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Disentangling sources of difficulty associated with the acquisition of accusative clitics in French

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Abstract

Accusative clitic pronouns are acquired later than both nominative and reflexive pronouns in typically developing French-speaking children. However recent research suggests that not all these clitics are equally difficult, 3rd person accusative clitics (ACC3) being more problematic than 1st and 2nd person. In this study, we explored three properties which could make ACC3 complex: (1) gender marking, (2) discourse-participant independent reference, and (3) optionality in spoken French. We have created specific experiments assessing the role of each of these properties in clitic acquisition in 41 French-speaking children aged 4–8. Results show that all three properties play a role in making ACC3 complex, with the strongest influence coming from gender marking. Implications of these results are discussed in light of previous related studies.

Keywords: Accusative clitics; Acquisition; French

1. Introduction

Accusative clitic pronouns (ACC) have been widely investigated in studies of the acquisition of Romance languages. They have attracted particular interest because of their late acquisition as compared to both nominative and reflexive pronouns in typically developing French-speaking children (Delage, 2008; Hamann et al., 1996; Jakubowicz et al., 1998; Jakubowicz and Rigaut, 2000; Van der Velde, 2003; Zesiger et al., 2010). Their complexity has positioned them as a clinical marker of specific language impairment or 'SLI' (Paradis et al., 2003; Parisse and Maillart, 2004) and more generally of atypical language development (Delage, 2008; Tuller et al., 2011). More recently, it has been suggested for Greek, Romanian and Catalan that not all ACC are equally difficult (Avram et al., 2015; Coene and Avram, 2011; Gavarró and Fortón, 2014; Tsimpli and Mastropavlou, 2007). Instead what appears to be problematic is specifically 3rd person clitics, while 1st and 2nd person ACC prove to be relatively simpler. This asymmetry has now also been confirmed for French by a recent study (Tuller et al., 2011). The aim of the present work is to further explore the 3rd versus 1st person distinction for ACC in French to elucidate why 3rd person clitics are associated with delayed development. More specifically, while all ACC share certain properties (listed in a–c in Table 1), those of the 3rd person present additional

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Table 1
Properties of accusative clitics (adapted from Tuller et al., 2011).

All ACC	Specifically 3rd person ACC
(a) Appearance in a non-canonical position	(d) **Morphological marking for gender** and number (while other ACC agree for number only)
(b) Co-occurrence with a nominative clitic	(e) **Discourse-participant independence** for their reference (and therefore unmarked for animacy)
(c) Non-local binding	(f) **Optionality in spoken French** under discourse/lexical conditions

characteristics which would render them particularly difficult (listed in d–f in Table 1) and which are the focus of this research.

This study considers the impact of each of these properties specific to 3rd person ACC, namely (i) the morphological marking for gender, (ii) the discourse-participant-independent reference (i.e., where reference is not tied to speaker-addressee roles) and (iii) the legitimate omission or 'optionality' in specific contexts of spoken French. These properties have been hypothesized to play a role in delaying the acquisition of 3rd person ACC in previous research, which we review below.

1.1. 3rd person ACC

Research on the acquisition of French ACC (1) has shown that these emerge more slowly than both (2) reflexive and (3) nominative clitics in typical language development:

(1) Jean **le** voit
John him sees
'John sees him'

(2) Jean **se** voit
John himself sees
'John sees himself'

(3) **Il** voit Jean
He sees John
'He sees John'

Hamann et al. (1996) analyzed the spontaneous language of a French-speaking child from age 2 to 2;10 and showed that while the nominative clitic was present from the first recording (i.e., at age 2;0) and was consistently used in more than half of the child productions, ACC were virtually absent until age 2;6. Moreover at age 2;9, the accusative was found only in 14% of the contexts where it should have been obligatorily realized,[1] contrary to nominative clitics which occurred in 63% of such contexts. A similar delay was observed by Jakubowicz et al. (1998) in an elicited production study of 20 French children aged 5;6 to 5;11. In addition, these authors noted a delay between the accusative as compared to the reflexive clitic (both encoding 3rd person). Thus a hierarchy emerges, with the nominative being acquired before the reflexive, which in turn is acquired before the accusative. Jakubowicz and Rigaut (2000) confirmed this hierarchy with an analysis of natural language corpora as well as with an elicited production task conducted with 12 young children aged 2 to 2;7. Subsequently, the hierarchy was replicated in a study of 99 children aged 3;5 to 6;5 tested specifically with elicited production (Zesiger et al., 2010). This study clearly illustrated the developmental trend of these elements, namely that while nominatives were at ceiling at age 3, reflexives approached this level at age 4 (85%) while ACC only did so at age 6 (90%).

