A subject advantage in covert dependencies: the case of *wh*-questions comprehension in French Sign Language

Abstract. Languages of the world vary with respect to the position in which *wh*-expressions are displayed in content questions. In some languages they are typically dislocated in a peripheral position, while in others they are left in situ, and some languages allow for both options. Studies on sentence-processing have shown that, as all A-bar dependencies, content questions involving wh-movement display a subject advantage, but very little is known about *wh*-in situ questions. The aim of this paper is to fill in this gap and explore whether a subject advantage can be found in *wh*-in situ questions. It reports the results of a sentence-to-picture matching task with in situ *wh*-questions in French Sign Language (LSF). Three adult populations with different age of exposure to sign language are included: native signers, early signers and late signers. Results show that comprehension of *wh*-in situ questions in LSF displays a subject advantage. This result is argued to be relevant for the analysis of *wh*-in situ, supporting a covert movement analysis against alternatives involving some instance of (unselective) binding. Moreover, comparison across populations show that delayed exposure to language has an impact on the comprehension of *wh*-questions, confirming that the effects of early language deprivation affect language competence in adulthood.
Keywords. French Sign Language; *wh*-in situ questions; subject advantage; age of first language exposure

1. Introduction: wh-questions in French Sign Language

Both in spoken and in sign languages (Zeshan, 2004) content questions typically contain specialized expressions (so-called *wh*-expressions) that identify the constituent that is questioned. The main typological divide across languages and modalities is related to the position of the *wh*-expression, which can either be dislocated in a peripheral position (as in English '**What** did John

eat?') or simply left *in situ* in the position where it receives its theta-role (as in Chinese 'Xiaoming chi-le **shenme**? —Xiaoming ate what—). Some languages appear to have both options, as is the case of French (as in '**Qu**'as-tu mangé' — What have you eaten — or 'Tu as mangé **quoi**' — You have eaten what —). Besides this common dichotomy, there is a striking difference between sign and spoken languages concerning the position where interrogative phrases are dislocated to that has attracted much attention (Cecchetto et al., 2009; Kelepir, 2020): while in the overwhelming majority of spoken languages, interrogative phrases are either in situ or at the **beginning** of the clause, in all sign languages studied so far interrogative phrases are either in situ or dislocated at the **end** of the clause (Zeshan, 2004).

French sign language is no exception and allows for both strategies. The preferred option is the in situ strategy illustrated in (1)[1], but the alternative with the *wh*-sign displaced in a clause-final position, illustrated in (2), is also possible. As shown in (2c) clause final *wh*-signs might leave their nominal restriction in situ.[2]

(1) a. WHO SCRATCH CAT — SUBJECT QUESTION

'Who scratched the cat?'

b. CHILD SCRATCH WHO — OBJECT QUESTION

'Who did the child scratch'

c. CAT WHICH SCRATCH CHILD — SUBJECT QUESTION

'Which cat scratched the child?'

d. CHILD SCRATCH CAT WHICH — OBJECT QUESTION

'Which cat did the child scratch?'

[1]LSF allows both SVO and SOV orders, with preference varying across individuals Hauser (2019). In the present study all the experiment items followed the SVO order, as the one illustrated in (1).

[2]Following standard conventions in sign language linguistics, glosses are given using small caps. Pronouns are indicated using the gloss IX followed by a subscript number for first, second or third person. A line above the glosses signals the presence of non-manual marking and its scope. Subscript letters (*a, b, c*, etc.) indicate the locus in the area of signing space where a particular referent is located. Finally, a line above the glosses signals the presence of non-manual marking and its scope. The label above that line describes its grammatical function. We did not conduct any systematic analysis of the role of non-manual markings in our study. Therefore, we will not indicate them in the examples we discuss, unless when they are cited from other studies.

(2) a. SCRATCH CAT WHO — SUBJECT QUESTION

'Who scratched the cat?'

b. CHILD SCRATCH WHO — OBJECT QUESTION

'Who did the child scratch?'

c. CHILD SCRATCH CAT WHICH — (Ambiguous) Question

'Which cat did the child scratch?'

'Which child scratched the cat?'

As can be noticed comparing (1) and (2) in situ *wh*-questions are never ambiguous, while movement *wh*-questions can sometimes be interpreted as subject or object questions depending on the position where the gap is posited. The sentence in (2c), in particular, is ambiguous depending on whether 'which' refers to the pied-piped object ('cat') or the stranded subject ('child'). This kind of ambiguity is not unusual in *wh*-movement questions across languages, and was the original reason why we decided to focus on in situ *wh*-questions when trying to build a test for assessing the comprehension of subject and object questions in LSF.

In addition of containing *wh*-signs (which might range across the full expected paradigm: 'who', 'what', 'which', 'when', 'where', 'why', and beyond with interrogative words literally meaning 'do-what' or 'what-age'), *wh*-questions in LSF are also characterized by a set of non-manual markers, mostly co-occurring with the *wh*-constituent, or occasionally spreading over larger portions of the sentence. These markers are illustrated in Figure 1: they include furrowed eyebrows and squinted eyes.

YOU TAKE $\overset{\text{wh}}{\overline{\text{WHAT}}}$

Figure 1: NMM in a movement *wh*-question in LSF

While *wh*-questions in sign languages are rather well documented in descriptive and theoretically oriented work (see Petronio & Lillo-Martin 1997; Branchini et al. 2013; Lillo-Martin & Quadros 2006; Aboh et al. 2005; Geraci et al. 2015 a.o.), the way these structures are processed and comprehended in the signing modality is still mostly *terra incognita*.

The first aim of this paper is to contribute to expand our knowledge on how these structures are treated across modalities by investigating how questions are comprehended by different populations of LSF signers. The second contribution this paper aims at concerns *wh*-in situ: with our study we want to verify whether the comprehension of *wh*-in situ questions is biased by the same asymmetries that have been reported for *wh*-movement questions, hence bringing a piece of experimental evidence into the theoretical debate concerning the existence of covert movement and in the general analysis to be given to *wh*-in situ questions. The third goal is to investigate the impact of age of first language exposure (AoE) on the comprehension of complex syntactic structures, and questions in particular, by comparing three groups of Deaf signers with different AoE to (sign) language.

This paper is organized as follows: Section 2 presents a survey of what we know about the comprehension of questions and other A-bar dependencies, and in particular about the subject advantage (2.1) and addresses a number of open questions concerning *wh*-in situ questions (2.2). Section 3 reports the main results in the literature about the impact of age of exposure to first language exposure on signing populations. Section 4 presents our study. Section 5 discusses our main results and concludes the paper.

2. Comprehending questions

The issue of how individuals comprehend different types of questions and other long distance dependencies has been central in the processing literature of the past 50 years. Here, we briefly summarize the main results concerning the subject advantage and in situ *wh*-questions.

