Takuya Goro

Chapter 8
Cross-linguistic variation in the scope of disjunction: Positive polarity, or anti-reconstruction?

1 Introduction

In this chapter, we explore the scope behavior of disjunction operators in human languages, comparing two competing accounts for a cross-linguistic contrast in relative scope relations between disjunction and negation. We will begin with a comparison of English disjunction *or* and Japanese disjunction *ka*. The crucial observation is that while *or* is interpreted within the scope of local negation, *ka* resists such narrow-scope interpretations. While Goro (2007) argued that this is because Japanese *ka* is a Positive Polarity Item (the Positive Polarity Account), Shibata (2015) proposed that transitive objects in Japanese must move over local negation (the Anti-reconstruction Account). Although the two accounts are fundamentally different with respect to the assumptions on the source of the scope constraint, they are hard to tease apart on the basis of data from adult language. They happen to share an important assumption on the mechanism that determines the scope of disjunction, and consequently, make exactly the same predictions on the possible scope of disjunction.

In what follows, we will argue that empirical data from first language acquisition research shed light on the problem. The acquisition of the scope of disjunction has invoked extensive cross-linguistic studies, yielding empirical data from languages like Japanese, English, Russian, Mandarin, Turkish, Italian, French, Hungarian and Catalan, which allow us to obtain a fairly comprehensive understanding about what the acquisition of disjunction in different languages is like. And importantly, the two competing accounts yield different predictions on how young children would learn the scope restriction on the disjunction in the target language. We will review the body of empirical evidence in the first language acquisition to construct a testing ground for the predictions of the two accounts, and argue that the available data favors the Positive Polarity Account over the Anti-reconstruction Account.

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2 The scope of Japanese logical connectives

In classical logic, a negation of logical disjunction, ¬(P∨Q), is equivalent to a conjunction of two negative propositions: ¬P∧¬Q. Sentences in natural language sometimes manifest an inference pattern that highly resembles the logical law of equivalence. For example, the following English sentence in (1) which involves negation and disjunction, allows an *conjunctive inference*: that is, the truth-condition of the sentence can be recast with two conjoined negative sentences.

(1) *John does**n't** speak French **or** Spanish*
→ John doesn't speak French AND John doesn't speak Spanish

This *conjunctive interpretation* of disjunction *or* suggests that English *or* semantically corresponds to Boolean (inclusive) disjunction, and in (1) it is interpreted under the scope of negation. In normal contexts, native English speakers judge the sentence (1) to be false if John speaks either Spanish or French. In other words, *P: John speaks French* and *Q: John speaks Spanish* should both be false in order for the truth-condition of (1) to be satisfied.

This conjunctive interpretation of disjunction is subject to cross-linguistic variation. For example, the Japanese counterpart of (1) yields a somewhat different interpretation. It is most naturally paraphrased by a disjunction of two negated sentences.

(2)	*Taro-wa*	*huransugo*	***ka***	*supeingo-o*	*hanasa-**nai***
	Taro-TOP	French	or	Spanish-ACC	speak-NEG

Lit.[1] 'Taro doesn't speak French or Spanish
→ Taro doesn't speak French OR Taro doesn't speak Spanish

Thus, the truth condition of the Japanese sentence (2) does not require both of the disjuncts to be false, and (2) is judged to be true if, for example, Taro speaks either one of the languages, but not both. This interpretive contrast between English and Japanese has been observed in experimental studies. For example, in Grüter, Lieberman and Gualmini's (2010) L2 study, control groups of adult English and Japanese speakers were presented test sentences with negation and disjunction in their native languages. The crucial condition involved situations in which only one of the disjuncts was true (e.g., the horse ate the carrot, but didn't eat the pepper). While English speakers accepted the test sentences only 8% of the time, Japanese speaker's acceptance rate was 98%.

1 "Lit." means "a literal translation into English." The interpretation of the original example may differ from the interpretation of the literal translation.

One possible way to account for the interpretive contrast, especially the lack of conjunctive interpretation of disjunction *ka* in Japanese sentences like (2), is to assume that the semantics of Japanese *ka* is fundamentally different from that of English *or*, and therefore *ka* does not interact with negation in the same way as its English counterpart. Such a "semantic account," however, can be immediately rejected on the basis of the observation that *ka* yields conjunctive interpretation just the same as *or* if it appears in a subordinate clause embedded under matrix negation. The following examples illustrate that the contrast between *ka* and *or* evaporates in embedded contexts (cf. Goro 2007):

(3) English: verbal complement clause
*John did**n't** say that Mary speaks French **or** Spanish*
→ John didn't say that Mary spoke French AND
John didn't say that Mary spoke Spanish

(4) Japanese: verbal complement clause

Taro-wa	*Yuki-ga*	*huransugo*	***ka***	*supeingo-o*	*hanasu-to*
Taro-TOP	Yuki-NOM	French	or	Spanish-ACC	speak-COMP

*iwa-**nakat**-ta*
say-NEG-PAST
→ Taro didn't say that Yuki spoke French AND
Taro didn't say that Yuki spoke Spanish

(5) English: relative clause
John didn't see a student who speaks French or Spanish
→ John didn't see a student who speaks Spanish AND
John didn't see a student who spoke French

(6) Japanese: relative clause

Taro-wa	*huransugo*	***ka***	*supeingo-o*	*hanasu*	*gakusei-o*	*mi-**nakat**-ta*
Taro-TOP	French	or	Spanish-ACC	speak	student-ACC	see-NEG-PAST

→ Taro didn't see a student who speaks Spanish AND
Taro didn't see a student who spoke French

The parallel interpretations of Japanese and English counterparts suggests that the semantics of *ka* and *or* is essentially the same. The interpretive contrast in the single-clause examples (1) and (2) is, then, likely to occur because of a difference in relative scope between disjunction and negation. In English (1), *or* is interpreted within the scope of negation; but in Japanese (2), *ka* is taking scope over negation.

Let us note here that some other Japanese quantified objects may take scope under local negation, resulting in scope ambiguity, as illustrated in (7) and (8).

(7) *Taro-wa* ***zen'in****-o* *sikara-****nakat****-ta*
Taro-TOP everyone-ACC scold-NEG-PAST
Lit. 'Taro didn't scold everyone'
→ ∀>>¬: Taro scold nobody
→ ¬>>∀: It is not the case that Taro scold everyone

(8) *Taro-wa* *hon-o* ***san****-satu* *yoma-****nakat****-ta*
Taro-TOP book-ACC three-CL read-NEG-PAST
Lit. 'Taro didn't read three books'
→ THREE>>¬: There are three books that Taro didn't read
→ ¬>>THREE: It is not the case that Taro read three books

In (7), the universal quantifier *zen'in* 'everyone' occupies the object position of the negated main verb, and it can be interpreted under the scope of negation, yielding a "not all" interpretation. Similarly, the numeral *san* 'three' is attached to the direct object in (8), and the narrow-scope interpretation of the quantified object is possible. Therefore, narrow-scope interpretations of quantified objects under clausemate negation are not uniformly prohibited in Japanese. The scope of *ka* must be subject to some independent constraint that forces it to scope over local negation.

One characteristic property of the scope constraint imposed on *ka* is that it is clause-bound: although *ka* resists taking scope under negation in the same clause, it can be interpreted under the scope extraclausal negation, as shown in (4) and (6). Here, it is interesting to observe that Japanese conjunction *. . . mo. . .mo* exhibits exactly the same scope behavior: it cannot take scope under local negation, but narrow-scope interpretations under extraclausal negation are possible (cf. Goro 2007).

(9) *Taro-wa* *huransugo* ***mo*** *supeingo* ***mo*** *hanasa-****nai***
Taro-TOP French also Spanish also speak-NEG
Lit. 'Taro doesn't speak both French and Spanish
→ ∧>>¬: Taro doesn't speak neither French nor Spanish
* ¬>>∧: Taro doesn't speak both French and Spanish

(10) *Taro-wa* *Yuki-ga* *huransugo* ***mo*** *supeingo* ***mo*** *hanasu-to*
Taro-TOP Yuki-NOM French also Spanish also speak-COMP
*iwa-****nakat****-ta*
say-NEG-PAST
→ ¬>>∧: Taro didn't say that Yuki speaks both French and Spanish

(11) *Taro-wa huransugo* ***mo*** *supeingo* ***mo*** *hanasu gakusei-o*
Taro-TOP French also Spanish also speak student-ACC
*mi-****nakat****-ta*
see-NEG-PAST
→ ¬>>∧: Taro didn't see a student who speaks both French and Spanish

Thus, it is reasonable to assume that Japanese logical connectives, *ka* and *. . .mo. . .mo*, obey the same constraint(s) on scope. In the next section, we will review two different accounts for the scope behavior of Japanese connectives.

