizes } k_i\ ]$

• We assume that an event-kind is the cross-world maximal sum of events just like an individual kind (a.o. Schwarz 2014, Gehrke 2017), which is formed via the $^\cap$-operator (Chierchia 1998).

(21) For any property P and world w, $^\cap P = \lambda w \iota P(w)$ if $\lambda w \iota P(w)$ is in the domain of kinds K; undefined, otherwise. (Chierchia 1998)

• Now, we are ready to spell out our analysis with these independently motivated ingredients.

- We propose that *soo* refers to propositions by mapping an *event-kind* to its content.

- The rationale is that one may obtain the maximal subset of events that have the same propositional content and construct an event-kind with it, i.e. $^\cap(\lambda w \lambda e\,[\text{E-CONT}_w(e) = p])$.

- Thus, whenever a new proposition is introduced to the discourse, *soo* may refer to it via anaphora to an event-kind constructed this way.

• Recall that E-CONT maps an event e to its unique propositional content p in w.

- The inverse is not true: two events e and e' may have the same propositional content.

- Thus, it is not trivial how one may retrieve an event e in w from p such that $\text{E-CONT}_w(e) = p$.

• In order to use $\text{E-CONT}_w(e) = p$ for retrieving an event from a proposition, one has to find a mapping in which its inverse is defined.

[3]One may adopt a single function from contentful entities, either individuals or events, to their contents.

- An event-kind makes it possible:

- for any p, one may find a unique event-kind k such that any realisation of it is mapped to p.

• To implement it, we take E-CONT to be defined for event-kinds.

(22) a. $\text{E-CONT}^{-}(p)$ is defined iff $^{\cap}(\lambda w \lambda e\,[\text{CONT}_w(e) = p])$ is defined.
b. If defined, $\text{E-CONT}^{-}(p) = ^{\cap}(\lambda w \lambda e\,[\text{CONT}_w(e) = p])$.

- Whatever analysis of propositional antecedent p one adopts, we can retrieve the event-kind from it via the E-CONT^{-} function.

• Now, the semantics of *soo* as a manner adverbial results in a parallel composition with clausal complementation with e modifier *that*-clause.[4]

(23) a. Taro thinks that p
b. $[\![\ \textit{that}\ p\ ]\!]^w = \lambda e.[\ \text{E-CONT}_w(e) = p]$
c. $[\![\ (23a)]\!]^w$
$= \exists e : e \in \textit{Dom}(\text{E-CONT}_w(e)).[\ \text{AGENT}(e)=\text{Taro} \wedge \text{think}_w(e) \wedge \text{E-CONT}_w(e) = p]$

(24) a. Taro thinks so$_i$.
b. Context: $\text{E-CONT}^{-}(p) = k_i$
c. $[\![\ \textit{soo}_i\ ]\!]^w = \lambda e.[\ e \text{ realizes } k_i\ ]$
d. $[\![\ (24a)\ ]\!]^w = \exists e\text{: } e \in \textit{Dom}(\text{E-CONT}_w(e)).[\ \text{AGENT}(e)=\text{Taro} \wedge \text{think}_w(e) \wedge e \text{ realizes } k_i\ ]$
$= \exists e\text{: } e \in \textit{Dom}(\text{E-CONT}_w(e)).[\ \text{AGENT}(e)=\text{Taro} \wedge \text{think}_w(e) \wedge \text{E-CONT}_w(e) = p]$

- This way, *soo* achieves propositional anaphora in the way of manner modification.

• Note that one may adopt whatever theory of propositional anaphora.

- Once a propositional antecedent is given, E-CONT^{-} provides the event-kind antecedent for *soo*.

- Thus, the proposed manner adverbial anapysis can be combined with any theory of propositional anaphora.

[4]For our purpose, one may alternatively take *soo* as a bare occurrence of an event-kind variable and the interpretation in (24a) is achieved via *Derived Kind Predication* (Chierchia 1998), which replaces a kind variable to an existentially bound individual variable when a kind variable is applied to non-kind predicates. However, this alternative requires some type-shifting operation when *so* is used as a manner adverbial.