2.1 The subject advantage in questions and other A-bar dependencies

A well-known asymmetry that goes under the name of subject advantage appears to characterize all A-bar dependencies, at least overt ones. Content questions are no exception, in that subject questions are in general easier to comprehend than object questions. Such an advantage is well documented in the adult sentence-processing literature (Van Gompel, 2013), but it also holds for children acquiring their first language: it has been demonstrated that comprehension of subject questions including reversible verbs is at ceiling by 4 years old, while that of object questions may still be challenging at 10 years old, with differences across languages (see Guasti 2004 for a discussion). Turning to special populations, the comprehension and production of subject questions appears to be easier than object questions for children with language impairments under a variety of conditions (Deevy & Leonard, 2004; Levy & Friedmann, 2009; Van Der Lely & Battell, 2003). The same asymmetry is documented for individuals with aphasia (Grodzinsky, 2000; Garraffa & Grillo, 2008; Sheppard et al., 2015).

As to how to explain such advantage, there is no general consensus, with proposals ranging from resource-based effects related to linear distance (e.g. King & Just 1991 and Gibson 1998), canonical order effects (Diessel & Tomasello, 2005), distribution-based effects (e.g. Mak et al. 2002), and prominence-factors (Van Valin & Wilkins 1996), to structurally based accounts appealing to structural principles such as Minimal attachment (Frazier 1987), the Minimal Chain Principle (De Vincenzi 1991), the Filler Gap domain (Hawkins 1999) or Relativized Minimality (Hawkins 1999; Friedmann et al. 2009). These different accounts make different predictions about the cross-linguistic extension of the phenomenon. While they all predict a subject advantage in languages with *wh*-movement at the beginning of the clause, like English, they differ in their predictions concerning other word orders and other questions patterns. In *wh*-movement questions of the English type, like (3) and (4), the basic idea from a processing point of view is that when the parser encounters the *wh*-phrase, it starts searching for an appropriate thematic role assigner—what Frazier called the 'active filler strategy' (Frazier & d'Arcais 1989), and posits a gap as soon as possible. The subject advantage can be seen as a direct reflex of this active filler strategy: the subject is

closer than the object and maintaining a shorter dependency is less costly and resource consuming.

(3) Which giraffe ___ licks the cow?

(4) Which giraffe does the cow lick ___?

Notice that in (3) and (4) the subject gap is closer to the *wh*-expression both linearly and structurally.

The reverse mechanism should hold true for languages with movement to the right, as in the marked strategy of LSF presented in (2), repeated here as (5): the parser encounters a gap and starts searching for a filler, i.e. a *wh*-element. Here is where structural and linear accounts differ. The subject gap in (5a) is still structurally closer to the *wh*-element than the object gap in (5b), but it is linearly more distant.

(5) a. ___ SCRATCH CAT WHO — SUBJECT QUESTION

'Who scratched the cat?'

b. CHILD SCRATCH ___ WHO — OBJECT QUESTION

'Who did the child scratch?'

The comprehension patterns of *wh*-to-the right questions have not yet been investigated so far, and we were not able to inquire on this aspect for this study given the marked status of the strategy in (5) in LSF (but see Cecchetto et al. submitted for a tentative in this direction).

The only studies concerning the processing patterns of A-bar dependencies where the gap precedes the filler focus on relative clauses, where typological variation allows to tease apart the linear and the structural analyses (see results on Korean by Kwon et al. 2013; Lin & Bever 2006; O'Grady et al. 2003; Slobin & Zimmer 1986, but also on Japanese by Miyamoto 2003; on Turkish by Özge et al. 2009; on Cantonese by Miyamoto 2019; on Whenzounese by Hu et al. 2018; on Mandarin Chinese[3] by Lin & Bever 2006; Wu 2009; Lau 2016; Jäger et al. 2015 or Huang 2019 a.o.). Besides some marginal controversy, most studies point towards a universal subject advantage, which in turns advocates for a structural approach.

[3]See Gibson (2000); Qiao et al. (2012) or Chen & Shirai (2015) among others for additional data suggesting the existence of an object advantage in prenominal RCs.

It has also been suggested that object questions (and object relative clauses) are more difficult because, after movement, the arguments in the sentence are no longer in canonical Subject-Verb-Object (SVO) word order (Diessel & Tomasello, 2005). This makes it more difficult to "guess" a meaning based on surface form. Subject questions are easier presumably because there are no overt word order differences between the interrogative and declarative forms. The only apparent change is the substitution of the *wh*-word for the subject, which is already in its required position at the front of the clause.

Across studies, the Subject Advantage has also been shown to be affected and modulated by a number of other factors (Vasishth & Lewis 2006), such as animacy and saliency (Traxler et al. 2005, Mak et al. 2002, Mak et al. 2006). Friedmann & Novogrodsky (2004) and Friedmann et al. (2009) show that object dependencies can become easier for children if the intervening subject is a pronominal subject instead of a full DP, as in example (6), and explain this as an effect of featural Relativized Minimality: while a full DP shares with the raised object a +NP feature, and hence intervenes in the relativization dependency, a pronominal subject does not, resulting in a disjoint configuration not affecting the dependency.

(6) I prefer the princess [that **you** draw ___].

Also, among object questions, *wh*-questions with lexical restrictions (e.g. 'which dog') emerge significantly later in L1 acquisition than bare *wh*-questions (e.g. 'who') and are associated with difficulty until about age 7 in monolingual development across languages (e.g. Avrutin 2000; Stromswold 1995; Tracy 1994). It has been argued that this asymmetry can also be explained as a Featural Relativized Minimality effect: overt object *which*-questions are subject to greater similarity-based intervention from the subject than bare *wh*-phrases (e.g. Martini et al. 2019; Omaki & Lidz 2015). Avrutin (2000, 2006) suggests that *which*-phrases require linking to specific sets of discourse entities, whilst *wh*-pronouns such as *who* do not. Therefore, computing mental representations for *which*-questions requires more computational resources than computing *who*-questions.

Little has been done on the investigation of whether there is a subject advantage in *wh* in situ

questions. Some studies suggest that *wh*-in situ object questions are easier to comprehend than *wh*-movement object questions at least in special populations (van der Meulen et al. 2005 and Drai & Grodzinsky 2006). One study (Arslan et al., 2017) investigated the comprehension of *wh*-questions in individuals with aphasia (IWA) speaking Turkish, a *wh*-in situ language, and German, a *wh*-movement language. They examined six German-speaking and 11 Turkish-speaking IWA using picture-pointing tasks and found that the Turkish IWA responded more accurately to object questions than to subject questions, while the German IWA performed better for subject questions. Some investigations that might also be relevant involve the processing of internally headed relative clauses (IHRCs), where there is arguably the same kind of covert dependency that is involved in *wh*-in situ. Studies in Korean (Kim & O'Grady, 2016; Lee, 1991; Lee-Ellis, 2011), where both types of relatives are available, reveal that children produce more object relatives than subject relatives in the form of IHRCs, whereas for subject relatives they prefer externally headed relative clauses (EHRCs), arguably involving overt movement. This pattern suggests that overt movement might be more difficult for children than covert movement.