3 The Positive Polarity Account and the Anti-reconstruction Account

The first account is what we will call the Positive Polarity Account, proposed by Goro (2007). In a nutshell, Goro (2007) argue that *ka* and *. . .mo. . .mo* are Positive Polarity Items (PPIs). The idea that disjunctions some languages are PPIs was originally discussed in Szabolcsi (2002), which argued that Hungarian disjunction *vagy* is a PPI. Szabolcsi's argument is based on the observation that *vagy* lacks conjunctive interpretations in single-clause negative sentences, but conjunctive interpretations become available if *vagy i*s embedded under extraclausal negation (cf. Szabolcsi 2002).

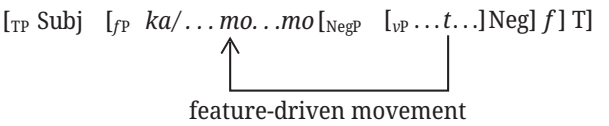
(12) ***Nem*** *csukt-uk be az ajtó-t* ***vagy*** *az ablak-ot*
not closed-1PL in the door-ACC or the window-ACC
Lit. 'We didn't close the door or the window'
→ We didn't close the door OR we didn't close the window

(13) ***Nem*** *hisz-em hogy becsulkt-uk volna az ajtó-t*
not think-1SG that in-closed-1PL AUX the door-ACC
vagy az ablak-ot
or the window-ACC
Lit. 'I don't think we closed the door or the window'
→ I don't think we closed the door AND I don't think we closed the window

Goro's analysis of Japanese *ka* and *. . .mo. . .mo* departs from Szabolcsi's (2002, 2004) in that it argues that positive polarity (i.e., obligatory wide-scope over local negation) is a consequence of syntactic movement. Goro argued that PPIs, including *ka*

and *. . .mo. . .mo*, have a weak uninterpretable feature in the sense of Chomsky (1995)[2] that must be checked in the specifier position of a specific functional projection. The projection is called *f* P, and assumed to be located right above NegP. Since *ka/. . .mo. . .mo* must move to the specifier position of the *f* P by the end of syntactic derivation, it always ends up in the position that is not c-commanded by local negation.

(14) *The movement analysis of positive polarity*



In the structure of (14), the raised object has its uninterpretable feature deleted at the specifier position of the local *f* P, and therefore it does not have to move anymore. It follows, then, that if there is negation in a higher clause, then *ka/. . . mo. . .mo* is interpreted under the scope of the extraclausal negation. The locality the scope constraint on *ka/. . .mo. . .mo* is thus captured by the syntactic movement analysis: the uninterpretable feature causes the object to move only locally, i.e., within the same clause, and hence it only affects relations of the elements within the domain of movement.

A set of supporting evidence for the syntactic account of positive polarity comes from observations on what Goro (2007) called *non-overt negations*. Several focus-related expressions in natural language make the sentences that involve them entail negated propositions. For example, sentences containing English focus-operator *only*, and its Japanese counterpart *dake*, entails negated propositions that involve alternatives of the focused element (cf. Horn 1969):

(15) a. ***Only*** *John speaks French*
b. *John-**dake**-ga* *huransugo-o* *hanasu*
John-only-NOM French-ACC speak
→ Everyone other than John does not speak French

When Japanese *ka* or *. . .mo. . .mo* cooccur with such a focus-related element, they yield the "Boolean," narrow-scope interpretation in the entailed negative proposition: conjunctive interpretation for *ka*, and "not both" disjunctive interpretation for *. . .mo. . .mo*. Thus, (16a) entails that *everyone other than Taro doesn't speak*

2 In the framework of Chomsky (1995), being a weak feature entails that the movement driven by the feature must occur covertly, without affecting the surface order of elements.

French AND doesn't speak Spanish; (16b) entails that *everyone other than Taro doesn't speak French OR doesn't speak Spanish.*

(16) a. *Taro-**dake**-ga* *huransugo* ***ka*** *supeingo-o* *hanasu*
Taro-only-NOM French or Spanish-ACC speak
→ For all x, x≠Taro, x doesn't speak French AND x doesn't speak Spanish
b. *Taro-**dake**-ga* *huransugo* ***mo*** *supeingo* ***mo*** *hanasu*
Taro-only-NOM French also Spanish also speak
→ "For all x, x≠Taro, x doesn't speak French OR doesn't speak Spanish"

Thus, the scope restriction on *ka/. . .mo. . .mo* does not apply to non-overt, semantic negations. This is exactly what the syntactic account of positive polarity predicts: the effect of the scope restriction as a consequence of syntactic movement is sensitive only to negations that have corresponding expressions within the relevant syntactic representations.[3]

This observation extends to cases that involve adverbs like *ayauku* 'nearly/almost', and *izure* 'eventually'. Sentences containing these adverbs entail a negative proposition, as shown in (17):

(17) a. *Taro-wa* ***ayauku*** *piza-o* *taberu* *tokoro-datta*
Taro-TOP nearly pizza-ACC eat the-moment-COP
"Taro nearly ate pizza"
→ Taro didn't eat pizza
b. *Taro-wa* ***izure*** *piza-o* *taberu*
Taro-TOP eventually pizza-ACC eat
"Taro will eventually eat pizza"
→ Taro has not eaten pizza yet

3 The following sentences with *sika-nai* have exactly the same (scope) interpretations as (16a/b), even though those sentences appear to involve overt negation:

a. *Taro-sika* *Huransugo* ***ka*** *supeingo-o* *hanasa-nai*
Taro-sika French or Spanish-ACC speak-NEG
→ For all x, x≠Taro, x doesn't speak French AND x doesn't speak Spanish
b. *Taro-sika* *huransugo* ***mo*** *supeingo* ***mo*** *Hanasa-nai*
Taro-only French also Spanish also speak-NEG
→ "For all x, x≠Taro, x doesn't speak French OR x doesn't speak Spanish"

This seems to be due to a peculiar property of the *sika-nai* construction: the position of *sika*-NP, rather than the negation morpheme, marks the scope of negation (See e.g., Kinuhata 2010 for relevant discussion).

In the negative entailments, *ka* and *. . .mo. . .mo* take scope under negation and yield the Boolean interpretations, just as predicted by the syntactic account of positive polarity (cf. Goro 2007).

(18) a. *Taro-wa* ***ayauku*** *piza* ***ka*** *pasuta-o* *taberu* *tokoro-datta*
Taro-TOP nearly pizza or pasta-ACC eat the-moment-COP
"Taro nearly ate pizza or pasta"
→ Taro didn't eat pizza AND Taro didn't eat pasta

b. *Taro-wa* ***izure*** *piza* ***ka*** *pasta-o* *taberu*
Taro-TOP eventually pizza or pasta-ACC eat
"Taro will eventually eat pizza or pasta"
→ Taro has not eaten pizza AND Taro has not eaten pasta

(19) a. *Taro-wa* ***ayauku*** *piza* ***mo*** *pasuta* ***mo*** *taberu*
Taro-TOP nearly pizza also pasta also eat
tokoro-datta
the-moment-COP
"Taro nearly ate both pizza and pasta"
→ Taro didn't eat pizza OR Taro didn't eat pasta

b. *Taro-wa* ***izure*** *piza* ***mo*** *pasuta-o* ***mo*** *taberu*
Taro-TOP eventually pizza also pasta also eat
"Taro will eventually eat both pizza and pasta"
→ Taro has not eaten pizza OR Taro has not eaten past

Another set of evidence concerns negative answers to a Yes-No question. In the dialogue illustrated in (20), the question asks whether or not the proposition *Taro speaks French* is true. The answer *Iie* 'No' asserts that the proposition is not true, and therefore, entails that the negation of the proposition.

(20) *Taro-wa* *huransugo-o* *hanasu-no?*
Taro-TOP French-ACC speak-Q
'Does Taro speak French?'
Iie
no
'No'

When disjunction *ka* or conjunction *. . .mo. . .mo* appears in the polar question, the negative answer invites the 'Boolean' inferences, in which those connectives are interpreted within the scope of negation. Thus, the negative answer in (21) is interpreted as meaning that Taro speaks neither French nor Spanish.