In sum, ACC are produced substantially less than other clitics in early childhood, yielding either frequent omissions of the object altogether, or the use of full lexical DPs (Determiner Phrases) instead. Elicited production experiments for clitics in French show that frequent omissions are indeed coupled with a substantial use of lexical DPs: At mean age 3;2, children omitted ACC 55.9% of the time and produced lexical DPs instead in 20.5% of their utterances (Van der Velde, 2003). This

[1] Meaning that these contexts did not meet specific restrictions (as further described) which could lead to ACC3 optionality in spoken French.

rate tapered off with time, falling at age 4;2 (21.5% omission and 9.3% lexical DPs) and dropping even more sharply by age 6;7 (8.3% omission and 7.3% lexical DPs).

When children do attempt to produce the clitic, it has been shown that they often make mistakes in gender. Zesiger et al. (2010) reported that children aged 3;5 to 6;5 frequently made gender errors on object clitics. The most frequent pattern was the feminine *la* replaced by the masculine *le* (26.8%), the reverse being produced significantly less often (10.4%). Tuller et al. (2011) also noted that, in an elicited production task, 17% of accusative clitics produced by children at age 6 contained an error of gender. Most errors occurred when the clitic sequences (nominative + accusative) involved a mismatch in gender. In these contexts, the authors propose that the child's working memory resources are particularly taxed.

Interestingly, while the global comprehension of accusative clitics appears to fare better than their production (Grüter, 2005, 2006; Tuller and Jakubowicz, 2004; Van der Velde, 2003; Zesiger et al., 2010), difficulty with the gender feature reported for production nevertheless carries over to comprehension. Comprehension of clitics was assessed by Zesiger et al. (2010) via a truth-value judgment task involving a puppet who produced a sentence when describing a picture. This sentence contained an object clitic which either corresponded to the sex of the referent in the picture or not. In this forced two-choice task, children at age 5 showed chance-level performance for detecting when the gender of the accusative clitic in the test stimuli mismatched that of the referent in the picture. Participants only reached 75% error detection at age 6. Once again, a difference between masculine and feminine ACC surfaced, with worse performance for detecting a gender error with feminine as compared to masculine clitics. Grüter et al. (2012) also reported that 4 year-old Spanish-speaking children encounter difficulties in making use of the gender cue on object clitics when identifying their referent in an eye-tracking study. Pirvulescu and Strik (2014) further tested the comprehension of both gender and number on clitic and strong pronouns in children aged 3 to 5 years old, by means of a picture choice task. Their results revealed that children had difficulties with these featural cues when determining antecedents for both clitic and strong pronouns, although these difficulties were more pronounced with clitics. They also showed that the youngest (3 year old) group tended to use the most recently mentioned noun to determine the clitic's reference, suggesting that this group applied another processing strategy than that of relying on the clitic's phi-features. They proposed that the younger children attempted to keep anaphoric dependencies as short as possible due to working memory limitations. Furthermore, these authors also showed that 3–4 year old children perform better with plural accusative clitics, i.e., *les*, than with singular ones, i.e., *le/la*. Note that these items differ with respect to gender marking, in that the former but not the latter morphologically encode this feature. Grüter and Crago (2012) investigated the relationship between the production of clitics and working memory in the context of L2 French. These authors showed a negative correlation between working memory (i.e., the digit span task) and the production of clitics by native Chinese-speaking children. The work by Grüter and Crago (2012) is part of a large body of work highlighting that the difficulty with 3rd person ACC extends beyond typical monolinguals to L2 learners (Grondin and White, 1996; Grüter, 2005; Paradis et al., 2003; Prévost, 2006), internationally adopted children (Delcenserie and Genesee, 2013; Delcenserie et al., 2013; Gauthier et al., 2012) and simultaneous bilinguals (Müller and Hulk, 2001; Pirvulescu et al., 2014). Protracted development of this clitic also clearly emerges in various situations of atypical language development, such as Specific Language Impairment (Hamann et al., 2003; Jakubowicz and Tuller, 2008; Paradis et al., 2003; Tuller et al., 2011), hearing loss (Delage, 2008; Delage and Tuller, 2007; Jakubowicz et al., 2000; Tuller and Delage, 2014), as well as epilepsy (Monjauze, 2007). The relationship between the development of clitic production and working memory has often been suggested to exist in a variety of these contexts (see e.g. Pirvulescu and Strik, 2014; Prévost, 2006; Tuller et al., 2011), however, Grüter and Crago (2012) and Mateu (2015) are the only empirical investigations of this link. Mateu has thus demonstrated that omission of accusative clitics correlated with results obtained in a non-word repetition task in Spanish-speaking children aged 2–3. How can we account for this phenomenon? Producing an accusative clitic arguably implies that the processing system retains and links information about two positions: the preverbal position where the clitic is pronounced (or 'spelled-out') after syntactic movement, and the post-verbal, canonical, 'pre-syntactic movement' position (or the 'gap'). This sort of cognitive manipulation arguably poses problems for immature cognitive systems and only become accessible to systems with higher computational resources (Booth et al., 2000).