2.2 In situ wh-questions

Theoretical investigations of in situ *wh*-questions have mostly focused on Chinese and Japanese and crucially maintain that in situ *wh*-questions involve a non-local dependency. For some scholars, this non-local dependency is literally the same as the one observed overtly in moved *wh*-questions: the LF-movement analysis (Huang, 1982) proposes that the only difference across languages is whether the movement operation that dislocates the *wh*-phrase to its scope position happens abstractly at Logical Form (LF) or concretely in overt syntax. Others (Pesetsky 1987, Watanabe 1992), capitalize on the fact that covert dependencies appear to be somehow insensitive to island conditions, and claim that the difference between moved and in situ *wh*-questions is more profound: in situ *wh*-elements do not move but rather get their quantificational force by being bound by an operator in the periphery of the clause (see Cheng 2003 for a review of competing theoretical analyses). Although different in many aspects, both approaches crucially claim that in order

to interpret a *wh*-question you must establish an abstract long-distance dependency between the clause-peripheral position where the *wh*-element gets its scope and the position within the clause where it receives its theta-role.

The processing reflex of this abstract dependency has only relatively recently begun to attract attention (Frazier 1999; Frazier & Clifton 2000; Musolino & Lidz 2003). The question is whether the same processing mechanisms that are deployed with overt dependencies are also employed in covert ones, and hence whether processing *wh*-in situ questions show evidence of non-local dependency formation, in spite of the fact that this is established covertly.

A number of studies have examined the processing of in situ *wh*-elements in Japanese. *Wh*-phrases in Japanese are pronounced in situ and get their scope by associating with an overt scope marker attached to the verb. Miyamoto (2002) investigated the processing of *wh*-elements inside an embedded clause, and manipulated whether the scope marker (*-ka*) was found on the embedded verb or on the matrix verb. With a self-paced reading paradigm, they found that participants showed longer reading times on non-scope-marked matrix verbs, relative to embedded verbs marked with *-ka*. Aoshima et al. (2004) extended and replicated these results. It thus appears that the distance of the dependency between a *wh*-element and its scope position in Japanese has an impact on processing which is analogous to that observed in English. Ueno & Kluender (2009) found that longer *wh*-in situ dependencies elicited a larger right-lateralized anterior negativity (RAN) signal compared to shorter ones, suggesting more processing costs associated with longer covert dependencies.

As Xiang et al. (2014) point out, it is difficult however to conclude from these results that in situ dependencies involve the construction of a covert dependency. The dependency between the *wh*-element and its scope marker in Japanese is indeed overt, since the scope marker is morphologically expressed. Investigating the comprehension of Chinese in situ *wh*-questions is more interesting from this point of view, since no scope marker or any overt cue guides the interpretation of questions in this language, and the covert long-distance dependency is a pure theoretical construct. Xiang et al. (2014), using the multiple-response speed–accuracy tradeoff (SAT) paradigm, show

that Chinese *wh*-in situ questions incur more processing costs than their declarative counterparts. Xiang et al. (2015), in two comprehension experiments, show moreover that the process of linking an in situ *wh*-phrase and its scope position induces a similarity-based memory interference effect if another clause boundary position intervenes. In addition, a set of sentence completion studies showed that the production of *wh*-in situ constructions is heavily modulated by the increased working memory burden that results from planning and maintaining a non-local dependency.

French sign language (LSF) appears to be just like Chinese from this point of view, in that there is no overt scope marker at the relevant periphery of the clause, which is presumably on the right, and the dependency connecting the *wh*-sign to its scope position is thus purely abstract. The first aim of this paper is to contribute to the growing body of literature on the processing of *wh*-in situ by adding the sign modality perspective, and to focus in particular on whether a subject advantage can be observed in *wh*-in situ questions.

If the subject advantage is due to **structural** factors and covert dependencies activate the same processing strategy as overt dependencies, we would expect to observe a subject advantage in the comprehension of *wh*-questions in LSF. If on the other hand the subject advantage is due to a **linear** distance (and again covert dependencies activate the same processing strategy as overt dependency), we would expect an object advantage, because the relevant periphery appears to the right in LSF. Moreover, an (unselective) **binding analysis** of *wh*-in situ would predict no Relativized Minimality effect in LSF, while a **covert movement analysis** might be compatible with the observation of fine-grained intervention effects modulated by the type of *wh*-element ('who' vs 'which').

If on the other hand the subject advantage is due to **canonicity** effects, we would expect no asymmetry between subject and object questions in LSF, since both types of questions display a canonical word order. The same prediction holds if the subject advantage is a bias connected to the **retrieval of the gap** and not to some more abstract distance dependency procedure, since no gap is present in LSF.

3. Age of first language exposure

Early exposure to language is well known to be crucial to language acquisition and language full development (Mayberry et al., 2002). While early exposure within the family is the default situation for hearing babies, this is not the case for deaf babies. Less than 10% of deaf children are born into deaf signing families (Mitchell & Karchmer 2004), and can receive a linguistic input from birth. The vast majority of deaf babies are born in hearing families, and are thus first exposed to a language they have no (immediate) access to, hence virtually to no language. As a consequence, most deaf children suffer from a more or less severe delay in language exposure, depending on a number of factors such as the age of diagnosis and the type of language intervention chosen by the parents (hearing aids and/cochlear implants and consequent training to spoken language, exposure to sign language, both). A minority of deaf children is exposed to sign language shortly after diagnosis, but most encounter sign language later in life, often after the failure of oral training.

As a result, deaf pre-lingual adult signers are a very heterogeneous population that includes native and non-native signers, some of which with a severely delayed exposure to language.

Several studies investigate the impact of delayed language exposure on sign language competence, reporting significant effects of age of exposure (AoE). We briefly report here the most significant findings focusing on behavioral studies.

The first work on the topic dates back to the late 1980s/early 1990s, and focused on morphological competences. Newport (1988) reports that non-native L1 signers differ from native signers in the morphological generalizations they make while acquiring verbs in ASL; Emmorey et al. (1995) show that only native signers, but not late signers (mean AoE=12 years) are sensitive to agreement errors. As for syntax, Mayberry (1993) shows that the performance of L1 signers decreases as AoE increases in a repetition task involving complex sentences. Interestingly, the same study reports that non-native L1 signers had a lower score than non-native L2 signers who acquired ASL at the same age (i.e children who had become deaf after they had acquired English: post-lingual deafness). Effects of AoE have also been reported for phonological processes and lexical access (Emmorey & Corina 1990).

Later work confirmed and generalized the early findings. Using a timed grammatical judgment task, Boudreault & Mayberry (2006a) found that the performance of non-native ASL signers decreased with increasing of AoE, and this both for early-acquired syntactic structures like simple sentences, negation, verbal agreement, and for late acquired syntactic structures, like *wh*-question, relative clauses and classifier sentences. Cormier et al. (2012) replicated these findings using a British Sign Language (BSL) version of Boudreault & Mayberry 2006b' task. They found that accuracy decreased as AoE increased only for deaf signers exposed to BSL between 2 and 8 years of age (defined as early signers in the study). AoE had no effect on signers exposed to BSL between 9 and 18 years of age (defined as late signers in the study). Considering that English reading performance was higher for these late signers, the authors suggest that their group of late signers was probably composed by people who had English as L1, and who acquired BSL as an L2.

Given these findings concerning the effects of AoE on language competence and the peculiar situation concerning language access in Deaf signers populations, a natural question is whether the comprehension of LSF *wh*-questions is also affected by this factor. In order to answer this question, our study compares the comprehension of *wh*-questions in LSF in three different populations of signers: natives, early learners and late learners.