(21) *Taro-wa huransugo **ka** supeingo-o hanasu-no?*
Taro-TOP French or Spanish-ACC speak-Q
'Does Taro speak French or Spanish?'
Iie
no
→ Taro doesn't speak French AND Taro doesn't speak Spanish

Similarly, *. . .mo. . .mo* yields the "not both" interpretation within the following dialogue:

(22) *Taro-wa huransugo **mo** supeingo mo hanasu-no?*
Taro-TOP French also Spanish also speak-Q
'Does Taro speak both French and Spanish?'
Iie
no
→ Taro doesn't speak French OR Taro doesn't speak Spanish

These narrow-scope interpretations of *ka/. . .mo. . .mo* become unavailable once the negative answer is followed by a full sentence with overt negation. Therefore, (23) sounds awkward as an answer for the question in (21), because it can only be interpreted with the wide-scope reading of *ka*, and therefore, does not provide any useful information for resolving the polar question.

(23) *Iie, Taro-wa huransugo **ka** supeingo-o hanasa-nai-yo*
no Taro-TOP French or Spanish-ACC speak-NEG-SFP
Lit. 'No, Taro doesn't speak French or Spanish'
→ Taro doesn't speak French OR Taro doesn't speak Spanish

Likewise, only the wide-scope reading of *. . .mo. . .mo* is allowed in (24), and therefore it cannot mean the same thing as the one-word answer in (22).

(24) Iie, Taro-wa huransugo **mo** supeingo **mo** hanasa-nai-yo
no Taro-TOP French also Spanish also speak-NEG-SFP
Lit. 'No, Taro doesn't speak both French and Spanish'
→ Taro doesn't speak French AND Taro doesn't speak Spanish

Thus, it appears that the scope restriction on *ka/. . .mo. . .mo* is uniformly insensitive to non-overt negations. The contrast between overt and non-overt negations follows straightforwardly from the syntactic movement analysis of positive polarity: the scope

restriction is simply a consequence of syntactic movement, and thus only affects relations of the syntactically represented elements.

Let us now turn to another set of empirical support for the Positive Polarity Account. Given the proposed syntactic representation in (14), it is predicted that if the local sentential negation is raised to some higher position (e.g., the head of CP), it takes scope over *ka/. . .mo. . .mo* in the specifier of *f*P. Japanese conditional sentences provide a ground for testing this prediction. It has been observed that negation in the antecedent clause of a conditional sentence take scope over nominative-marked transitive subjects, although nominative-transitive subjects usually take wider scope than negation in an independent clause (cf. Goro 2007). Observe the contrast between (25) and (26):

(25) *Zen'in-ga* *syukudai-o* *dasa-nakat-ta*
everyone-NOM homework-ACC submit-NEG-PAST
Lit. 'Everyone didn't turn in the homework'
→ ∀ >>¬ / *¬>>∀

(26) *Mosi* *zen'in-ga* *syukudai-o* *dasa-nai-to* *sensei-wa*
if everyone-NOM homework-ACC submit-NEG-COMP teacher-TOP
okoru-yo
get-angry-SFP
Lit. 'If everyone doesn't turn in the homework, the teacher will get angry'
→ ∀ >>¬ / ¬>>∀

The sentence in (25) is unambiguous: the nominative-marked universal quantifier *zen'in* takes scope over negation, and thus the sentence means that nobody turned in the homework. In contrast, the narrow scope interpretation of *zen'in* is possible in (26), and it can be interpreted as meaning if it is not the case that everyone turns in the homework (i.e., if there is at least one person who fails to turn in the homework), the teacher will get angry. These data suggest that sentential negation in the antecedent of conditional sentences takes wider scope than negation in other kinds of clauses. Let us then assume, following Kato (1997), that in the antecedent of conditionals, negation is syntactically raised to the position from which it c-commands the nominative-marked subject in the specifier of TP. It follows from the assumption that such negation also c-commands anything below TP, including elements in *f*P in the proposed structure in (14). Therefore, the Positive Polarity Account predicts that *ka/. . .mo. . .mo* can be interpreted under the scope of negation in the antecedent of conditionals.

The prediction is borne out, as shown in (27) and (28):

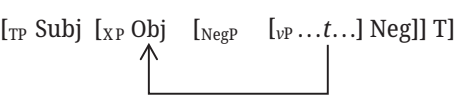
(27) *Mosi huransugo* ***ka*** *supeingo-o hanas-e-**nai**-to komaru-yo*
If French or Spanish-ACC speak-can-NEG-PAST be-in-trouble-SFP
Lit. 'If you don't speak French or Spanish, you'll be in trouble'
→ If you don't speak French AND you don't speak Spanish, you'll be in trouble

(28) *Mosi huransugo* ***mo*** *supeingo* ***mo*** *hanas-e-**nai**-to*
If French also Spanish also speak-can-NEG-PAST
komaru-yo
be-in-trouble-SFP
Lit. 'If you don't speak both French and Spanish, you'll be in trouble'
→ If you don't speak French OR you don't speak Spanish, you'll be in trouble

In (27) and (28), *ka* and *. . .mo. . .mo* is interpreted under the scope of local negation. In the antecedent of conditionals, negation takes wider scope than in, for example, an independent declarative clause. The observation that *ka* and *. . .mo. . .mo* are interpreted under the scope of local negation in this environment is neatly captured by the syntactic approach to positive polarity, which we call the Positive Polarity Account.

Thus far, we have reviewed the Positive Polarity Account of Japanese logical connectives, proposed by Goro (2007). The second account that we will turn to is found in Shibata (2015), and we call it the Anti-reconstruction Account. The Anti-reconstruction Account shares an important assumption with the Positive Polarity Account: it assumes that the scope constraint on Japanese logical connectives is a consequence of syntactic movement. In the Anti-reconstruction Account, however, the relevant movement operation applies to objects in general, rather than to specific lexical items that are PPIs (i.e., items that have a specific uninterpretable feature). Shibata (2015) argued that this movement is required to license the accusative case particle on the object. The obligatory movement of the object in negative transitive sentences are schematically illustrated in (29) (cf. Shibata 2015).

(29) *Object raising in Japanese*



Given the object raising in (29), the wide-scope interpretations of quantified objects in negative sentences in Japanese is accounted for. Note here that Japanese quantified objects in general may take scope over local negation (see (7) and (8) above).

This is in contrast with languages like English, in which some objects are not allowed to scope over negation. English disjunction *or*, and universal *every*, show such restricted scope patterns.

(30) *John does**n't** speak French **or** Spanish*
$^{OK}\neg>>\vee$; $^{*}\vee>>\neg$

(31) *John did**n't** buy **everything***
$^{OK}\neg>>\forall$; $^{*}\forall>>\neg$

Here we will not try to explain why *or* and *every* behave this way; for our current purpose, it is important to observe that in English wide-scope interpretations of objects in negative sentences seems to be more restricted than corresponding narrow-scope interpretations, but no such restrictions on wide-scope objects can be found in Japanese. This is neatly captured in the Anti-reconstruction account by the assumption of object raising in (29): since objects in general moves above negation in Japanese, they take scope over negation "as default".

Under the Anti-reconstruction Account, the narrow-scope interpretations of objects under local negation have to be derived via "reconstruction" of the moved object to its base position. Shibata (2015) argued that this reconstruction process cannot be applied to a certain set of lexical items including focus particles (*-mo* 'also', *-dake* 'only', etc.) and disjunction, because with these items the crucial operator is inserted acyclically after movement and determines its scope in the position where it is inserted.[4] Therefore, under the Anti-reconstruction account, the obligatory wide-scope of *ka* in (2), and *. . .mo. . .mo* in (9) is due to the unavailability of reconstruction for these elements.

Summarizing, we have reviewed the two accounts of the scope restriction imposed on Japanese disjunction *ka* (as well as conjunction *. . .mo. . .mo*). The Positive Polarity Account, on the one hand, assumes that the scope restriction is due to a property of the lexical item: *ka* is a PPI, which must move above negation. The

4 Shibata (2015) argued that for disjunction, a silent operator O_{ALT} proposed by Chierchia, Fox and Spector (2012) is acyclically inserted, and blocks reconstruction of the disjunctive phrase. However, this account does not really explain why reconstruction of the disjunctive object without O_{ALT} is not possible. The function of O_{ALT} is to exclude the alternative proposition associated with conjunction: for example, O_{ALT} (John or Tom) → NOT (both John and Tom), and hence, disjunction usually yields the exclusive-OR interpretation. However, this exclusive-OR interpretation does not arise when disjunction is interpreted in the scope of negation, which suggests that O_{ALT} is not inserted, or is cancelled, in this case. It is not clear, then, what exactly is a problem in reconstructing the disjunctive object without O_{ALT}, deriving the correct conjunctive interpretation under the scope of negation.