Clitic omission has also been accounted for in terms of the Unique Checking Constraint or UCC (see e.g. Gavarró et al., 2010; Wexler et al., 2003/2004). The UCC predicts clitic omission in languages where the past participle morphologically agrees with the accusative clitic, as is the case in French (e.g. Il **l**'a peint**e**, la fille: He her painted + feminine, the girl). This is claimed to stem from young children's systems not being mature enough to carry out such a complex operation. Indeed the DP 'pro' which co-occurs with clitics in the canonical object position (see (4)) must raise to spec,ClP by passing *also* through Spec,AgrOP, because past participle agreement is required (see also Sportiche, 1996):

(4) [ClP CLi [AgrOP VP . . . DPi

In these instances, the child system opts instead to not project ClP, so that the 'pro' DP only has to check a single D-feature against AgrO, thus giving rise to clitic omission. It is relevant to note that this reasoning predicts that omission should not only occur with 3rd person ACC in French, but also with other clitics such as 1st/2nd person ACC, since past participle agreement occurs with these latter elements as well (Il **t**'a décrit**e**, Maria: 'He has you described + feminine Maria').

1.2. 3rd person vs 1st person ACC

In contrast to the bulk of studies discussed above, few investigations have been conducted of clitics in typically developing French other than those of the 3rd person (except for Hamann et al., 1996, who counted all accusative clitics and Tuller et al., 2011 described below). For other Romance languages, a few authors have observed an asymmetric development between 3rd person (5) and 1st/2nd person ACC (6), with the former emerging slower than the latter (Avram and Coene, 2008; Baauw, 2000; Coene and Avram, 2011; Gavarró and Fortón, 2014; Silva, 2010; Tsimpli and Mastropavlou, 2007):

(5) Jean **le/la** regarde
John him/her looks-at
'John is looking at him/her'

(6) Jean **me/te** regarde
John me/you looks-at
'John is looking at me/you'

Coene and Avram (2011) analyzed longitudinal corpora of the speech of two monolingual Romanian children (aged 1;05–3;05) and found that in obligatory clitic contexts, ACC of the third person were frequently omitted until age 3 years, while those of the first and second person were always present from the earliest utterances. This asymmetric omission pattern was also observed for very young Catalan-speaking children (Gavarró and Fortón, 2014), for Greek-speaking children with SLI aged 3;5 to 7 (Tsimpli, 2001) and for adult L2 learners (Tsimpli and Mastropavlou, 2007).

Tuller et al. (2011) studied this phenomenon in French-speaking adolescents suffering from different pathologies. These authors conducted an elicited production task with 36 typically-developing (TD) children aged 6 and 11, as well as 71 adolescents (age range 11–20 years) with atypical language development. The clinical population was divided into three groups: SLI, mild-to-moderate hearing loss (MMHL), and Rolandic Epilepsy (RE). Both 1st and 3rd person clitics were evaluated. The authors report that all clinical groups, as well as the youngest TD group (aged 6), showed difficulty specifically with 3rd person ACC. More precisely, the TD 11-year-old group performed at ceiling for all clitic pronouns, while the TD 6-year-olds were at ceiling performance only for 3rd person nominatives (97.4%) and 3rd person reflexives (96.4%) but not for 3rd person accusative clitics which yielded an accuracy of 70.3% (versus 90.6% for 1st person accusative clitics). Similarly, the group with SLI produced 3rd person nominative clitics and 3rd person reflexive clitics at mean rates of 86.6% and 93.6% respectively, while 3rd person accusative clitics were produced with a significantly lower mean rate of 49.7%. Performance by this group with 3rd person ACC also strikes a significant contrast with that of 1st person ACC, which revealed a mean rate of 85%. For MMHL, the mean rate of production of 1st person accusative clitics was high as well, attaining 88.8% and in RE it was as much as 95%, in contrast to the mean production rates for 3rd person ACC, 80.9% for MMHL and 85% for RE. These results attest to the status of 3rd person ACC as a persistent marker of atypical language development stemming from different etiologies. In addition, most crucially for the present study, 3rd person ACC were significantly more subject to avoidance than 1st person ACC in both TD-6-year-olds and in adolescents with atypical language development.