4 Anti-factivity and unavailability of question antecedent

• We have suggested a manner adverbial analysis of propositional anaphora, which only requires independently motivated ingredients.

- In this section, we further show that anti-factivity of *soo* follows from an independently motivated property of *sub-kinds*.

- We suggest that the event-sub-kinds formed via E-CONT$^-$ are *ad hoc* sub-kinds (Mendia 2020), which are not given as natural taxonomic classes, but contextually constructed.

(25) a. The lions that eat people are widespread.
b. The dogs that bite are dangerous. (Mendia 2020)

• Carlson (1977) suggests a generalisation on sub-kinds such that sub-kinds must not have an instance that realises more than one sub-kinds.[5]

(26) Two kinds of dog are sitting in the next room.
a. There are three bull-dogs and two beagles in the next room.
b. # There is only Fido, who is a border collie and a watch-dog in the next room.

(Mendia 2020)

• Carlson (1977) postulates it as *Disjointness Condition*.

(27) **Disjointness Condition** (Carlson 1977): A kind-referring expression can only refer to a contextually defined subset of all the possible subkinds that the noun is true of, such that:
a. the subkinds in this subset are disjoint and share no realizations,
b. the subkinds collectively cover all the space of realizations of the kind.

• We propose that an event-kind constructed with E-CONT$^-$ is also an *ad hoc* sub-kind.

- The disjointness condition is trivial for those event-sub-kinds, though:

- since those events are in the domain of E-CONT by definition, they have a unique propositional content, and thus E-CONT$^-(p)$ and E-CONT$^-(q)$ do not overlap,

- i.e. there is no event e in w such that E-CONT$_w(e) = p$ and E-CONT$_w(e) = q$.[6]

[5] We take it for granted that an event-kind based on its propositional content is necessarily a sub-kind in the sense that different events are mapped to different propositional contents for E-CONT to be meaningful at all. If so, any events that have a non-trivial propositional content should be a sub-kind.

[6] This does not deny the possibility that E-CONT$_w(e) = p \wedge q$.

• However, if applied to their contents, the disjointness condition becomes non-trivial.

- See Appendix for a way to derive (28) from (27) by letting E-CONT preserve the partition structure as a homomorphism.

(28) **Disjointness Condition for contentful kinds**: A kind-referring expression can only refer to a contextually defined subset of all the possible contentful subkinds that the expression is true of, such that:

a. **the propositional contents** of the subkinds in this subset are disjoint,
b. **the propositional contents** of the subkinds collectively cover the logical space.

- Let us adopt the following abbreviation.[7]

(29) Abbreviation: $\text{E-CONT}_w(k) = p$ iff $\forall e\,[e$ is realisation of $k \rightarrow \text{E-CONT}_w(e) = p]$

• Now, the disjointness condition on the content of event-sub-kinds is defined with a partition function Π *a la* Mendia (2020) as shown in (30).

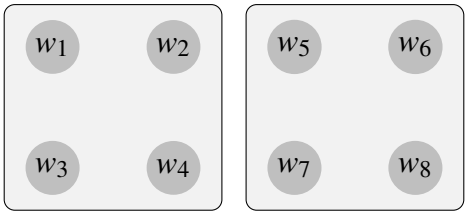
(30) Let K an event-kind, c the context set, and Π a partition function.
An event-sub-kind k based on E-CONT is defined iff:

a. $k \in \Pi(K)$, (k is a sub-kind)
b. $c \notin \{\text{E-CONT}_w(k) : k \in \Pi(K)\}$, (non-triviality)
c. $\cup\{\text{E-CONT}_w(k) : k \in \Pi(K)\} = c$, and (collective exhaustivity)
d. $\forall k, k' \in \Pi(K)\,[\text{E-CONT}_w(k) \cap \text{E-CONT}_w(k') = \emptyset]$. (disjointness)

- This requires that the context c is partitioned to a non-singleton set of mutually incompatible propositions.