4. The present study

This section presents our experiment on *wh*-questions comprehension in LSF. We developed a sentence to picture matching task, which we administered to three different groups of signers: native signers (exposed to LSF from birth and with at least one deaf parent), early signers (exposed to LSF before the age of 6), and late signers (exposed between the age of 6 and the age of 15). We had the following hypotheses:

1. If *wh*-expressions in in situ questions must establish a covert dependency that is structurally constrained in order to be interpreted, we expect to find a subject advantage in LSF;

2. If this covert dependency is an instance of covert movement, subject to the same constraints as overt movement, we further expect *which* questions to be more difficult to comprehend

than *who* questions.

3. Since in general, AoE has an impact on the comprehension of long-distance dependencies, we expect Native signers to outperform Early and Late signers, and that more complex sentences should be particularly challenging for non-native signers and Late signers in particular;

4. If the first hypothesis is correct we thus further expect that the subject advantage in LSF should be stronger in non-natives than in natives.

All the material, datafiles and scripts used for the analysis can be found on the public repository OSF[4].

4.1 Participants

Participants were selected following four general inclusion criteria: i) onset of deafness no later than three years of age; ii) first exposure to sign language no later than 15 years of age; iii) LSF as the preferred means of communication; iv) absence of cognitive disabilities. To identify participants with potential cognitive problems, we tested them with the cognitive non-linguistic Odd One Out test. This test contained items composed by four pictures in a row (see Figure 2 for an example). The task was to find the intruder (i.e. the bee in Figure 2). The test consisted of 28 items preceded by two training items. For each participant, considering language group mean and standard deviations, z-scores were calculated. The criterion for exclusion from the study consisted in having z-scores lower than -2.5.

Figure 2: Example of one item of the Odd One Out Cognitive Task

[4] https://osf.io/paj9n/?view_only=c9eaff3ba5a541cf9829a7de59a82e56

All participants were divided into three groups: i) native signers, who were exposed to sign language from birth (AoE= 0) and had at least one signing parent or signing close relative; ii) early signers who were exposed to sign language before entering to primary school (AoE range: 2-5) and iii) late signers who were exposed to sign language during compulsory school (AoE range: 6-15). Participants were recruited online, through social medias. We collected data from 49 participants (40 in Paris and 9 in Nantes). During the experiment session we also collected meta-data regarding their signing background (AoE relative to LSF, presence or not of Deaf relatives, modality of communication with parents, siblings, other relatives, type of education whether oralist, bimodal or mostly LSF, etc.) through a questionnaire. The meta-data were anonymized following the CER-PD[5] and the CNIL[6] recommendations.

Five participants were excluded from the study: one of them because he ended up being Belgian and Belgian Sign Language was his first language; four were excluded due to their very late AoE (after 15 y.o.). The remaining forty-four participants (23 women, 21 men) were included in the study, as reported in Table 1.

One ANOVA and two Kruskall-Wallis tests showed that the three groups did not differ for: i) age ($F(2)=1.844$, $p=0.17$), ii) z-scores in the Odd One Out test ($H(2)=1.482$, $p=0.48$); iii) level of education ($H(2)=1.196$, $p=0.55$).

[5]Comité d'Éthique pour la Recherche - Paris Descartes
[6]Commission Nationale de l'Informatique et des Libertés

Group	N	Age	AoE	Cognitive Z-score	Level of Education
Native	13	M=39 y SD=10 y		M=-0.21 SD=0.91	Median= university education
Early	15	M=34 y SD=7 y	M=3 y SD=1 y	M=0.19 SD=1.09	Median= university education
Late	15	M=41 y SD=13 y	M=9 y SD=3 y	M=0.01 SD=1.01	Median= high school

Table 1: Summary of the biographical characteristics of the three groups of LSF signers and summary of the Odd One Out test (cognitive z-score).

4.2 Materials

Our sentence-to-picture matching task is based on Friedmann & Novogrodsky (2004) 's task and is composed by *who*-questions and *which*-questions. Target questions were of two types: Subject Questions (SUBJ) and Object Questions (OBJ). In SUBJ questions the *wh*-word referred to the subject; in OBJ questions the *wh*-word referred to the object. All sentences were signed by a Deaf native signer and videotaped.

The experiment included 32 *who*-questions with 16 SUBJ and 16 OBJ questions, and 30 which-questions with 15 SUBJ and 15 OBJ questions. Each pair of SUBJ and OBJ questions was matched with the same picture displaying three characters: two of them, identical, are either performing an action or undergoing that action with respect to a third different character standing in between them (see Figure 3).

All target items were divided in two blocks that were administred to all participants in two separate sessions. In each block, 14 fillers (*where*-questions) were added. The fillers were the same across the two blocks. The function of the fillers was three-folded. 1) As fillers were simple, participants did not need to keep the same level of concentration throughout the whole experiment and could rest. 2) Performance in fillers was used as an objective measure of attention and overall comprehension. Participants who responded correctly to less than 75% of the fillers were excluded

from the analysis. 3) Fillers provided some trials targeting the middle character. Since the experimental design tends to bias participants to always click on the left or right characters, half of the fillers targeted the middle character while the other half targeted one of the side characters.

All Items were randomized.

The glosses of all experimental items are listed in the Appendix and the complete test is accessible upon request on *xxxx obscured for blind review reasons*.

Here, we present one example for each type of stimulus:

(7) *Who*-questions

1. SUBJ

   IX-1 QUESTION. (*Context*)

   WHO$_a$ $_a$BITE$_b$ CAT$_b$ (*Stimulus*)

   'I have a question: who bites the cat?'

2. OBJ

   IX-1 QUESTION. (*Context*)

   CAT$_a$ $_a$BITE$_b$ WHO$_b$ (*Stimulus*)

   'I have a question: who does the cat bite?'

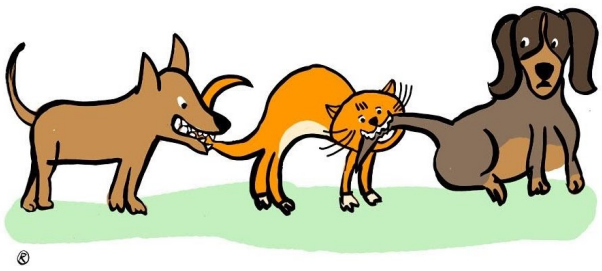

Figure 3: Picture associated to the *who*-questions in (7): the dog on the left matches the subject question, whereas the dog on the right matches the object question.

(8) *Which*-questions

1. SUB

   LA-LA TWO PENGUIN ONE MONKEY. (*Context*)

PENGUIN WHICH PUNCH MONKEY (*Stimulus*)

'There are two penguins and one monkey.

Which penguin punches the monkey?'

2. OBJ

LA-LA TWO PENGUIN ONE MONKEY. (*Context*)

MONKEY PUNCH PENGUIN WHICH (*Stimulus*)

'There are two penguins and one monkey.

Which penguin does the monkey punch?'