1.3. Sources of difficulty for 3rd person ACC

What makes these clitics particularly complex? One possibility is that the 3rd person feature itself is the source of their difficulty, independently of the accusative case. However, the person feature alone cannot account for the difficulty of 3rd person accusative clitics since nominative clitics of the 3rd person are even produced earlier than those of the 1st and 2nd person in very early typical development of French, between the ages of 1;9 and 2;9 (Pierce, 1992; Hamann et al., 1996; Van der Velde, 1999). No differences are reported between the production rates of 1st and 3rd person nominative clitics later, by age 4 (respectively 85% and 88%, Dupuy, 2009). By age 6, children reach a production rate of 98% for production of both 1st and 3rd person nominatives (Tuller et al., 2011), and commit very few errors: In an elicited production task, typically-developing children aged 6 to 11 (N = 36, M age = 8;8) only produced 1.9% of 3rd person nominative clitics with a

gender error and 0.6% with a person error (Delage, 2008), contrasting with the frequent gender errors on 3rd person accusatives reported in the literature (as previously described). Given that ceiling performance is observed with 3rd person nominatives by age 6 while difficulty with 3rd person accusative clitics persists (Tuller et al., 2011), the 3rd person feature alone does not seem to be the source of complexity, leading to the conclusion that other properties specifically associated with 3rd person accusative clitics also affect its acquisition, ''each of these properties adding complexity, separately and conjointly'' (Tuller et al., 2011:437). It is to these specific properties proposed by Tuller et al. which we now turn.

A first potential source of difficulty evoked for the 3rd person ACC is the **morphological marking for gender**. Indeed these clitics are marked for both gender and number in the singular (*le*/*la*) while their counterpart object clitics of other persons only inflect for number. It is worth recalling that 1st and 2nd person ACC do not morphologically encode gender in either singular or plural forms (*me/te* for singular, *vous/nous* for plural). Indeed all forms may be used to refer both to masculine or feminine antecedents. Given previous evidence showing the high prevalence of gender errors in studies targeting production of 3rd person ACC, the factor of gender may thus constitute a valuable source of complexity of this element.

Another property of 3rd person accusative clitics is their reference which is characterized by **discourse-participant-independence**, in contrast to ACC of the 1st and 2nd person which are restricted to discourse-participants for reference and, as a result, are obligatorily animate (Tuller et al., 2011). Discourse-participant independence as such widens the source of possible referents and may thus also be a source of difficulty in the acquisition of 3rd person ACC. Gibson (1998) considers that building a structure for a new discourse referent increases the processing cost, which may lead to ''decays in the activations associated with preceding lexical items'' (Gibson, 1998:12). This would explain why sentences like (7a), with 1st or 2nd person nominative clitics, are simpler to process (by adults) than (7b) where the referent of the 3rd person clitic is lacking (Gibson and Warren, 1998).

(7a) The student who the professor who **I** collaborated with had advised copied the article.
(7b) The student who the professor who **they** collaborated with had advised copied the article

A third property of 3rd person ACC which may influence their acquisition and which is specific to 3rd person ACC as compared to other ACC is that they may be felicitously deleted in spoken French when the reference is sufficiently salient in the discourse (see Fónagy, 1985; Lambrecht and Lemoine, 1996; Lemoine, 1997; Tuller, 2000). Consider the examples (8) below which illustrate this **optionality in spoken French** (Fónagy, 1985):

(8a) –Voulez-vous que je vous donne mon numéro de téléphone?
want-you that I you give my number of telephone
'Do you want me to give you my phone number?'

–Non, je connais __.
no, I know
'No, I know __'

(8b) – Les Hauts-de-Seine, vous connaissez __?
The Hauts-de-Seine, you know
'The Hauts-de-Seine, you know __?'

(8c) The gardener with an upward head movement toward a tree:
– J'abats __?
I chop-down
'I chop down __?'

In addition to discourse-salience restrictions, object omission is also subject to lexical restrictions (see Fónagy, 1985; Tuller, 2000), as can be observed below (from Tuller, 2000). In other words, third person ACC can be omitted only if they are used with specific verbs.