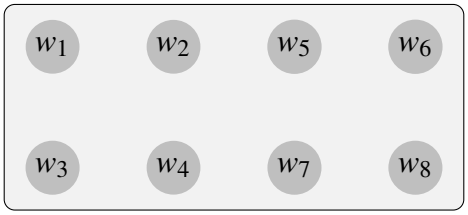
- Suppose $c = \{w_1, w_2, w_3, w_4, w_5, w_6, w_7, w_8\}$.

(31) ✓ $p = \{w_1, w_2, w_3, w_4\}, q = \{w_5, w_6, w_7, w_8\}$ ⇒ well-defined partition

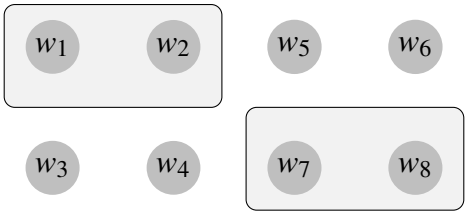


[7] See Appendix for a way to derive it, too.

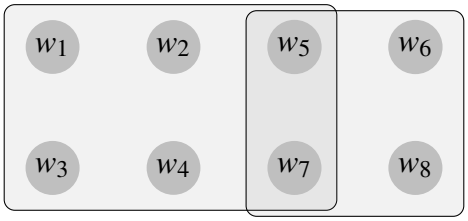
(32) ✗ $p = \{w_1, w_2, w_3, w_4, w_5, w_6, w_7, w_8\}$ ⇒ violation of non-triviality



(33) ✗ $p = \{w_1, w_2\}, q = \{w_7, w_8\}$ ⇒ violation of collective exhaustivity



(34) ✗ $p = \{w_1, w_2, w_3, w_4, w_5, w_6\}, q = \{w_5, w_6, w_7, w_8\}$ ⇒ violation of disjointness



- We leave it open where this disjointness condition comes from, but let us take it as a presupposition of *soo* for concreteness sake.

- Let $\textsc{disjoint}^{\Pi,K}(k)$ abbreviate (30).[8]

(35) $[\![so_i]\!]^{w,c} = \lambda e$: $\textsc{disjoint}^{\Pi,K}(k_i)$.[e realizes k_i]

- **Anti-factivity**:

- Suppose that *soo* is evaluated under the complement of a factive verb.

- Factivity inference for p requires that p is entailed in c, i.e. $c \subseteq p$.[9]

- (32) examplifies a relation between c and p when c entails p.

[8] One may assume that Π and K are existentially closed or they are contextually given.
[9] A simple presupposition $w \in p$ does not give us a clear picture of how it contradicts with the partition requirement.

- From (32), it either violates non-triviality or disjointness:

- if p is the only member of $c \notin \{\text{E-CONT}_w(k) : k \in \Pi(K)\}$, non-triviality is violated, and

- if there is q such that $p \neq q$ and $q \in \{\text{E-CONT}_w(k) : k \in \Pi(K)\}$, $q \subset p$ and thus disjointness is violated.

- Therefore, the conjunction of factivity presupposition and DISJOINT presupposition always leads to contradiction, giving rise to Logical triviality (Gajewski 2002:*et seq*).

- **Unavailability of question antecedent**:

- Suppose that *soo* takes an event-kind whose content is a question.

- Here, assume that denotations of declaratives and denotations of interrogatives have the same semantic type.

- Still, questions violate the non-triviality condition of (30) by virtue of being non-informative:

- the information content of a question is the same as c and thus it may never meet (30) as in (32).

- As a result, $\text{E-CONT}^{-}(Q)$ is undefined because an event-sub-kind associated with Q is undefined due to violation of non-triviality.

- Therefore, *soo* cannot find an event-sub-kind antecedent whenever its targeted antecedent is a question.

- **Taking stock**:

- Anti-factivity and unavailavility of question antecedent do not follow from vanilla propositional anaphora.

- However, these puzzling properties follow if one applies a general constraint on sub-kinds to their propositional contents as well.