Anti-reconstruction Account, on the other hand, assumes that in Japanese objects in transitive sentences move above negation in the same clause, and a certain set of items such as *ka* cannot be reconstructed and interpreted within the scope of negation. Although the two approaches differ fundamentally with respect to the assumptions about what moves and why it moves, they are quite hard to tease apart, because they share the assumption that the scope constraint is a consequence of syntactic movement. Thus, the locality effect of the scope constraint, its insensitivity to non-overt negations, and narrow-scope interpretations in the antecedent of conditionals are equally accounted for by either of the accounts, exactly in the same manner: the relevant syntactic movement only affects relations of elements in the syntactic domain of the movement. In fact, the two accounts yield exactly the same predictions with regard to what kind of scope interpretations are possible for items like disjunction *ka*. As is obvious in (14) and (29), the landing sites of the movement proposed in these accounts are essentially the same position – somewhere between the subject and negation. Since the landing sites of the movement that determines the scope of *ka* are essentially the same in the two accounts, their predictions about the scope of *ka* are inevitably the same. Given the difficulty to empirically distinguish the two alternative accounts with the data from adult language, we will look into the realm of first language acquisition studies.

4 Predictions on first language acquisition

Let us first consider a possible acquisition scenario under the Anti-reconstruction Account. In this scenario, children acquiring Japanese need to learn that transitive objects must move above negation. Since Japanese is a verb-final language and negation is suffixed onto the verb, surface word orders provide children little evidence with regard to the relative syntactic hierarchy between the object and negation. Let us then assume that children resort to scope interpretations to determine whether Japanese objects must move above negation: once the child observes a certain amount of cases in adult utterances where the object is obviously taking scope over negation, she concludes that Japanese objects obligatorily move to a position higher than negation. Under this scenario, Japanese children learn that syntactic objects in general take scope over negation, regardless of what kind of lexical item fills the object position. Therefore, it is predicted that children acquire adult-like wide-scope interpretations of various scope-bearing objects (e.g., disjunction, conjunction, universals, , etc.) "at the same time." For example, if a child exhibits adult-like wide-scope interpretation with disjunction *ka* in the object position of simple negative sentences, then it is predicted that the same child assigns the

same wide-scope interpretation to conjunction *. . .mo. . .mo*, and vice versa. In other words, the Anti-reconstruction Account predicts that the developmental timings of the emergence of adult-like wide-scope interpretations of different lexical elements should coincide.

Under the Positive Polarity Account, on the other hand, children learn the property of individual lexical items: whether or not the item is a PPI. Therefore, at a certain developmental stage, it is possible that children have different assumptions for each individual lexical item; for example, a child may go through a stage in which she assumes that *. . .mo. . .mo* is a PPI, while *ka* is not. In such a case, she would assign obligatory wide-scope interpretations to *. . .mo. . .mo* appearing in the object position of simple negative sentences, but she would also allow non-adult narrow-scope interpretations of *ka* in the same context.

This kind of developmental dissociation is not only possible, but also predicted to occur under the Positive Polarity Account combined with certain learnability assumptions (e.g., Goro 2007, 2015; Crain 2012; Pagliarini, Crain and Guasti 2018; Shimada and Goro 2021). First, it is widely assumed that "negative evidence" does not play a crucial role in first language acquisition (e.g., Pinker 1989), and the lack of negative evidence is especially acute within the domain of the acquisition of scope (Goro 2007). Under this assumption, children's hypotheses regarding the target grammar must be constrained so that they can be corrected, if necessary, on the basis of positive evidence alone. Goro (2007), among others, proposed that children's hypotheses are constrained by the Semantic Subset Principle (e.g., Crain, Ni and Conway 1994; Crain and Thornton 1998). The Semantic Subset Principle dictates children to start off from the hypothesis that yields the interpretation which is true in a narrower range of circumstances. Suppose, now, with disjunction *ka*, the relevant options are: (i) *ka* is a PPI, and (ii) *ka* is not a PPI. When *ka* appears in the object position of simple negative sentence, the former option (i) leads to the wide-scope, disjunctive interpretation: *not P OR not Q*. In contrast, the latter option (ii) leads to narrow-scope, conjunctive interpretation of disjunction: *not P AND not Q*. The latter interpretation is a "semantic subset" of the former interpretation in that it is true in a narrower range of situations. Therefore, given the Semantic Subset Principle, it is predicted that children's initial hypothesis is that *ka* is not a PPI. With this initial assumption, it is possible for children to discover that *ka* is actually a PPI on the basis of positive evidence alone: they just need to witness adults use the crucial form (i.e., simple negative sentence with *ka* in the object position) in a situation where it is clear that only one of the relevant disjuncts is false.

Importantly, this prediction is reversed with the conjunction *. . .mo. . .mo*. Here, the options are (i) *. . .mo. . .mo* is a PPI, and (ii) *. . .mo. . .mo* is not a PPI. In negative contexts, the option (i) leads to wide-scope interpretations of conjunction: *not P AND not Q*. The option (ii), on the other hand, yields narrow-scope interpretations of

conjunction: *not (both P and Q) = not P OR not Q*. Since the former interpretation is a semantic subset of the latter, the Semantic Subset Principle predicts that this is the initial hypothesis that children adhere to until they encounter falsifying evidence. In other words, for Japanese children, *. . .mo. . .mo* is a PPI from the beginning.

Furthermore, under the Positive Polarity Account with the Semantic Subset Principle, the same prediction is extended to the acquisition of disjunction and conjunction in any other language; that is, irrespective of the property of the target language, children should initially treat disjunction as not a PPI, and conjunction as a PPI. Thus, children across different linguistic communities should initially assign narrow-scope interpretation to disjunctive objects, and wide-scope interpretation to conjunctive objects, in simple negative sentences. Therefore, for children acquiring a language like Japanese (both disjunction and conjunction take wider scope than negation), the timings of emergence of the adult-like wide-scope interpretations are predicted to differ for disjunction and conjunction: while conjunction should show adult-like wide-scope from the beginning, wide-scope disjunction should be late-emerging.

Summarizing, the Anti-reconstruction Account and the Positive Polarity Account yield significantly different predictions regarding how the (alleged) adult knowledge is acquired in Japanese. Under the Anti-reconstruction account, children learn *a property of language*: whether or not syntactic objects move above negation. In contrast, under the Positive Polarity account, what children learn is *a property of lexical items*: whether or not each item is a PPI. Therefore, the Anti-reconstruction Account predicts that adult-like wide-scope assignments to various scope-bearing objects in negative sentence is acquired "at the same time." On the other hand, the Positive Polarity Account does not predict such a developmental correlation, and when combined with certain learnability assumptions, it predicts that the acquisition of wide-scope for disjunction should be acquired later than the acquisition of wide-scope for conjunction.

In what follows, we are going to review existing empirical data on the first language acquisition of scope to examine the predictions of the two approaches. Acquisition of scope (especially relative scope between sentential negation and another scope-bearing element) has attracted a lot of attention in first language acquisition research (e.g., Musolino, Crain and Thornton 2000; Lidz and Musolino 2002; Gualmini 2004; Goro and Akiba 2004; Zhou and Crain 2009; Viau, Lidz and Musolino 2010; Han, Lidz and Musolino 2016; Pagliarini, Crain and Guasti 2018; Shimada and Goro 2021, a.o.), and the mounting empirical data in this domain allow us to have a fairly comprehensive cross-linguistic picture of the developmental trajectories of scope interpretations. Our main focus will be on the data from Japanese, because the Anti-reconstruction Account was originally proposed specifically for Japanese, but we will also turn to the data from various different languages, in order to examine the predictions of the Positive Polarity Account.