(9) Le sac à dos de Luc pèse une tonne le vendredi soir. Ça contient tous ses livres et tous ses cahiers.
*T'as déjà porté __?/T'as déjà vu __?
The backpack of Luke weighs a ton the Friday evening. That contains all his books and all his notebooks.
*You have ever carried__?/You have ever seen __?
'Luke's backpack weighs a ton on Friday evenings. It's got all of his books and all of his notebooks.
Have you ever worn __?/Have you ever seen __?'

In sum, the legitimate omission of 3rd person ACC is subject to **discourse** restrictions, but also to **lexical** ones, which may require time to be mastered, resulting in prolonged object omission. Children exposed to a variety of null object contexts such as seen above might thus assume that such null objects have a wider distribution than they actually do in the target grammar (Pérez-Leroux et al., 2008). Indeed the object omission stage is attested across languages (Deen, 2006; Jakubowicz et al., 1997; Schaeffer, 1997, 2000; Wexler et al., 2003/2004, and others). However as Pérez-Leroux et al. (2008) have shown empirically, children learning languages with a complex typology of null objects, such as French, are later to restrict the distribution of these null objects than children learning a language with a simpler object drop typology, such as English. This reasoning can be extended to explain the asymmetry within French between 3rd person ACC and 1st and 2nd person ACC, which are typologically simpler in that they are never legitimately dropped.

The explanations based on the above properties, initially reported by Tuller et al. (2011), suggest that 3rd ACC possess various properties which may have an impact on their acquisition. It has already been shown that a major source of complexity of object clitics is their non-canonical position resulting from internal merge (Belletti, 1999). Other authors have also evoked processing difficulties in chain crossing to explain the difficulty of accusative clitics, as opposed to reflexive ones (See Zesiger et al., 2010). These considerations however do not explain the specific difficulty of the 3rd person ACC as compared to the 1st. Based on this observation, the complexity of 3rd person object clitics is arguably the result of a combination of several properties aside from their non-canonical position. As we have shown, the properties associated with third person accusative clitics that set them apart from 1st and 2nd, include their morphologically marking for gender, their reference not being restricted to discourse participants and their being subject to legitimate omission in certain contexts. The reasoning regarding these properties being complex is as follows: (i) If morphological agreement is part of the difficulty involved in producing third person accusative clitics, because of the need to keep in working memory the gender of the referent, we expect that ACC3, which display gender agreement, would be harder than 1st and 2nd person ACC (ACC1/2), which are void of such agreement. (ii) If establishing non-discourse-participant reference adds difficulty because the larger set of possible referents for ACC3 would tax working memory resources, then we expect ACC3 to be harder to master than ACC1/2 whose set of possible referents is highly restricted, i.e., respectively the speaker or the hearer. (iii) If the legitimate omission of ACC3 in certain contexts increases its difficulty because children become more likely to overgeneralize this omission, we expect more difficulty with the mastery of those contexts that demand the obligatory presence of ACC3, a difficulty which would not exist for ACC1/2, which are invariably obligatory in the input.

In this work we thus propose to assess the empirical effect of gender marking, discourse-participant independence and legitimate omission, by using experimental materials which allow us to disentangle these properties of 3rd person ACC. We predict that each of these properties will have a significant effect on acquisition, and we spell out the nature of the effect expected in our description of each corresponding experiment.

2. Method

2.1. Participants

The participants were 41 children aged 4 to 8 divided into two age groups: 4–6 and 6–8.[2] Characteristics of these two groups are presented in Table 2. We chose this age range to avoid both ceiling and floor effects.[3] All children were monolingual French-speakers ($N = 17$, mean age = 6;4) or had acquired French before the age of three ($N = 24$, mean age = 6;6). The latter were children who were born in Switzerland (and thus were exposed to French since birth) but whose parents (either one or both) have another native language.[4] Note that we will present the results of mono- and bilingual children together since no significant difference was found between these two groups (whatever the task used, as detailed in Appendix 1). Lastly, the participants did not present any particular academic or language difficulty and thus did not receive speech-language therapy.

[2] The four experiments have the same participants. However, note that we added 10 additional 4-year-old children to experiment 3 in order to further assess the impact of discourse-participant independence in a larger group of young children.

[3] Indeed Delage (2008) demonstrated that 8-year-old typically-developing children already attain ceiling performance in elicited production of accusative clitics while children younger than 4 are likely to have excessive difficulty with our grammatical judgment task which requires metalinguistic knowledge (Maillart and Schelstraete, 2007).