- This hinges on the idea that propositional anaphora via manner adverbial pro-form makes reference to event-kinds.

- Thus, these two properties are now taken as pieces of support for our manner adverbial analysis of propositional anaphora.

5 Conclusion

- Clausal embedding comprises contentful individuals (at least underlyingly) (Kratzer 2006, Moulton 2009, 2015, Uegaki 2015, Elliott 2020:a.o.).

- Moulton (2015) argues that the English clausal anaphor *so* is an argument of a clause-taking predicate, while *that*-clauses are modifiers of an argument slot.

- In this view, it is puzzling why some languages adopt adverbial pro-forms, e.g., English *so*, Japanese *soo*, Mandarin *zheme*, for clausal anaphora.

• In our analysis, they have the semantics as a manner modifier.

- Nonetheless, CONT-based event-subkinds allow it to achieve clausal anaphora in exactly the same way as how *that*-clause combines with its content under event-based modifier analyses of *that*-clause (e.g., Elliot 2020).

- The presence of clausal anaphora via adverbial pro-forms offers a novel piece of support to the modifier view of clausal embedding.

• Furthermore, we have shown that a general disjointness constraint on sub-kinds derives anti-factivity and unavailavility of question antecedent with *soo*, which would remain puzzling, otherwise.

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Appendix: Some technical details

• **Disjointness condition on event-subkinds**:

- Domain of events D_v is closed under the sum operation '+' and partially ordered based on the sub-part relation '$\sqsubseteq$' (Link 1983:*et seq*).

- The basic mereological operations:

(36) a. Overlap: $x \circ y \Leftrightarrow \exists z[z \sqsubseteq x \& z \sqsubseteq y]]$
b. Generalised Sum: $\oplus \mathrm{P} = \iota x. \forall y[\mathrm{P}(y) \rightarrow y \sqsubseteq x] \& \forall z[z \sqsubseteq x \rightarrow \exists z'[\mathrm{P}(z') \& z' \circ z]]$

• The disjointness condition on event-subkinds is defined as (37).

(37) Let K the 'relevant' event-kind, and Π a partition function.
An event-subkind k is defined in a world w iff:

a.	$k \in \Pi(K)$,	(k is a subkind)
b.	$K \notin \Pi(K)$,	(non-triviality)
c.	$\oplus\Pi(K) = K$, and	(collective exhaustivity)
d.	$\forall k, k' \in \Pi(K)[\neg(k_w \circ k'_w)]$	(disjointness)

- We leave it open what kind of event-kind K is, but the easiest option is to say that K is an event-kind that has an information content, i.e. $K =^{\cap} (\lambda w \lambda e[e \in Dom(\textsc{e-cont}_w(e))])$.

• **Inquisitive setting**

- For a general reason and a specific reason, we assume that declaratives and interrogatives both denote a set of sets of possible worlds (Ciardelli et al. 2018:a.o.).

- An *information state* (state) s is a set of possible worlds.

- A proposition p is a *downward closed* set of information states.

(38) A set of states S is *downward closed* iff for any state $s \in S$, if there is another $s' \subseteq s$, $s' \in S$.

• Let W be the domain of possible worlds.

- The context c is a downward closed set of states.[10]

• One may single out the largest state which is not a subset of any other state.

(39) A state s is a *maximal state* of p iff for any state $s' \in p$, $s \not\subset s'$.

[10]The initial context $c_0 = \mathcal{P}(W)$.

- p is *inquisitive* iff p has more than one maximal states and p is *non-inquisitive* iff p has a unique maximal state.

• One may retrieve the information content of p by taking the grand union of its states.

(40) a. For any proposition p, INFO(p) = $\cup p$, where INFO(p) is the information content of p.
b. A proposition p is *informative* iff INFO(p) $\neq$ INFO(c).
c. A proposition p is *non-informative* iff INFO(p) = INFO(c).

- A declarative denotes an informative proposition and an interrogative denotes a non-informative proposition.