5 The acquisition of scope in negative sentences

5.1 Japanese children and their lack of bias towards isomorphic scope interpretation

In the early 2000s, much of the first language acquisition studies on children's scope interpretations revolved around the *Observation of Isomorphism*, first reported by Musolino (1998), and then made widely acknowledged by Musolino, Crain and Thornton (2000). The relevant observation is that young English-speaking children's scope interpretations appear to be restricted to "isomorphic" ones, i.e., ones that correspond to the surface syntactic hierarchies. That is, for example, young children showed non-adult bias towards the narrow scope interpretation of the object QNP in the following test sentence:

(32) *The detective didn't find someone/some guys.*

In the adult interpretation, the indefinite existential object *someone/some guys* take wider scope than negation. In fact, when English-speaking adults were presented the sentence as a description of a situation where the detective found some of his friends but missed one (i.e., there is someone that the detective didn't find), they judged the sentence as "true" 100% of the time. Children's acceptance rates of the test sentence in the same situation were much lower, however: 35% for the younger group (age 3;10 to 5;2) and 65% for the older group (age 5;2 to 6;6). Thus, it appeared that children, especially the younger ones, had a strong tendency to interpret the sentence (32) as *the detective didn't find anyone*, adhering to the "isomorphic", narrow-scope interpretation of the existential indefinite in the object position.

The same kind of bias towards isomorphic interpretation was also observed with universally quantified NPs in the subject position. Musolino, Crain and Thornton reported that children at around age 5 overwhelmingly rejected (acceptance rate = 7.5%) the following test sentence as a description of a situation in which some, but not every horse jumped over the fence:

(33) *Every horse didn't jump over the fence.*

Children's reluctance to accept the sentence in this situation suggested that they didn't access the narrow-scope, "inverse" interpretation of *every* (i.e., "Not every horse jumped over the fence"), which are easily available for adult speakers. This pattern of children's response contrasted with the case where *every* appeared in the object position of a negative sentence, in which they showed no problem in accessing the "not every" interpretation:

(34) *The Smurf didn't buy every orange*.

When this sentence was presented under the situation where the Smurf bought some, but not every orange, children accepted the sentence 85% of the time. Thus, it looked as though young English-speaking children systematically interpreted the relative scope between negation and quantified NPs on the basis of their position in syntax: the subject scopes over negation, and the object scopes under negation.

Musolino, Crain and Thornton (2000) proposed a grammatical account for the non-adult bias towards isomorphic scope interpretations that English-speaking children show. They argued that children's grammar is essentially like adult grammar of Mandarin Chinese, where non-isomorphic interpretations are not possible:

(35) *Mei-pi ma dou mei tiao-guo langan*
'Every horse didn't jump over the fence'
∀(x) [horse(x) →¬ jump over the fence(x)] (every > not)

But this grammatical account was quickly abandoned, after subsequent experimental studies repeatedly found that manipulations on experimental designs made English-speaking children access non-isomorphic scope readings. For example, Gualmini (2004) demonstrated that children consistently accepted adult-like wide-scope reading of *some* in sentences like (32) when the relevant test sentences were used to point out the discrepancy between the expectation built up in the experimental context and the actual outcome. Musolino and Lidz (2002) found that children's performance on inverse scope was greatly improved when the negative test sentence like (33) was preceded by a positive lead-in (e.g., *Every horse jumped over the fence, but every horse didn't jump over the barn*). Furthermore, Zhou and Crain (2009) showed that children acquiring Mandarin Chinese assigned inverse scope interpretations to sentences like (35), thereby rejecting the idea that the Mandarin-type "isomorphic" grammar is the universal default option that children initially take.

As for the acquisition of Japanese, previous studies generally agreed that children's scope interpretations are not restricted to isomorphic ones. Let us first review Terunuma's (2001) study that examined Japanese children's interpretation of negative sentences containing a universally quantified NP. A sample test sentence is given in (36):

(36) *Tora-wa ninjin-o* ***zenbu*** *tabe-**nakat**-ta yo*
tiger-TOP carrot-ACC all eat-NEG-PAST SFP
Lit. 'The tiger didn't eat all the carrots'

The test sentence was paired with two kinds of experimental stories: in the first version, the tiger didn't eat any of the carrots, corresponding to the wide-scope interpretation of the object; the other story was that the tiger ate some of the carrots, but not all, which corresponds to the narrow-scope, "isomorphic interpretation of the quantified object. The results were that Japanese children accepted the test sentence almost 100% of the time in the first condition, but in the second condition, younger children's (age 3;10 to 4;7) acceptance rate was dropped to 37.5%, and older children (4;8 to 5;1) accepted the narrow-scope interpretation 70.8% of the time. Therefore, if anything, Japanese children showed bias towards *non*-isomorphic, wide-scope interpretation of the universally quantified object. The reason why they showed such a non-isomorphic bias is not entirely clear, but for our current purpose, it suffices to note that even younger Japanese children successfully accessed adult-like wide-scope interpretations of universally quantified objects in negative sentences.

Turning now to Japanese children's interpretation of negative sentences containing an indefinite existential, relevant data can be found in Goro and Akiba (2004). In their experiment, Goro and Akiba used the following test sentence, in which *nanika* 'something' appears in the object position:

(37) *Butasan-wa* ***nanika*** *tabe-**nakat**-ta*
pig-TOP something eat-NEG-PAST
Lit. 'The pig didn't eat something'

The test sentence was presented in the situation that matched the wide-scope interpretation of *nanika*: there were three pieces of food, and the pig only ate two of them; that is, there was something that the pig didn't eat. The result was straightforward: Japanese children at around age 5 accepted the sentence 88.3% of the time. This suggests that the children accessed the adult-like wide-scope interpretation of *nanika*, because the narrow-scope counterpart (i.e., 'It is not the case that the pig ate something') would have made the sentence false in the situation. Therefore, Terunuma's (2001) observation that Japanese children showed no problem with interpretations in which the object takes scope over negation was replicated, with a different type of quantificational element.

Given the empirical evidence so far, it seems safe to conclude that Japanese children, at least at around age 5, are not restricted to isomorphic scope interpretations, and crucially, are able to interpret the object as taking scope over negation. Under the Anti-reconstruction Account, this would be interpreted as showing that 5-year-olds acquiring Japanese have already mastered the obligatory raising of syntactic objects. Then, it is predicted that children at the same age would also interpret the disjunction *ka* and the conjunction *. . .mo. . .mo* in negative sentences

in adult-like manner, assigning them wide-scope interpretations. Let us see if this prediction is borne out.

5.2 Children's scope assignments to *ka* and *. . .mo. . .mo*

As we have reviewed, Japanese disjunction *ka* and conjunction *. . .mo. . .mo* must take scope over local negation. Therefore, under adult interpretation, the following test sentences from Goro and Akiba's (2004) study are assigned the wide-scope interpretations of the object:

(38) *Butasan-wa ninjin* ***ka*** *piiman-o tabe-**nakat**-ta*
pig-TOP carrot or pepper-ACC eat-NEG-PAST
Lit. 'The pig didn't eat the carrot or the pepper'
→ The pig didn't eat the carrot OR he didn't eat the pepper

(39) *Butasan-wa ninjin* ***mo*** *piiman* ***mo*** *tabe-**nakat**-ta*
pig-TOP carrot also pepper also eat-NEG-PAST
Lit. 'The pig didn't eat both the carrot and the pepper'
→ The pig didn't eat the carrot AND he didn't eat the pepper

Goro and Akiba sought to determine whether Japanese-speaking children also assign the same wide-scope interpretation to *ka* and *. . .mo. . .mo*. In their experiment, the crucial test condition involved a story in which a pig is invited to play an "eating game." In the game, the pig tried to eat two kinds of vegetables, a carrot and a pepper, and he managed to eat the carrot, but didn't eat the pepper. The test sentence (38) or (39) was presented in this situation.[5] Under adult interpretation, (38) is true, and (39) is false. In fact, adult native speakers of Japanese in the control group accepted (38) 100% of the time, while rejecting (39) 100% of the time.

Thirty Japanese speaking children at age 3;7 to 6;3 (mean: 5;3) participated in the experiment. Children's response pattern with the test sentence (39), namely the one involved the conjunction *. . .mo. . .mo*, was pretty much the same as adults': they rejected the *. . .mo. . .mo* sentence 95% of the time. This response pattern strongly suggests that at around age 5, Japanese children are able to assign the adult-like wide-scope interpretation to the conjunction *. . .mo. . .mo* appearing in the object

5 This is a simplified description of the experimental design. For full description and the logic behind it, see Goro and Akiba (2004) and Goro (2017). In a nutshell, the crucial test sentences were presented as the puppet's guess about what had happened in the eating game, in order to satisfy the felicity conditions associated to the use of disjunction and negation.

position of simple negative sentences. In contrast, children's performance with the test sentence (38), the one involved the disjunction *ka*, diverged from that of adults. Their acceptance rate was only 25%, which is in stark contrast with the 100% acceptance by adults. Among 30 children in the experiment, only 4 were fully adult-like, in that they consistently accepted the relevant test sentences across different trials. The remaining 26 children, in contrast, rejected the crucial test sentences 87% of the time. Most of those children justified their negative judgment by saying either "because the pig did eat one of the vegetables" or "because it is only one of the vegetables that the pig didn't eat." Therefore, for the vast majority of Japanese-speaking children at around age 5, it appeared that sentences like (39) have non-adult, "conjunctive" truth condition: The pig didn't eat the carrot AND he didn't eat the pepper.