[4] All these children were schooled in monolingual French-speaking classes and had one French-speaking parent. This is why we can assume that they are French-dominant bilinguals.

Table 2
Characteristics of the two age groups.

Group	*N*	Sex	Age range (year;month)	Age: *M* (SD) (year;month)
4–6	21	10M 11F	4;7–6;4	5;7 (0;6)
6–8	20	10M 10F	6;5–8;5	7;4 (0;8)

2.2. General procedure

All children were tested individually by two experimenters in a single school in Geneva. Their answers were (digitally) recorded for subsequent transcription and coding. All transcriptions were meticulously checked at least twice: after the initial check, a second check was done by a different coder in order to verify the precision of all transcriptions and to correct any potential errors. In case of doubt, especially when the elided form of the accusative clitic (l') was required, the three coders (all native French-speakers) listened to the problematic recording once again in order to reach a consensus. Inter-rater agreement thus attained 100% for each instance of the clitic with the elided vowel (l'). If a doubt persisted concerning the realization or not of the accusative clitic in sequences such as ''elle/il l'arrose'', such productions were characterized as omissions.

We used a total of four experimental tasks focusing on accusative clitics of which three were specifically designed for this study. As previously explained, our study aims to explore the respective roles of properties which should make 3rd person accusative clitics (ACC3) more difficult to acquire than 1st (ACC1) and 2nd person (ACC2): **morphological marking for gender**, **discourse-participant independence** and **optionality in spoken French** under specific (discourse and lexical) conditions. We have therefore developed one experimental task for each of these potential sources of difficulty. In addition, we wanted to replicate the results of Tuller et al. (2011) which clearly showed the gap between ACC1 and ACC3 (in favor of the first) in 6-year-old children. We also wanted to replicate Delage (2008) who showed that typically-developing 8-year-olds performed at equally high rates for ACC1 and ACC3. With this in mind, we focus on children around the age of 6 years so as to (i) check for the presence of the ACC1/ACC3 gap in children younger than those tested in Tuller et al.'s study, and (ii) document the evolution from poor performance to mastery of both ACC1 and ACC3.

In the following sections, we systematically present the properties of the ACC that are examined, our corresponding prediction, experiment, results and discussion. All the participants completed the different tasks in the same session and in the same order as that in which we present these tasks.

Note that, due to the non-normal distribution of the data (confirmed by the Shapiro–Wilk test), our main analyses were conducted with non-parametric tests, with the Mann–Whitney test for inter-group comparisons and the Wilcoxon test for intra-group comparisons, associated with the Friedman ANOVA and Spearman's rank correlations.

2.3. *EXPERIMENT 1:* ACC1/ACC3 gap

This task was used to verify the presence of the discrepancy between ACC1 and ACC3. We expected to replicate results obtained by Tuller et al. (2011) in 6-year-olds, i.e., to show better performance for ACC1 compared to that of ACC3. Moreover, since the ACC1/ACC3 gap disappears at age 8 (Delage, 2008), we expected to find a less pronounced gap in the older group (6–8), compared to the younger one (4–6).

2.3.1. Task and stimuli

In order to test production of ACC1 and ACC3, we administered a shortened version of the Production Probe for Pronoun Clitics (PPPC, Tuller et al., 2004) which was used in 2011 by the same authors to highlight the ACC1/ACC3 gap. We adapted this task by removing items which require the production of reflexive clitics and by adding fillers in order to avoid that all items required accusative clitics. The final task contained 16 test items (ACC1 and ACC3) which were randomized and preceded by 2 pre-test items and mixed with 4 fillers (see Table 3). Appendix 2 provides the complete list of all target items. The experimenter elicited clitics by asking a question about a drawing appearing on a computer screen, as illustrated in Table 4 (for the two pre-test items).

As detailed in the initial description of this task (Tuller et al., 2011), the omission of the accusative clitics elicited in these contexts would lead to an ungrammatical response, in the sense that discourse and lexical restrictions allowing their potential legitimate omission are not present. Moreover, whenever the child answered with a structure other than the one expected (that is, with a verb which does not require an accusative clitic), the experimenter asked the child to reformulate his/her answer by specifying the verb to use. Below is an illustration of how this was accomplished with an example such

Table 3
Clitic pronouns elicited by the shortened version of the PPPC (EXPERIMENT 1).