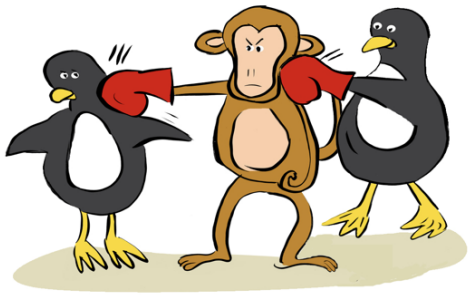

Figure 4: Picture associated to the *which* questions in (8): the penguin on the right matches the subject question, whereas the penguin on the left matches the object question.

(9) Fillers

LA-LA TWO GIRL ONE MOM. (*Context*)

MOM WHERE (*Stimulus*)

'There are two girls and a mom. Where is the mom?'

Figure 5: Picture associated to the filler *where*-question in 9. The central character (i.e. the mom) corresponds to the target answer.

4.3 Procedure

The test was built using a software specifically developed for *xxxx obscured for blind review reasons*. The task began with a video in LSF presenting instructions, followed by a short training phase. The duration of each testing session was around 20-25 minutes and was embedded within a larger testing session (around 1h and 30 minutes) during which the participants were undertaking other lexical and syntactic tests. Participants were left alone in the experiment room to perform the test on their own. They were sitting at approximately 45 cm from the screen (4:3 display, 22" screen) and answered using a mouse by clicking on the selected character.

For each trial, participants saw first the video stimulus, automatically followed by the picture on which they had to click on a character to provide their answer. The stimulus video always started by a small context introducing the characters present in the video in the case of *which*-questions (see 8) and fillers (see 9) and a simple 'I have a question' frame in the case of *who*-questions (see 7). The experiment procedure is illustrated in Figure 6.

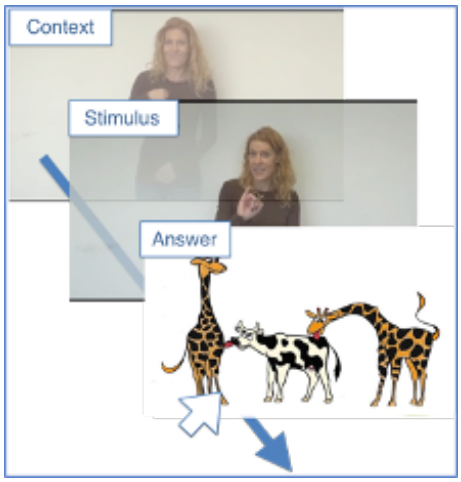

Figure 6: Picture illustrating the experiment procedure

4.4 Results

4.4.1 *Data analysis*

Data were shaped into a binary dataset in which correct answers were coded as '1' and incorrect answers were coded as '0'. We first conducted an item analysis to detect items on which native

signers performed under 50% on average to identify and remove problematic items, likely to be affected by a technical issue (if this was the case, we removed the item altogether, both SUBJ and OBJ version of it). This led to the removal of three items (two *who*-questions and one *which*-question), hence leaving 58 items (19 *who*-questions and 19 *which*-questions) to analyze.

Results were analyzed with the R software (version 4.0.0, R, Development Core Team, 2005) using generalized linear mixed models from the binomial family via the glmer function in the package lme4 (Bates, 2005). We studied the interaction between the three independent variables, namely, language group (native, early & late), condition (SUBJ & OBJ), and type of question (which vs. who). Random variables were intercepts for participants and items.

4.4.2 *Accuracy*

The results concerning accuracy are presented globally in Figure 7.

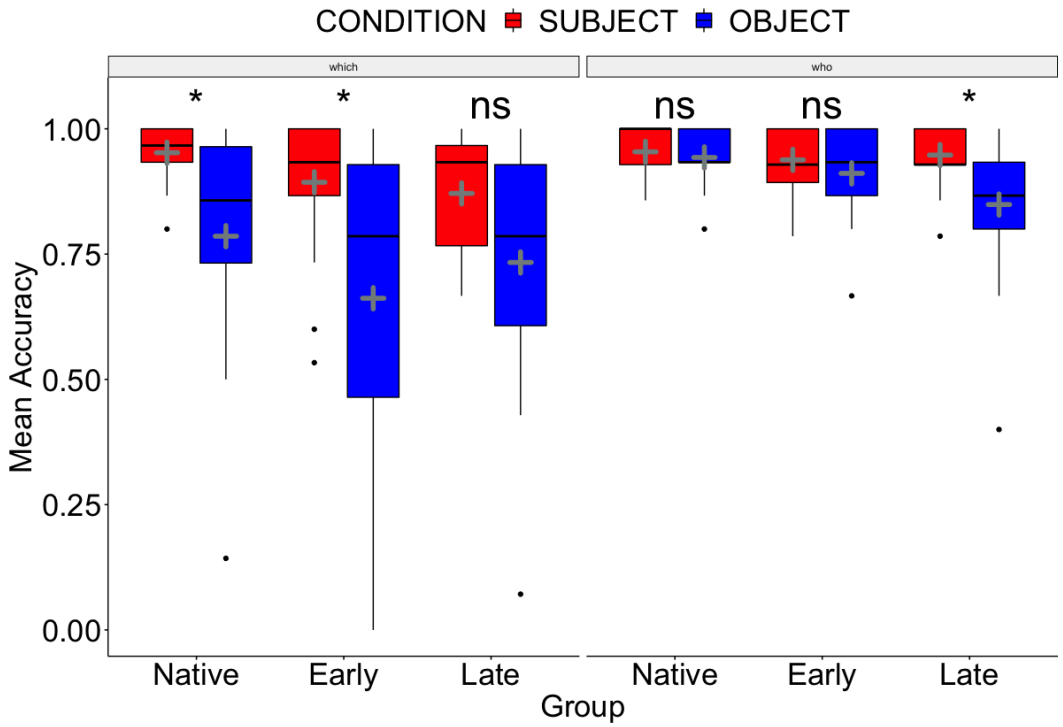

Figure 7: Accuracy in subject (red) and object (blue) question comprehension in LSF, for native (left), early (middle) and late (right) signers, comparing *which* (left panel) and *who* (right panel) questions. Average score per group is represented through a grey cross, median is the horizontal black line, the statistical significance (*) or non significance (ns) of the difference across conditions is indicated above each pair of columns.

As predicted from what we know about *wh*-movement questions, there is a strong difference linked to question type, with *which*-questions being understood significantly less accurately than *who*-questions (Est.= 1.14571, SE= 0.26741, p<0.0001). We also observe that accuracy in subject questions is significantly higher than in object questions (Est.= -1.13332, SE= 0.14932, p¡0.0001) and that the two parameters strongly interact (Est.= 1.00227, SE= 0.30145, p<0.0001). Finally, when we compare language groups, we find a marginal difference between Native and Late learners (Est.= -0.75802, SE= 0.45266, p=0.094013) but a significant interaction between this factor, the type of question and the subject/object condition (Est.= -1.88732, SE=0.74106, p=0.010872).

We can conclude that our study about accuracy reveals a significant subject advantage both in *which* questions and in *who* questions, hence suggesting that covert A-bar dependencies are subject to the same bias that holds for overt A-bar dependencies. Our study also confirms that there exists a strong asymmetry between *wh*-questions with lexical restrictions (*which* questions) and bare *wh*-questions (*who* questions), as found in acquisition and processing studies focusing on *wh*-movement languages. Finally, we found that the complexity provoked by object questions especially in *which*-questions is particularly affecting Late learners of LSF. This result is yet another evidence indicating that a delayed AoE has a lifelong impact on individuals' language competence.