One possible explanation for Japanese children's conjunctive interpretation of *ka* in negative sentences is that, as predicted by the Positive Polarity Account, they interpreted *ka* under the scope of negation. Although this does not correspond to the adult interpretation of the relevant sentences in Japanese, it has been observed that English-speaking children at around the same age are capable of correctly computing the semantic interaction between disjunction and negation, assigning a conjunctive truth condition to sentences when appropriate (e.g., Crain et al. 2002; Gualmini and Crain 2005). Thus, it should not be surprising that Japanese children who have independently learned the semantics of *ka* and negation are also capable of computing conjunctive interpretation of *ka* when it scopes under negation. However, such non-adult, narrow-scope assignment to *ka* is unexpected under the Anti-reconstruction Account. Remember that Japanese children at around age 5 are able to assign adult-like wide-scope interpretations to universal *zenbu*, indefinite *nanika*, and conjunction *. . .mo. . .mo* appearing in the object position of negative sentences. If those wide-scope interpretations are driven by obligatory raising of syntactic objects, then it remains quite mysterious why only *ka* is not subject to the movement and resists the wide-scope interpretation at age 5.

Thus, existing empirical evidence does not support the prediction of the Anti-reconstruction Account. Before concluding, however, we must consider one possible alternative interpretation of Japanese children's behavior with the disjunction *ka*. Suppose that children somehow interpret *ka* as a conjunction, rather than disjunction. Recently, Singh et al. (2016) proposed that English-speaking 5-year-olds may derive a conjunctive interpretation from disjunction *or* through the mechanism called *strengthening*.[6] Tieu et al. (2017) followed this position, and argued on the

6 Under Singh et al.'s (2016) model, the strengthening mechanism consists of recursive application of the exhaustive operator EXH, which derives so-called free-choice interpretation of disjunction in adult languages. The only difference between children and adults in this model is whether or not

basis of their experimental data that French- and Japanese-speaking children also accessed the strengthened, conjunctive interpretation of disjunction in each respective language. Given the strengthening mechanism, we can come up with an alternative derivation of the conjunctive truth conditions of the crucial test sentences of Goro and Akiba's study in the following steps: (i) applying syntactic movement to the object *ka*, making it scope above negation, (ii) strengthening the meaning of *ka*, arriving at a conjunctive interpretation of the lexical item, and (iii) computing the truth condition of the whole sentence as "not P AND not Q." This alternative explanation is perfectly compatible with the Anti-reconstruction Account, because it involves movement of the object over negation. Therefore, it is now necessary to determine the source of Japanese children's conjunctive interpretation of *ka* in negative sentences, i.e., whether it is because of non-adult narrow-scope assignment, or non-adult strengthening.

Shimada and Goro (2021) recently embarked on the research project to investigate Japanese children's interpretation of *ka* in the subject and the nominative object of negative sentences. The crucial assumption here is that Japanese nominative subjects and nominative-marked objects are syntactically higher than negation. First, nominative-marked subjects in Japanese generally resist taking scope under negation, as in the following example:

(40) ***Zen'in**-ga* *susi-o* *tabe-**nakat**-ta*
everyone-NOM sushi-ACC eat-NEG-PAST
Lit. 'Everyone didn't eat sushi'
$^{OK}\forall >> \neg$; $^{*}\neg >> \forall$

Second, in contrast to accusative objects, nominative-marked objects must take scope over negation (e.g., Koizumi 1994, 1995)

(41) a. *Taro-wa* *susi-**dake**-o* *tabe-rare-**nai***[7]
Taro-TOP sushi-only-ACC eat-CAN-NEG
→ ¬>>ONLY: "It is not the case that Taro can eat only sushi (i.e., he needs something else to eat with it

an appropriate lexical alternative for disjunction *or* is retrieved in on-line processing. See Singh et al. (2016) for more details.

7 With a non-stative predicate, Japanese nominative objects are licensed by the potential morpheme *-rare-* (e.g., Kuno 1973). This morpheme is not required to make the sentence (41a) grammatical, but it is inserted to keep it minimally different from the nominative-object counterpart (41b).

b. *Taro-wa susi-**dake**-ga tabe-rare-**nai***
Taro-TOP sushi-only-NOM eat-CAN-NEG
→ ONLY>>¬: "Sushi is the only thing that Taro cannot eat (i.e., he can eat everything else)

Given these observations, Shimada and Goro assumed that Japanese children would interpret *ka* outside the scope of sentential negation if it appears in the nominative subject position or in the nominative object position. However, if children's conjunctive interpretations of *ka* that were observed in Goro and Akiba (2004) are due to strengthening (with the movement of objects above negation), then they are predicted to persist in those environments. In other words, if children move objects above negation and apply strengthening to derive conjunctive interpretation of *ka*, then they should do the same with *ka* which are already higher than negation, and access a conjunctive truth condition.

Shimada and Goro carried out three experiment to test the prediction. In Experiment 1, the crucial test sentence involved *ka* within the accusative-marked object. The purpose of this is to replicate the results of previous studies. In Experiment 2, *ka* is placed within the nominative subject. The crucial test sentence of Experiment 3 is minimally different from the one in Experiment 1, in which the object is marked by nominative *-ga*.

(42) *Experiment 1: ka in accusative object*
*Risusan-wa piiman **ka** ninjin-o tabe-re-**nakat**-ta*
squirrel-TOP pepper Or carrot-ACC eat-CAN-NEG-PAST
Lit. "The squirrel couldn't eat the pepper or the carrot"

(43) *Experiment 2: ka in nominative subject*
*Zousan **ka** butasan-ga ninjin-o tabe-re-**nakat**-ta*
elephant or pig-NOM carrot-ACC eat-CAN-NEG-PAST
Lit. "The elephant or the pig couldn't eat the pepper"

(44) *Experiment 3: ka in nominative object*
*Risusan-wa piiman **ka** ninjin-ga tabe-re-**nakat**-ta*
squirrel-TOP pepper or carrot-NOM eat-CAN-NEG-PAST
Lit. "The squirrel couldn't eat the pepper or the carrot"

In the experiments, the crucial test sentences were presented in situations that matched the wide-scope, disjunctive interpretation of *ka* (e.g., the squirrel could eat the pepper, but couldn't eat the carrot). In experiment 1, children at around age 5 accepted the crucial test sentence 46.6% of the time. That is, about half of

the time, Japanese children assigned a conjunctive truth condition to the test sentences, thereby replicating the findings in the previous study by Goro and Akiba. In contrast, children in Experiment 2 and 3 overwhelmingly accepted the test sentences: the acceptance rate was 96.7% in Experiment 2, and 93.3% in Experiment 3. That is, children ceased to assign conjunctive interpretations to *ka* when it appears in a syntactic position that is higher than negation. This in turn means children's conjunctive interpretation of *ka* in Experiment 1 (and previous studies) cannot be reduced to strengthening, and therefore, the Anti-reconstruction Account cannot be maintained by resorting to the strengthening account of children's conjunctive interpretation of disjunction. Japanese children's interpretation of *ka* in negative sentences is modulated by syntax, and this suggests that their non-adult conjunctive interpretation of *ka* is mainly due to non-adult scope assignment.

Summarizing so far, we have reviewed empirical evidence that demonstrates adult-like wide-scope interpretations of various quantificational objects in Japanese are acquired at different developmental timings. At around age 5, Japanese children have acquired the adult-like wide-scope interpretations for the universal *zenbu*, the existential *nanika*, and the conjunction *. . .mo. . .mo*. However, they adhere to narrow-scope interpretation of the disjunction *ka* appearing in the accusative object position negative sentences, resulting in non-adult conjunctive interpretations of disjunction. Combined together, these data run counter to the prediction of the Anti-reconstruction Account. It appears that Japanese children are not learning to move syntactic objects in general over negation. Rather, they seem to be learning properties of each lexical item, and depending on factors such as whether the default hypothesis that children generate for each item (e.g., whether or not it is a PPI) happens to match the target, or how often the crucial evidence for learning the target appears in the input data, the timings of the emergence of target-like interpretations vary. Given these considerations, we conclude that the acquisition data from Japanese children supports the Positive Polarity Account, and strongly suggests that the scope behavior of Japanese disjunction *ka* is due to a property of the lexical item, rather than due to a property of the language.