• From now on, we parametrise $[\![\,]\!]$ with c instead of w:

- $[\![\phi]\!]^c$=$\{s \in c : \forall w \in s\,[[\![\phi]\!]^w = 1]\}$, i.e. a set of sets of worlds in which ϕ is true.

• Accordingly, we parametrise E-CONT with INFO(c): it maps an event e to its content p relative to the information stored in c.

- One may assume an accessibility relation wRw' such that w' is compatible with the epistemic states of the interlocutors in w (cf. Stalnaker 2006: on common knowledge).

- This makes E-CONT$_w$=E-CONT$_{\cup c}$ iff $\cup c = \{w' : wRw'\}$.

- As a result, one may map E-CONT$_w$ to a unique corresponding E-CONT$_{\cup c}$ relative to R.

- We assume that for any e, E-CONT$_{\cup c}(e)$, if defined, is compatible with $\cup c$ (cf. Kratzer 2006, Moulton 2015)

• Lastly, the definition of kinds is adjusted.

- Recall $k = \lambda w\, \iota.P(w)$, where k is a kind associated with property P.

- So far, we have been implicitly assuming that E-CONT$_w(k)$=E-CONT$_w(k_w)$, where $k_w = \iota.P(w)$

- Now, we assume E-CONT$_{\cup c}(k)$=E-CONT$_{\cup c}(\oplus\{k_w : w \in \cup c\})$.

• We abbreviate $\oplus\{k_w : w \in \cup c\}$ as $k_{\cup c}$

• **Homomorphism from event-subkinds to their contents**

- We propose that E-CONT is a homomorphism from the partition of *ad hoc* event-subkinds to the partition of their propositional contents.

- More specifically, the following equation has to hold:

- E-CONT$_{\cup c}(e + e')$ =E-CONT$_{\cup c}(e) \cup$E-CONT$_{\cup c}(e')$

- Note that + and ∪ are join operations respectively in the mereology and in the set theory often used in theories of natural language semantics.

• It requires E-CONT function to be *cumulative* with respect to events and propositions,

- i.e. whenever $\text{E-CONT}_{\cup c}(e) = p$ and $\text{E-CONT}_{\cup c}(e') = q$, then $\text{E-CONT}_{\cup c}(e + e') = p \cup q$.

• Notice that if $\text{E-CONT}_{\cup c}(e) = p$ and $\text{E-CONT}_{\cup c}(e') = p$, then $\text{E-CONT}_{\cup c}(e + e') = p$

- e.g., if $p = \{s_1, ..., s_n\}$, $p \cup p = \{s_1, ..., s_n\} = p$.

• Now, the domain of E-CONT contains event-kinds without any effort.

(41) $\text{E-CONT}_{\cup c}(k) = \text{E-CONT}_{\cup c}(e_1 + ... + e_n)$ such that $\oplus\{e_1, ..., e_n\} = k_{\cup c}$
$= \cup\{\text{E-CONT}_{\cup c}(e) : e \text{ is a realisation of } k_{\cup c} \,\&\, \text{E-CONT}_{\cup c}(e) \cap \cup c \neq \emptyset\}$

• This can be extended to consider the value of $\text{E-CONT}_{\cup c}(K)$.

- We adopt the naive assumption that E-CONT is a function onto the domain of propositions compatible with $\cup c$: $\mathit{Range}(\text{E-CONT}_{\cup c}) = \{p : p \cap \cup c \neq \emptyset\}$.

- $\text{E-CONT}_{\cup c}(K) = \cup\{\text{E-CONT}_{\cup c}(e) : e \text{ is realisation of } K_{\cup c} \,\&\, \cup \text{E-CONT}_{\cup c}(e) \cap \cup c \neq \emptyset\}$

- As an abbreviation, let $c_K = \text{E-CONT}_{\cup c}(K)$.

- Whatever it is, $\cup c \subseteq \cup c_K \subseteq W$.

• We are ready to see how the disjointness condition on the event-subkinds leads to the partition condition on their contents.

- We assume that the relevant homomorphism is from the domain of events to the domain of 'classical' propositions, i.e. the information contents of propositions.