2 pre-test items		16 test items		4 fillers
1 x ACC1	1 x ACC3	8 x ACC1	8 x ACC3	All intransitive verbs
me	la	**me**	4 masc. **le**	
			4 fem. **la**	e.g.: il nage 'he's swimming'

Table 4
Examples of stimuli (EXPERIMENT 1).

ACC3	Experimenter: Que fait le monsieur avec sa voiture? 'What's the man doing with his car?' Expected response: Il **la** lave. He her washes 'He's washing it'.
ACC1	Experimenter: Lui, il dit « Hé, Marie, que fait la vache? » Toi, tu es Marie, qu'est-ce que tu réponds? '*He* says « Hey, Mary, what's the cow doing? » '*You* are Mary, what do you answer?' Expected response: Elle **me** lèche. She me licks 'It's licking me'.

Note: Illustrations are given in Appendix 3.

as that in (10), where the expected response is *Elle me lèche* (''It's licking me'') and the child provided an utterance which does not require a clitic (10a) and is prompted to correct the utterance with the appropriate transitive verb (10b)[5]:

(10a) La vache est sympa
'The cow is nice'
(10b) Mais comment tu dirais avec lécher?
'But how could you say it with 'lick'?'

2.3.2. Results

For the total of 41 children aged 4–8, ACC1 were produced at 90% (SD = 21), thus approaching ceiling performance, whereas ACC3 were produced at only 76% (SD = 25). The difference is significant ($T = 30$, $p < .001$, $r = .41$), which clearly confirms the existence of the ACC1/ACC3 gap. Note that these rates include, in addition to the correctly produced accusative clitics, those accusative clitics that were produced with an error of gender or person.[6] Note that production rates of entirely correct ACC1 and ACC3 also differed ($T = 103$, $p < .001$, $r = .37$). The ACC1/ACC3 gap is observed both in the group aged 4–6 ($T = 15.5$, $p < .01$, $r = .44$) and in the one aged 6–8 ($T = 0$, $p < .01$, $r = .42$). Given that previous work revealed an absence of this gap in 8-year-olds (ACC1 vs. ACC3: $p = 0.3$, Delage, 2008) as well as beyond the age of 8, we can now confirm that children do not attain ceiling performance for ACC3 before the age of 8. Fig. 1 shows rates of ACC1/ACC3 production for our two age groups, compared to rates obtained in 12 8-year-old children ($M = 8;2$, SD = 0;3) tested in a previous study (Delage, 2008).

Finally, erroneous clitics consist of person errors (3.7%, SD = 8) for ACC1 and of gender errors (12.2%, SD = 11.7) for ACC3. Non-expected responses consist of clitic omission (9.1%, SD = 19) and use of DP (0.9%, SD = 4.3) for ACC1, and clitic omission (17.1%, SD = 20.5), use of DP (5.5%, SD = 10.1), non-response (0.9%, SD = 3.3) and case errors (0.1%, SD = 0.3) for ACC3.

[5] This same strategy was applied during the other elicitation probes of the present study.
[6] Note that the two occurrences of grammatical dative clitics were counted as correct responses so as to render our results comparable to those reported in Tuller et al. (2011) who proceeded this way.

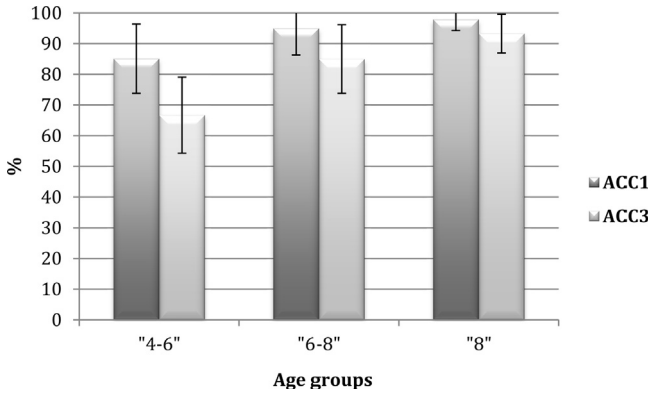


Fig. 1. Correct production rates (%) and standard deviations for ACC1 and ACC3 in 4–6, 6–8 and 8-year-old age groups (EXPERIMENT 1).

2.3.3. Discussion

One of the aims of the present research was to confirm the delay of ACC3 as compared to ACC1, namely the ACC1/ACC3 gap (Avram and Coene, 2008; Tsimpli and Mastropavlou, 2007; Tuller et al., 2011) and to investigate the developmental trajectory of this delay. Our results have clearly shown this asymmetry and further highlighted for the first time that the gap between ACC3 and ACC1 persists until when children are 8 years old.