5.3 The acquisition of disjunction: A review of cross-linguistic data

In the previous section, we argued that empirical data regarding Japanese children's scope interpretations favored the Positive Polarity Account over the Anti-reconstruction Account as an explanation for why Japanese logical connectives (i.e., disjunction and conjunction) must take scope over local negation. We now turn to cross-linguistic data, to see if we can find further supports for the Positive Polarity

Account. Remember the Positive Polarity Account (combined with specific learnability assumptions) predicts that children's universal default hypothesis is that disjunction is *not* a PPI (and conjunction is a PPI[8]). Therefore, even in languages in which disjunction exhibits PPI-properties (e.g., obligatory wide-scope over local negation), young children should initially show non-adult bias towards the narrow-scope, conjunctive interpretation of disjunction appearing in the object position of simple negative sentences. In what follows, we will review data from various experimental studies, focusing on the results from the conditions that meet the following criteria: (i) the crucial test sentences involve sentential negation and a disjunction phrase in the object position, and (ii) the task is to judge if the test sentence matches a "not P OR not Q" situation.

Russian

Verbuk (2006) investigated Russian-speaking children's interpretation of sentences containing negation and disjunction. A sample test sentence is given in (45):

(45) *Koška* ***ne*** *našla klučik* ***ili*** *zerkal'ce*[9]
Cat not find key or mirror
Lit. 'The cat did not find the key or the mirror'

The task was picture-matching, and two pictures were presented with the test sentence. Picture One depicted a cat having one box which contained either a key or a mirror. In Picture Two, there was a cat, but with no boxes. The logic behind this design is that if the participant assigns a wide-scope, disjunctive interpretation to the disjunction *ili* in the test sentence, then she should choose Picture One; conversely, if the participant interprets *ili* under the scope of negation, computing a conjunctive truth condition, then she should choose Picture Two. The results were as follows. First, Russian adults in the experiment consistently chose Picture One, suggesting that the wide-scope, disjunctive interpretation of *ili* is the default interpretation in adult Russian. Russian children (Mean age: 5;4), in contrast, chose

8 Cross-linguistic data regarding the acquisition of the scope of conjunction are still much smaller than those of disjunction, and we are not going to discuss them independently in this paper. See Crain et al. (2013) for data from Mandarin and English, in which children assigned wide-scope interpretations to conjunction in negative sentences.

9 In the actual experiment of Verbuk (2006), this test sentence was embedded within a larger "carrier" sentence, probably in an attempt to make the test sentences sounds as natural as possible.

Picture One only 19.2%[10] of the time. In other words, they strongly preferred Picture Two, which matched the "not P AND not Q" interpretation. Thus, Russian children showed a strong non-adult bias towards the narrow-scope, conjunctive interpretation of the disjunction *ili* in the crucial test sentences.

Mandarin Chinese

Jing, Crain and Hsu (2005) carried out a series of Truth-Value Judgment Task with Mandarin-speaking adults and children. Among their experiments, what interests us here is the one that used a negative test sentence with an object disjunction, as in (46)

(46) *Tangtaoya* ***meiyou*** *ju-qi* *zhouzi* ***huozhe*** *dianshiji*
Donald Duck not-PAST lift-up table or TV
Lit. 'Donald Duck didn't lift up the table or the TV'

The test sentence was presented after a story in which three characters tried to lift things, with Donald Duck being one of them. At the end of the story, Donald Duck successfully lifted the table up, but could not lift up the TV. According to Jing, Crain and Hsu (2005: 178) the results were as follows: "Whereas the group of adult controls always accepted sentences like this, 20 out of 21 children[11] rejected them." Although no concrete numbers of acceptance rates were provided in the paper, it is clear that the responses from Mandarin adults and children were drastically different: while adults always accepted a disjunctive reading of the test sentence, children consistently rejected it. This result was replicated by Crain et al. (2013), with a slightly different experimental settings. In their experiments, Mandarin adults accepted the crucial test sentences with disjunction and negation 95% of the time in the crucial test condition, but children (Mean age: 4;5) did so only 3% of the time. Thus, across different studies, Mandarin-speaking children showed a very strong bias towards non-adult, narrow-scope interpretations of the disjunction *huozhe* in simple negative sentences.

10 Verbuk (2006) does not explicitly provide this number. We calculated the number using the data given in the tables that report individual response patterns.
11 Those children ranged in age from 4;4 to 5;3 (Mean: 4;10).

Turkish

Geçkin, Crain and Thornton (2016) reported the results from experiments with Turkish speakers. They followed Goro and Akiba's (2004) experimental design, and the test sentences involved two kinds of lexical items that express disjunction in Turkish: *ya. . .ya da* 'either or' and *veya* 'or'

(47) *Bu hayvan-cık* ***ya*** *havuc-u* ***ya da*** *biber-i ye-**me**-di*
This animal-DIM either carrot-ACC or pepper-ACC eat-NEG-PAST
'This animal did not eat a certain carrot or a certain pepper'

(48) *Bu hayvan-cık havuc-u* ***veya*** *biber-i ye-**me**-di*
This animal-DIM carrot-ACC or pepper-ACC eat-NEG-PAST
'This animal did not eat a certain carrot or a certain pepper'

These test sentences were presented as a description for an animal who ate a carrot or a pepper, but not both. Adults' acceptance rates were 97.2% for test sentences like (47), and 77% for sentences like (48). In contrast, children (Mean age: 4;7) accepted test sentences like (47) only 13.5% of the time, and their acceptance rate went further down to 1.2% with test sentences like (48).[12]

Italian

Experimental data regarding interpretations of Italian disjunction *o* in negative sentences can be found in Pagliarini, Crain and Guasti (2018). They employed the experimental design of Goro and Akiba (2004), and a sample test sentence is given in (49):

(49) *Ill gatto* ***non*** *ha managiato la carota* ***o*** *il peperone*
the cat not has eaten the carrot or the pepper
Lit. 'The cat didn't eat the carrot or the pepper'

12 In Turkish, presence of the accusative case-marker on the object affects scope interpretations. In the current case, Geçkin, Crain and Thornton (2016) confirmed that disjunctive test sentences without an accusative marker yielded conjunctive interpretation from both children and adults. We will not discuss the issues around case markings and scope interpretations in Turkish. For our current purpose, it suffices to point out that presence/absence of accusative marker in the test sentences did not affect children's scope interpretations: either way, they consistently accessed narrow-scope, conjunctive interpretation of disjunction.

As in the previous studies, the participants judged whether this sentence was a correct description of a cat who had eaten either the carrot or the pepper, but not both. Pagliarini, Crain and Guasti administrated two slightly different experiments, but the results were essentially the same. In their Experiment 1, adults accepted the test sentence 100% of the time; children (mean age: 4;6) did so 60.5% of the time. In Experiment 2, the acceptance rate from adult participants was 91.1%, and that from children (mean age: 5;2) was 54.2%.

Although the differences in the acceptance rates from adults and children were statistically significant, that is, Italian children did show non-adult narrow-scope interpretations of negated disjunction, the proportion of non-adult responses appears to be smaller than those observed in previous studies. Pagliarini, Crain and Guasti argued that Italian children in fact acquire the adult-like wide-scope interpretation of negated disjunction faster than, for example, Japanese children, and that is because Italian is a negative concord language that uses a specific linguistic form (*né. . . né*, 'neither. . . nor') to express a conjunction of two negated propositions (i.e., not P AND not Q). This account, however, was not supported by a later study that investigated French and Hungarian, which we will turn next.

French and Hungarian

French and Hungarian share some important properties with Italian. First, disjunction in these languages take wider scope than local negation; second, they have a specific linguistic form to express "neither" (*ni. . . ni* in French; *sem. . . sem* in Hungarian). If the existence of such a form in the target language helps children to discard their initial hypothesis that disjunction is not a PPI, as Pagliarini, Crain and Thornton (2018) argued, then French and Hungarian-speaking children and Italian children at around the same age should show similar level of performance with negative test sentences involving disjunction. Pagliarini et al. (2022) tested this prediction with a series of experiments with French and Hungarian speakers.

Samples of the relevant French and Hungarian test sentences are given below. As in Pagliarini, Crain and Thornton (2018), the 'silver medal' condition in which the animal ate only one of the vegetables provided the crucial test case.