- $\text{INFO}(\text{E-CONT}_{\cup c}(e + e')) = \text{INFO}(\text{E-CONT}_{\cup c}(e)) \cup \text{INFO}(\text{E-CONT}_{\cup c}(e'))$

• (42) shows the effect of event-sub-kind disjointness condition on their propositional contents.

- Here, $k \circ k'$ in the domain of events corresponds to $p \cap q \neq \emptyset$ in the domain of propositions.

(42) a. $K \notin \Pi(K)$ (non-triviality)
$\rightarrow \text{INFO}(\text{E-CONT}_{\cup c}(K)) \notin \{\text{INFO}(\text{E-CONT}_{\cup c}(k)) : k \in \Pi(K)\}$
$= \cup c_K \notin \{\cup \text{E-CONT}_{\cup c}(k) : k \in \Pi(K)\}$

b. $\oplus\Pi(K) = K$ (collective exhaustivity)
$\rightarrow \cup\{\text{INFO}(\text{E-CONT}_{\cup c}(k)) : k \in \Pi(K)\} = \text{INFO}(\text{E-CONT}_{\cup c}(K))$
$= \cup\{\cup \text{E-CONT}_{\cup c}(k) : k \in \Pi(K)\} = \cup c_K$

c. $\forall k, k' \in \Pi(K)\,[\neg(k \circ k')]$ (disjointness)
$\rightarrow \forall k, k' \in \Pi(K)\,[\text{INFO}(\text{E-CONT}_{\cup c}(k)) \cap \text{INFO}(\text{E-CONT}_{\cup c}(k')) = \emptyset]$
$= \forall k, k' \in \Pi(K)\,[\cup \text{E-CONT}_{\cup c}(k) \cap \cup \text{E-CONT}_{\cup c}(k') = \emptyset]$

- This way, the proposed disjointness condition (30) on the contents of event-subkinds can be derived by letting E-CONT offer a homomorphism between the domain of event-subkinds and the domain of propositions.

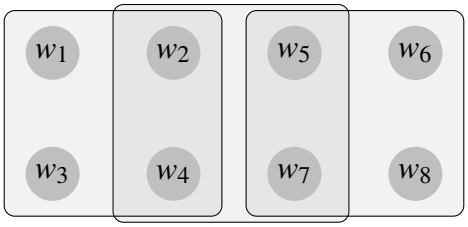
- It is not a new idea that homomorphism is called for when one applies a constraint on one domain to another domain, e.g., measurement (Krifka 1989, Nakanishi 2007, 2008, Champollion 2017:among many others).

- Our proposition disjointness condition can be taken as another case, in which a disjointness condition on one domain is applied to another domain via homomorphism.

• **Basic case**

- Suppose $\cup c_K = \{w_1, w_2, w_3, w_4, w_5, w_6, w_7, w_8\}$ and $\cup c = \{w_2, w_4, w_5, w_7\}$

(43) ✓$\cup p = \{w_1, w_2, w_3, w_4\}, \cup q = \{w_5, w_6, w_7, w_8\}$ ⇒ well-defined partition



• **Anti-factivity**

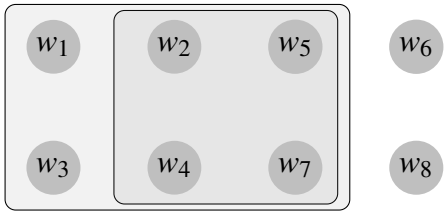
- We omit the $e \in Dom(\text{E-CONT}(w)(e))$ presupposition for an expository sake.