4.4.3 *Errors*

Participants could make two types of errors in their answers. They could click the wrong *side* character, for example the wrong dog in Figure (3) above, or the wrong penguin in Figure (4), or they could click the *middle* character, such as for example the cat in Figure (3), or the monkey in Figure (4). So analysing the distribution of these two types of errors is a necessary step. Since participants performed fairly well across all conditions, we do not have enough errors to conduct a statistical analysis in order to determine whether there is a pattern emerging. Table 2 summarizes the figures we obtain regarding each type of error (side vs. middle character) depending on the language group, the condition, and the type of question.

Group	Question type	Condition	Side Character	Middle Character	Total
Native	Which	Subject	2	8	10
		Object	21	21	42
	Who	Subject	2	7	9
		Object	3	9	12
Early	Which	Subject	10	14	24
		Object	53	18	71
	Who	Subject	8	5	13
		Object	8	12	20
Late	Which	Subject	15	14	29
		Object	36	20	56
	Who	Subject	7	4	11
		Object	7	27	34
Total			172	159	331

Table 2: Number of clicks on the side character or on the middle character, based on the language group, the type of question, and the condition.

Both types of errors are more or less equally attested, and for each type there are more errors in the object condition than in the subject condition, as expected. Both types of errors are more present in *which*-questions than in *who*-questions, again as expected. The only puzzling fact concerns the distribution of the middle character errors in late learners: there are slightly more errors of this kind in *who*-questions (27) than in *which*-questions (20). We do not have an explanation for this asymmetry that might disappear if more errors were to be made.

5. Discussion and conclusions

The first result of this paper is that the comprehension of *wh*-in situ questions in LSF displays a subject advantage. This is important evidence that the theoretical construct of covert dependency

that syntacticians posit in *wh*-in situ questions has indeed a reflex in comprehension, and the most classical one: the subject advantage.

This conclusion is reinforced by the fact that we observed in LSF the same asymmetry between question types that has been reported and discussed for spoken languages. The subject advantage is much stronger for *which*-questions than for *who*-questions. This result strongly suggests that in *wh*-in situ there is a long distance dependency which is processed and/or represented in a way that is similar enough to overt movement dependencies that it is biased by not only the subject advantage but also the *which* vs *who* divide.

This result can also contribute to the ongoing debate about the nature and causes of the subject advantage, challenging in particular reductionist accounts (see Lasnik 1999 for a similar reasoning concerning island effects). Whatever the final explanation is given to this bias, it has to be an explanation that holds for both overt and covert dependencies. This implies that the subject advantage cannot be reduced to the presence of a gap (there is no such gap here), nor to linear distance (there is no linear distance here), nor to canonical word order effects (in LSF both subject and object *wh*-questions follow the canonical word order observed in declaratives).

One possible explanation for the subject bias and for the *who-which* divide is Relativized Minimality (Rizzi, 1990), but only if we assume that covert dependencies imply the movement of the same phrase that is moved in overt dependencies. If we make this assumption, then we can say that both in overt and in covert movement from object position:

a) the subject intervenes

b) when the *wh*-expression and the intervening subject have a +NP feature (i.e. with *which + NP)* the intervention effect is stronger than when the *wh*-element is bare (e.g. with *who*). This makes sense because Relativized Mimimality belongs to grammar and it is not a gap retrieval process related to the materiality of online incremental processing.

As such, our results can therefore also contribute to the ongoing debate conserning the x-nature of the covert dependency associated with *wh*-in situ questions. The Relativized Minimality explanation just sketched is compatible with the traditional LF movement analysis (Huang, 1982)

or a more minimalist version of it in which the difference between overt and covert movement is whether you spell out the head or the tail of a chain.

By contrast, alternative analyses in terms of Unselective Binding (Pesetsky 1987; Watanabe 1992, among others), which certainly account for the presence of scope markers and the island insensitivity displayed by *wh*-in situ in languages like Japanese, do not predict Relativized Minimality effects. This is so, because Unselective Binding involves a quantifier that binds any and all unbound variables in its scope and therefore a full definite NP in subject position is not expected to intervene in such dependency.

Summarizing, we arrive at the following conclusion: on one hand Relativized Minimality effects found in LSF suggest that an analysis in terms of covert movement is on the right track, while, an Unselective Binding analysis better accounts for the absence of island effects in *wh*-in situ languages (but see Nishigauchi 1990 and Richards 2000 for accounts of this lack of island sensitivity in terms of covert clausal pied piping).

However, this is not the end of the story. Recently, Bayer & Cheng (2017) claimed that *wh*-in situ languages can be classified in two groups. The first group includes languages, like Japanese, which display an overt scope marker and where *wh*-in situ is NOT subject to island effects. In this case, Bayer & Cheng (2017) argue that Unselective Binding is at play. The second group of *wh*-in situ languages includes those languages, like Bengali, where there is no evidence for the existence of a scope marker and where *wh*-in situ is subject to island effects. For these languages, Bayer & Cheng (2017) claim that covert movement is involved.

Going back to our results, the existence of intervention effects in LSF supports the general classification proposed by Bayer & Cheng (2017) and, more specifically, it represents an additional argument in favor of a covert movement analysis for some of *wh*-in situ languages.

Going further on this direction, if Bayer & Cheng (2017)'s reasoning is on the right track and LSF belongs to those languages where *wh*-in situ is associated to covert movement, then we expect that LSF *wh*-in situ questions exhibit island sensitivity. Interestingly, this is exactly what has been shown by Hauser (2019). She shows in particular that LSF questions are sensitive to the

Coordinated Sentence Constraint (CSC) and the Complex NP constraint (CNPC: Ross 1967). This is shown by the contrast between 10a-10b and 10c, illustrating that coordinated structures only allow ATB questions in LSF.

(10) [$_{left}$ JEAN BUY FLOWER] BEFORE [$_{right}$ MARIE STEAL BIKE] Baseline

'Jean bought flowers and before Marie stole a bike.'

a. *[$_{left}$ **WHO** BUY FLOWER] BEFORE [$_{right}$ MARIE STEAL BIKE] ? *1st clause

b. *[$_{left}$ JEAN BUY FLOWER] BEFORE [$_{right}$ **WHO** STEAL BIKE] ? *2nd clause

c. [$_{left}$ **WHO** BUY FLOWER] BEFORE [$_{right}$ _$_{gap}$ STEAL BIKE] ? Across-the-board

'Who bought flowers and before stole a bike ?'

(Hauser, 2019): 124-125

In 10c the meaning differs from the baseline in that the *wh*-word can only be interpreted as corresponding to the subject of both conjuncts.

LSF also displays CNPC effects, in particular with relative clauses. While it is possible to ask questions on the main clause (see 11a), material within the relative clause remains inaccessible to *wh*-question (cf. 11b).