(50) *French test sentence*

Le chat	***n'a***	***pas***	*mangé*	*la carotte*	***ou***	*le poivron*
The cat	CL-has	not	eaten	the carrot	or	the pepper

(51) *Hungarian test sentence*

A cica	***nem***	*etta*	*meg*	*a répát*	***vagy***	*a paprikát*
The cat	not	ate	PRT	the carrot	or	the pepper

The results are the followings. French-speaking children (mean age: 5;3) accepted the crucial test sentences 34% of the time, and Hungarian children (mean age: 5;2) did so 25% of the time. Adult acceptance rates were 96% for French, and 90% for Hungarian. Thus again, French and Hungarian children showed a bias towards non-adult narrow-scope interpretations of disjunction, and the proportions of adult-like responses were not as high as that from Italian children. This suggests that French and Hungarian children did not benefit from the existence of the forms like *ni. . . ni* or *sem. . . sem* in their target language, contrary to the prediction of the account proposed by Pagliarini, Crain and Thornton (2018). Therefore, the source of apparent differences in the proportion of adult-like responses from various different studies is still not clear at this moment. We leave this issue open here, simply noting that non-adult, narrow-scope interpretations of disjunction in negative sentences were observed in all the studies reviewed here, with children acquiring different languages.

The empirical data that we have reviewed so far are summarized in Figure 1:[13]

Several generalizations emerge from the data in Figure 1. First, across those typologically distinct languages, adult's response patterns are extremely consistent and similar: apart from the Turkish *veya* case, the acceptance rates are all over 90%. These numbers are in stark contrast with the comparable adult data from languages like English (e.g., Grüter, Lieberman and Gualmini 2010), German (Geçkin, Thornton and Crain 2018) and Dutch (Pagliarini et al. (2022): in those languages, adults consistently reject the test sentences with disjunction and negation in a "not P OR not Q" situation. Second, children at around age 5 all show non-adult, narrow-scope conjunctive interpretation of disjunction across all the diverse languages that have been studied so far. Third, although in no studies are children fully adult-like, the proportions of adult-like responses are highly variable among different studies. The source of this heterogeneity is not entirely clear at this point, but this does suggest that the crucial "trigger" that eventually leads children to learn the adult-like interpretation is not abundant in the input, and cannot be inferred from some obvious and easily observable properties of the target language.

13 Pagliarini et al. (2021) report yet another set of data from Catalan. We didn't include the Catalan data in Figure 1 because the crucial results were essentially the same as the ones that are reviewed here: adults' acceptance rate was 100%; children's was 43%.

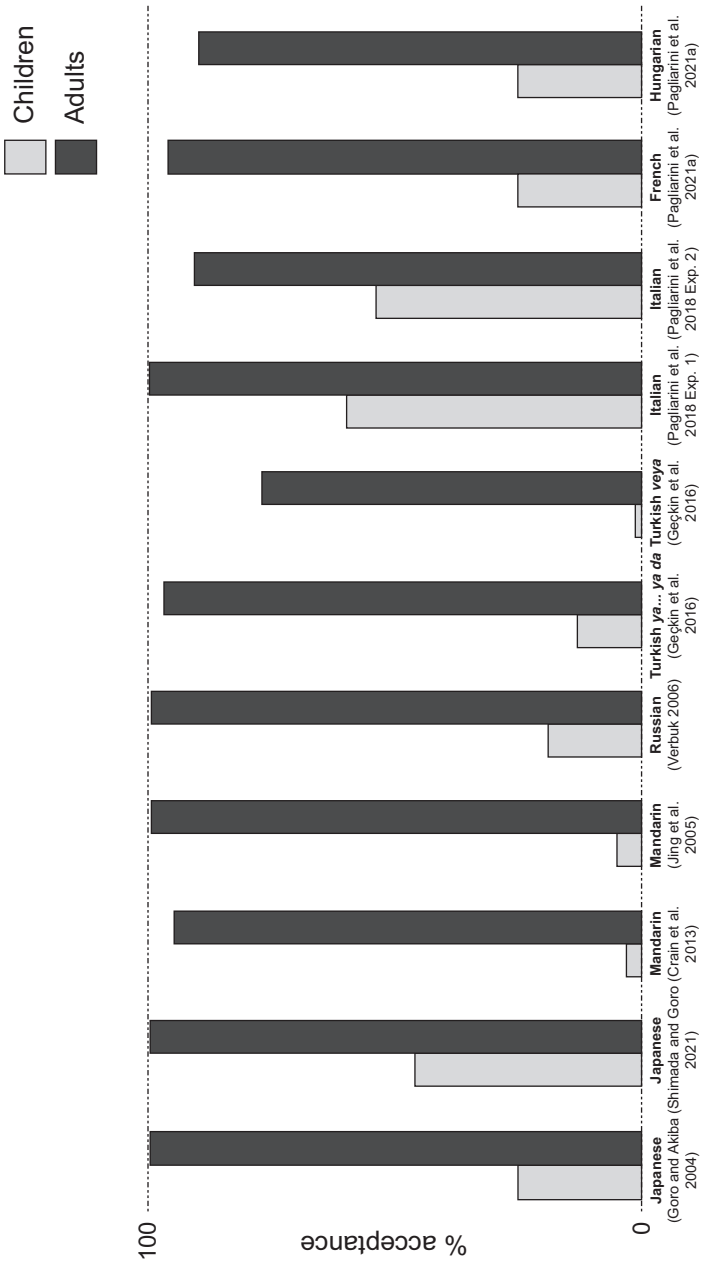


Figure 1: Adults and children's acceptance rates of wide-scope interpretation of object disjunction in negative sentences.

Under the Positive Polarity Account, the crucial trigger that would drive children to the correct adult knowledge of disjunction is an input sentence containing disjunction and negation in the same clause, with disjunction in the position lower than negation. In any language, this kind of input sentences can be extremely sparse, due to the pragmatic felicity conditions associated with disjunction and negation (e.g., Goro 2007; Shimada and Goro 2021). Cross-linguistically, a use of disjunctive expressions usually invokes so-called *ignorance implicature*: for example, the utterance "John ate sushi or pasta" implies that the speaker is unsure about what exactly John ate. On the other hand, negative sentences are most typically used to point out that the contextual expectation was not fulfilled, which means that a speaker who chooses to use a negative description of a situation is typically aware of what was expected and what actually happened. Thus, the felicity conditions for the use of disjunction and negation are partially contradictory, and only very limited contexts in the real life can satisfy those conditions simultaneously. This would lead to sparseness of the crucial trigger data in the input, which in turn make the acquisition of positive polarity of disjunction difficult and take extended time, with considerable individual variations.[14]

Given these considerations, we conclude that the available cross-linguistic evidence from children is consistent with the predictions of the Positive Polarity Account. The source of the scope restriction on disjunction is not a property of language, but is a property of specific lexical items: positive polarity. Children's initial hypothesis about polarity sensitivity of disjunction (and conjunction) is determined by the Semantic Subset Principle. The universal default hypothesis is that disjunction is not a PPI, and the available data show that the default hypothesis persists up to the fifth year of first language acquisition.

6 Conclusion

In this chapter, we reviewed cross-linguistic data from first language acquisition in order to compare two competing accounts for the nature of the scope constraint on Japanese disjunction *ka*. The data from language acquisition are in favor of

14 A remaining question is how it is possible for all children to encounter the crucial triggering data if the relevant data are so sparse. Adult's performance with disjunction, as summarized in Figure 1, show very little variance, suggesting that virtually everyone in the relevant linguistic communities converge on the same scope interpretations of disjunction. It remains mysterious, then, how this is possible with sparse and thus unreliable triggering data. Right now, we don't have any concrete answer to this question. See Shimada and Goro (2021) for some relevant discussion.

the Positive Polarity account, which assumes that a property of each lexical item determines the scope behavior of the element. Given this result, we would like to stress that empirical data from first language acquisition studies can bring about novel and useful insights to the theories of (adult) language. This should not be surprising, given that a theory of adult linguistic knowledge is supposed to be able to explain how the knowledge is acquired (i.e., *explanatory adequacy*: e.g., Chomsky 1965, 1981, 1986). In other words, theoretical analyses of adult language and empirical evidence from child language acquisition should both be integral parts of the study of language. Given the development of cross-linguistic studies in the relevant fields, integration of linguistic theories and language acquisition studies will give us even more opportunities to deepen our understandings of the nature of human language.

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