(44) a. Taro knows so$_i$.
b. Context: $\text{E-CONT}^{-}(p) = k_i$
c. $[\![soo_i]\!]^w = \lambda e : \text{PART}^{\Pi,K}(k_i).[e \text{ realizes } k_i]$
d. $[\![(44a)]\!]^w = \exists e : \cup c \subseteq \cup p \,\&\, \text{PART}^{\Pi,K}(k_i).[\ \text{AGENT}(e)=\text{Taro} \wedge \text{think}_w(e) \wedge e \text{ realizes } k_i\ ]$
Assertion: $\exists e.[\ \text{AGENT}(e)=\text{Taro} \wedge \text{think}_w(e) \wedge \text{E-CONT}_{\cup c}(e) = p]$
Presupposition: $\cup c \subseteq \cup p \,\&\, \text{PART}^{\Pi,K}(k_i)$
$= \cup c \subseteq \cup p \,\&\, \cup c_K \notin \{\cup \text{E-CONT}_{\cup c}(k) : k \in \Pi(K)\} \,\&\, \cup\{\cup \text{E-CONT}_{\cup c}(k) : k \in \Pi(K)\} = \cup c_K \,\&\, \forall k, k' \in \Pi(K)\, \forall k, k' \in \Pi(K)\, [\cup \text{E-CONT}_{\cup c}(k) \cap \cup \text{E-CONT}_{\cup c}(k') = \emptyset]$

- The context with a factivity inference looks as follows.

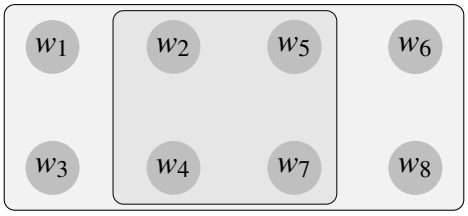
- Suppose $\cup c_K = \{w_1, w_2, w_3, w_4, w_5, w_6, w_7, w_8\}$ and $\cup c = \{w_2, w_4, w_5, w_7\}$

(45) ✓$\cup p = \{w_1, w_2, w_3, w_4, w_5, w_6\}$ and $\cup c \subseteq \cup p$ ⇒ Factivity inference for p



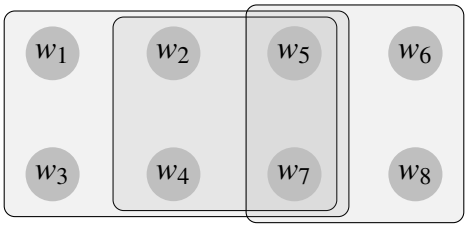
- $\cup c_K \notin \{\cup\text{E-CONT}(w)(k) : k \in \Pi(K)\}$ prohibits the following kind of context.

(46) ✗$\cup p = \{w_1, w_2, w_3, w_4, w_5, w_6, w_7, w_8\} = \cup c_K$ ⇒ violation of non-triviality



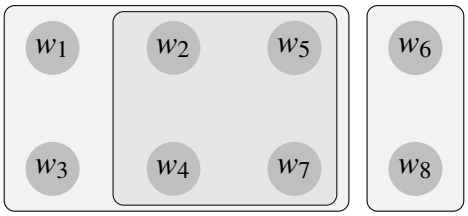
- As $\cup p$ alone does not cover $\cup c_K$, there has to be q such that $p \neq q$ and $\cup p \cup \cup q = \cup c_K$.
- However, recall that for any k, $\text{E-CONT}_{\cup c}(e) \cap \cup c \neq \emptyset$.
- This prohibits the following kind of context.

(47) ✗$\cup p = \{w_1, w_2, w_3, w_4, w_5, w_6\}$, $\cup q = \{w_5, w_6, w_7, w_8\}$ ⇒ violation of disjointness



- On this point, notice that $\cup p \cap \cup q = \emptyset$ entails $\cup c \cap \cup q = \emptyset$ since $\cup c \subseteq \cup p$.
- This means that the remaining possibility is also prohibited because q is not compatible with $\cup c$ and such a proposition is not in the range of $\text{E-CONT}_{\cup c}$.

(48) ✗ $\cup p = \{w_1, w_2, w_3, w_4, w_5, w_6\}$, $\cup q = \{w_7, w_8\}$ ⇒ violation of compatibility



- Therefore, all the possible configuration of $p, q \in \{\cup\text{E-CONT}_{\cup c} : k \in K(\Pi)\}$ leads to violation of some condition.
- i.e. the presupposition in (44a) always results in contradiction.
- Thus, this leads to ungramaticality via Logical analyticity.