(11) MARIE PREFER WOMAN [$_{rel}$ PI CUDDLE DOG] Baseline

'Mary prefers the woman who is cuddling the dog.'

a. **WHO** PREFER WOMAN [(PI) CUDDLE DOG] Main clause

'Who prefers the woman who is cuddling the dog.'

b. *IX-2 PREFER WOMAN [(PI) CUDDLE **WHO**] *Rel. clause

(Hauser, 2019): 62

This pattern contrasts with what happens with sentential complements, where LSF allows questions on either clauses, as shown in 12.

(12) MARIE SAY [WOMAN CUDDLE DOG] Baseline

'Mary says that the woman is cuddling the dog.'

a. **WHO** SAY WOMAN [CUDDLE DOG] Main clause

'Who says that the woman is cuddling the dog.'

b. MARIE SAYS [WOMAN CUDDLE **WHO**] Sub. Clause

'Who did Marie say that the woman is cuddling ?'

(Hauser, 2019): 62

In the light of these data, Hauser (2019) concludes that while LSF is a *wh*-in situ language, it shows the same type of island effects as *wh*-movement languages. This conclusion appears to go in the same direction as our results on the pattern of comprehension biases observed with *wh*-in situ questions in LSF. In both cases, the dependency associated with *wh*-in situ in LSF presents all the properties of a covert movement.

Finally, our results show that AoE has a long lasting impact on the comprehension of *wh*-questions, confirming that the effects of early language deprivation affect language competence in adulthood. This results joins many others (see *hidden for sake of anonymity*) and strongly advocates in favor of the implementation of language policies addressed to Deaf children prioritizing sign language exposition as early as possible.

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Appendix: List of stimuli

Fillers

Code Item	Gloss and translation
Filler1	HERE 2 GIRL, 1 MOM. MOM WHERE? 'There are two girls and a mom. Where's the mom?'
Filler2	IX-1 QUESTION, PUT-CL-HANDLING$_{(hat)}$ HAT BLUE WHERE? 'I have a question: where's the blue hat?'
Filler3	IX-1 QUESTION, BOX WHERE? 'I have a question: where's the box?'
Filler4	HERE 2 CHILD, 1 CLOWN, CLOWN WHERE? 'There are two children and a clown. Where's the clown?'
Filler5	IX-1 QUESTION, GIRL BLOND WHERE? 'I have a question: where's the blond girl?'
Filler6	IX-1 QUESTION, GIRL DRESS BLUE WHERE? 'I have a question: where's the girl in a blue dress?'
Filler7	HERE 2 BOY, 1 HORSE. HORSE WHERE? 'There are two boys and a horse. Where's the horse?'
Filler8	HERE 2 GIRL, 1 MOM. GIRL BLOND WHERE? 'There are two girls and a mom. Where's the blond girl?'
Filler9	IX-1 QUESTION, ELEPHANT GREY WHERE? 'I have a question: where's the grey elephant?'
Filler10	IX-1 QUESTION, BROOM WHERE? 'I have a question: where's the broom?'
Filler11	HERE 2 COW, 1 SHEEP. SHEEP WHERE? 'There are two cows and a sheep. Where's the sheep?'

Code Item	Gloss and translation
Filler12	IX-1 QUESTION, TAIL WHERE? 'I have a question: where's the tail?'
Filler13	HERE 2 CLOWNS, 1 CHILD. CHILD WHERE? 'There are two clowns and a child. Where's the child?'
Filler14	HERE 2 ELEPHANTS, 1 LION. LION WHERE? 'There are two elephants and a lion. Where's the lion?'

Block A

Item Type	Gloss and translation
Training 1	IX-1 QUESTION. TOWEL RED DARK WHERE? 'I have a question: where is the dark red towel?'
Training 2	IX-1 QUESTION. WHO WATER CHILD? 'I have a question: who waters the child?'
Training 3	HERE 2 ANGEL 1 MAN. ANGEL WHICH PET MAN? 'There are two angels and a man. Which angel pets the man?'
wh-04-sub	IX-1 QUESTION. WHO PUSH MAN? 'I have a question: who pushes the man?'
wh-05-sub	IX-1 QUESTION. WHO WATER LION? 'I have a question: who waters the lion?'
wh-06-obj	IX-1 QUESTION. MAN-DIVER GRAB WHO? 'I have a question: Who does the diver grab?'
wh-07-sub	IX-1 QUESTION. WHO WIPE CHILD? 'I have a question: Who wipes the child?'
wh-08-sub	IX-1 QUESTION. WHO PICTURE-TAKE MOM? 'I have a question: Who takes mom in picture?'

Item Type	Gloss and translation
wh-09-sub	IX-1 QUESTION, WHO BITE CAT? 'I have a question: who bites the cat?'
wh-10-sub	IX-1 QUESTION, WHO CUDDLE CHILD? 'I have a question: who cuddles the child?'
wh-11-sub	IX-1 QUESTION, WHO CHEEK-PINCH KING? 'I have a question: who pinches the king's cheek?'
wh-12-sub	IX-1 QUESTION, WHO WIPE KING? 'I have a question: who wipes the king?'
wh-13-obj	IX-1 QUESTION, CHILD PET WHO? 'I have a question: who does the child pet?'
wh-14-obj	IX-1 QUESTION, COW LICK WHO? 'I have a question: who does the cow licks?'
wh-15-obj	IX-1 QUESTION, CHILD PUSH-CL-HANDLING$_{(stroller)}$ WHO? 'I have a question: who does the child push in a stroller?'
wh-16-obj	IX-1 QUESTION, SQUID PUSH WHO? 'I have a question: who does the squid pushes?'
wh-17-obj	IX-1 QUESTION, DOG LICK WHO? 'I have a question: who does the dog lick?'
wh-18-obj	IX-1 QUESTION, DOG LIFT WHO? 'I have a question: who does the god lift?'
wh-19-obj	IX-1 QUESTION, FATHER TICKLE WHO? 'I have a question: who does the father tickles?'
Which-20-sub	HERE 2 LION, 1 CLOWN. LION WHICH WATER CLOWN? 'There are two lions and a clown. Which lion waters the clown?'

Item Type	**Gloss and translation**
Which-21-sub	HERE 2 SOLDIER, 1 OLD(PERSON). SOLDIER WHICH PAINT PERSON-CL OLD? 'There are two soldiers and an old person. Which soldier paints the old person?'
Which-22-sub	HERE 2 ANGEL 1 CHILD. ANGEL WHICH PET CHILD? 'There are two angels and a child. Which angel pets the child?'
Which-23-sub	HERE 2 PENGUIN, 1 MONKEY. PENGUIN WHICH PUNCH MONKEY? 'There are two penguins and a monkey. Which penguin punches the monkey?'
Which-24-sub	HERE 2 CHILD, 1 MONKEY. CHILD WHICH PET MONKEY? 'There are two children and a monkey. Which child pets the monkey?'
Which-25-sub	HERE 2 DANCER, 1 QUEEN. DANCER WHICH GRAB-HANDLING-CL$_{(dress)}$ QUEEN? 'There are two dancers and a queen. Which dancer grabs the queen by her dress?'
Which-26-sub	HERE 2 ZEBRA, 1 COW. ZEBRA WHICH BITE COW? 'There are two zebras and a cow. Which zebra bites the cow?'
Which-27-sub	HERE 2 DOG, 1 HIPPOPOTAMUS. DOG WHICH PAINT HIPPOPOTAMUS? 'There are two dogs and an hippopotamus. Which dogs paints the hippopotamus?'
Which-28-obj	HERE 2 CHILD, 1 FAIRY. FAIRY PISTOL-WATER-SPRINKLES CHILD WHICH? 'There are two children and a fairy. Which child does the fairy water?'

Item Type	Gloss and translation
Which-29-obj	HERE 2 CHILD, 1 MOM. MOM FACE-PAINT CHILD WHICH? 'There are two children and a mom. Which child does the mom paint the face of?'
Which-30-obj	HERE 2 ELEPHANT, 1 CHILD. CHILD PAINT ELEPHANTS WHICH? 'There are two elephants and a child. Which elephant does the child paint?'
Which-31-obj	HERE 2 GRANNY, 1 CHILD. CHILD PINCH GRANNY WHICH? 'There are two grannies and a child. Which granny does the child pinch?'
Which-32-obj	HERE 2 CHILD, 1 HIPPOPOTAMUS. HIPPOPOTAMUS WIPE CHILD WHICH? 'There are two children and an hippopotamus. Which child does the hippopotamus wipe?'
Which-33-obj	HERE 2 POLICEMAN, 1 KING. KING BRUSH POLICEMAN WHICH? 'There are two policemen and a king. Which policeman does the king brush?'
Which-34-obj	HERE 2 MAN, 1 MONKEY. MONKEY PHOTOGRAPH MAN WHICH? 'There are two men and a monkey. Which man does the monkey take picture of?'
Which-35-obj	HERE 2 DOGS, 1 CHILD. CHILD PET DOG WHICH? 'There are two dogs and a child. Which dog does the child pet? '

Block B

Item Type	**Gloss and translation**
Training 1	IX-1 QUESTION. TOWEL RED DARK WHERE? 'I have a question: where is the dark red towel?'
Training 2	IX-1 QUESTION. CHILD WATER WHO? 'I have a question : who does the child water?'
Training 3	HERE 2 ANGEL 1 MAN. MAN PET ANGEL WHICH? 'There are two angels and a man. Which angel does the man pet?'
wh-04-obj	IX-1 QUESTION. MAN PUSH WHO? 'I have a question : who does the man push?'
wh-05-obj	IX-1 QUESTION. LION WATER WHO? 'I have a question: who does the lion water?'
wh-06-sub	IX-1 QUESTION. WHO GRAB MAN-DIVER? 'I have a question: Who grabs the diver?'
wh-07-obj	IX-1 QUESTION. CHILD WIPE WHO? 'I have a question: Who does the child wipe?'
wh-08-obj	IX-1 QUESTION. MOM PICTURE-TAKE WHO? 'I have a question: Who does the mom take in picture?'
wh-09-obj	IX-1 QUESTION, CAT BITE WHO? 'I have a question: who does the cat bite?'
wh-10-obj	IX-1 QUESTION, CHILD CUDDLE WHO? 'I have a question: who does the child cuddle?'
wh-11-obj	IX-1 QUESTION, KING CHEEK-PINCH WHO? 'I have a question: who does the king pinch the cheek of?'
wh-12-obj	IX-1 QUESTION, KING WIPE WHO? 'I have a question: who does the king wipe?'

Item Type	Gloss and translation
wh-13-sub	IX-1 QUESTION, WHO PET CHILD? 'I have a question: who pets the child?'
wh-14-sub	IX-1 QUESTION, WHO LICK COW? 'I have a question: who licks the cow?'
wh-15-sub	IX-1 QUESTION, WHO PUSH-CL-HANDLING$_{(stroller)}$ CHILD? 'I have a question: who pushes the child in a stroller?'
wh-16-sub	IX-1 QUESTION, WHO PUSH SQUID? 'I have a question: who pushes the squid push?'
wh-17-sub	IX-1 QUESTION, WHO LICK DOG? 'I have a question: who licks the dog?'
wh-18-sub	IX-1 QUESTION, WHO LIFT DOG? 'I have a question: who lifts the dog?'
wh-19-sub	IX-1 QUESTION, WHO TICKLE FATHER? 'I have a question: who tickles the father?'
Which-20-obj	HERE 2 LION, 1 CLOWN. CLOWN WATER LION? 'There are two lions and a clown. Which lion does the clown water?'
Which-21-obj	HERE 2 SOLDIER, 1 OLD. PERSON-CL OLD PAINT SOLDIER WHICH? 'There are two soldiers and an old person. Which soldier does the old person paint?'
Which-22-obj	HERE 2 ANGEL 1 CHILD. CHILD PET ANGEL WHICH? 'There are two angels and a child. Which angel does the child pet?'
Which-23-obj	HERE 2 PENGUIN, 1 MONKEY. MONKEY PUNCH PENGUIN WHICH? 'There are two penguins and a monkey. Which penguin does the monkey punch?'

Item Type	**Gloss and translation**
Which-24-obj	HERE 2 CHILD, 1 MONKEY. MONKEY PET CHILD WHICH? 'There are two children and a monkey. Which child does the monkey pet?'
Which-25-obj	HERE 2 DANCER, 1 QUEEN. QUEEN GRAB-HANDLING-CL$_{(dress)}$ DANCER WHICH? 'There are two dancers and a queen. Which dancer does the queen grab by her dress?'
Which-26-obj	HERE 2 ZEBRA, 1 COW. COW BITE ZEBRA WHICH? 'There are two zebras and a cow. Which zebra does the cow bite?'
Which-27-obj	HERE 2 DOG, 1 HIPPOPOTAMUS. HIPPOPOTAMUS PAINT DOG WHICH? 'There are two dogs and an hippopotamus. Which dog does the hippopotamus paints?'
Which-28-sub	HERE 2 CHILD, 1 FAIRY. CHILD WHICH PISTOL-WATER-SPRINKLE FAIRY? 'There are two children and a fairy. Which child waters the fairy?'
Which-29-sub	HERE 2 CHILD, 1 MOM. CHILD WHICH FACE-PAINT MOM? 'There are two children and a mom. Which child paints the mom on her face?'
Which-30-sub	HERE 2 ELEPHANT, 1 CHILD. ELEPHANT WHICH PAINT CHILD? 'There are two elephants and a child. Which elephant paints the child?'
Which-31-sub	HERE 2 GRANNY, 1 CHILD. GRANNY WHICH PINCH CHILD? 'There are two grannies and a child. Which granny pinches the child?'

Item Type	**Gloss and translation**
Which-32-sub	HERE 2 CHILD, 1 HIPPOPOTAMUS. CHILD WHICH WIPE HIPPOPOTAMUS? 'There are two children and an hippopotamus. Which child wipes the hippopotamus?'
Which-33-sub	HERE 2 POLICEMAN, 1 KING. POLICEMAN WHICH BRUSH KING? 'There are two policemen and a king. Which policeman brushes the king?'
Which-34-sub	HERE 2 MAN, 1 MONKEY. MAN WHICH PHOTOGRAPH MONKEY? 'There are two men and a monkey. Which man takes picture of the monkey?'
Which-35-sub	HERE 2 DOGS, 1 CHILD. DOG WHICH PET CHILD? 'There are two dogs and a child. Which dog pets the child? '