• The gist is that any $\cup q$ cannot be disjoint with $\cup p$ and compatible with $\cup c$ at the same time as long as $\cup c \subseteq \cup p$.

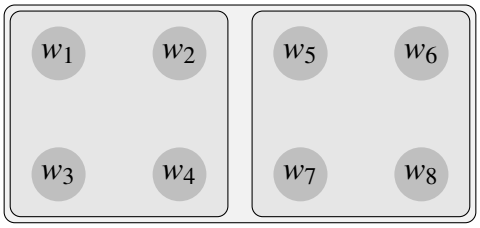
• **No inquisitive antecedent**

- The ?-operator and the inquisitive negation are defined below (Ciardelli et al. 2018).

(49) a. $[\![\phi?]\!]^c = [\![\phi]\!]^c \cup [\![\neg\phi]\!]^c$
b. $[\![\neg\phi]\!]^c = \{s : \forall s' \in [\![\phi]\!]^c [s \cap s' = \emptyset]\}$

• Suppose $c = \{w_1, w_2, w_3, w_4, w_5, w_6, w_7, w_8\}$

- If $\cup p = \{w_1, w_2, w_3, w_4\}$, then $\cup \neg p = \{w_5, w_6, w_7, w_8\}, \cup p? = \{w_1, w_2, w_3, w_4, w_5, w_6, w_7, w_8\} = \cup c$

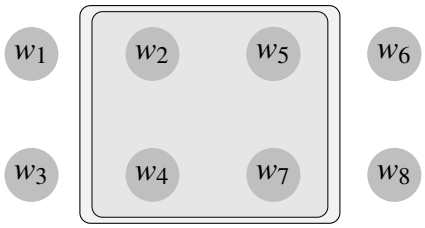


- Consider a case in which *soo* takes an inquisitive antecedent.

(50) a. Taro thinks so_i.
b. Context: $\text{E-CONT}^{-}(p?) = k_i$
c. $[\![soo_i]\!]^w = \lambda e : \text{PART}^{\Pi,K}(k_i).[e \text{ realizes } k_i]$
Presupposition: $\cup c_K \notin \{\cup\text{E-CONT}_{\cup c}(k) : k \in \Pi(K)\} \,\&\, \cup\{\cup\text{E-CONT}_{\cup c}(k) : k \in \Pi(K)\} = \cup c_K \,\&\, \forall k, k' \in \Pi(K)\, \forall k, k' \in \Pi(K)\, [\cup\text{E-CONT}_{\cup c}(k) \cap \cup\text{E-CONT}_{\cup c}(k') = \emptyset]$

- Suppose $W = \{w_1, w_2, w_3, w_4, w_5, w_6, w_7, w_8\}$ and $\cup c = \{w_2, w_4, w_5, w_7\}$

(51) $\cup p? = \{w_2, w_4, w_5, w_7\} = \cup c$ $\Rightarrow$ question



- By virtue of inquisitivity, $\cup p? = \cup c$ for any p.

• Suppose $\cup c = \cup c_K$.

- Since $\cup p? \in \{\cup\text{E-CONT}_{\cup c}(k) : k \in \Pi(K)\}$, $\cup c_K \in \{\cup\text{E-CONT}_{\cup c}(k) : k \in \Pi(K)\}$.

- This violates non-triviality.

• Suppose $\cup c \subset \cup c_K$.

- By supposition, there has to be q such that $p? \neq q$ and $\cup p? \cup \cup q = \cup c_K$

- Notice that this leads to the same situation as we saw in cases of factivity,

- i.e. $\cup p? = \cup c$, one may not meet the disjointness ($\cup p? \cap \cup q = \emptyset$) and the compatibility ($\cup c \cap \cup q \neq \emptyset$) at the same time.

• Thus, both cases lead to contradiction and the presupposition in (50a) always results in contradiction.

- Thus, this leads to ungramaticality via Logical analyticity.

• The gist is that $\cup p? = \cup c$ by virtue of inquisitivity.