2.4. EXPERIMENT 2: Morphological marking for gender

We developed a task to test specifically and independently gender as a potential factor of difficulty in producing ACC3. This task is designed similarly to the preceding test since it also elicits accusative clitics by requiring participants to give an answer to a question about an image appearing on a computer screen. The originality we added is the presence of accusative clitics whose gender is neutralized. This was attained by using the form with the elided vowel (**l'**) which does not show overt agreement and can therefore refer to either a masculine or feminine antecedent. We also varied the gender of both nominative and accusative clitics to create different types of clitic sequences (i.e., a nominative clitic immediately followed by an accusative clitic). We expected that two consecutive clitics with different marking for gender, (called **mismatch sequences**, e.g., nominative masculine **il** 'he' followed by accusative feminine **la** 'her', as in **il la** lave 'he her washes') would be more complex to process than clitics sharing the same morphological properties (called **match sequences**). Indeed, the combination of two clitics requires participants to hold in working memory their two distinct referents including their respective morphological properties. It thus seems logical that such discordance between two morphological markings would require increased working memory demands and lead to confusion as well as subsequently to gender error in such sequences.

We predict that gender agreement plays a role in the acquisition of ACC3, and more specifically that children will perform better on neutral sequences (without gender agreement on ACC3) than on other sequences (with overt agreement). Moreover, if gender mismatch makes indeed the task more complex, in particular due to the additional cost involved in storing two different morphological features, we expect performance to be worse on mismatch sequences than on match sequences. Thus, as Tuller et al. (2011) underlined in their study, children are likely to confuse the gender of the nominative clitic and the gender of the last DP they hear, both being of discordant gender in the mismatch sequences. More precisely, the predominant pattern that these authors have found involved the child using the gender of the last DP of the question for the nominative clitic and then the opposite gender for the accusative clitic, as shown below:

(11) Experimenter:	Que	fait	Pierre	à	la	dame?
	what	does	Pierre	to	the	lady
	'What is Pierre doing to the lady?'					
Expected response:	Il	la	coiffe.			
	he	her	doing-hair			
	'He's doing her hair'					
TD-6 y-o:	Elle	le	coiffe.			
	she	him	doing-hair			
	'She's doing his hair'					

2.4.1. Task and stimuli

Three types of sequences, all involving singular accusative clitics, were elicited in this task (examples 12–14):

(12) **Neutral sequences** with a nominative clitic marked for gender (***il/elle*** 'he/she') followed by the form of ACC3 with the elided vowel (**l'**), such as ***il/elle l'****arrose* 'he/she is sprinkling him/her'

(13) **Match sequences** with nominative and accusative clitics sharing the same gender marking (***il le*** 'he him', ***elle la*** 'she her'), such as ***il le/elle la*** montre 'he's pointing at him/she's pointing at her'

(14) **Mismatch sequences** with nominative and accusative clitics sharing different gender marking (***il la***'he her', ***elle le*** 'she him'), such as ***il la/elle le*** *montre* 'he's pointing at her/she's pointing at him'

There were a total of 18 test items altogether (see Table 5), preceded by 4 pre-test items and alternated with 6 fillers. Before the testing, children were familiarized with the pictograms used (from *Pictelia* software).

In each trial, the experimenter started by producing a sentence in an SVO order to describe the transitive action illustrated on the screen (see examples in Appendix 4). The pictures corresponding to the subject and to the verb then disappeared in order to avoid the influence of the canonical position of the three pictures on the screen (the picture on the left of the screen representing the subject, the one in the middle the verb and the one on the right the object), with only the picture of the object remaining. At this point, the experimenter asked a question to elicit the appropriate sequence of clitics. Table 6 illustrates this procedure for neutral, match and mismatch sequences. Note, too, that pictograms representing the verbs were animated to better illustrate the actions, which made this task more attractive for very young children. Appendix 5 provides the complete list of all target items.

2.4.2. Results

A Friedman ANOVA analysis (conducted on results of the 41 children) shows a significant effect of the type of sequences ($r = 17.60$, $dl = 2$, $p < .001$), which thus confirms our initial hypothesis. Neutral sequences (considered as the less complex sequences) were produced correctly (57%, SD = 39) at significantly higher rates than match sequences (47%, SD = 39; $T = 51.5$, $p < .01$, $r = .29$) and mismatch sequences (39%, SD = 35; $T = 21$, $p < .001$, $r = .39$). On the other hand, performance on match sequences was better than on mismatch sequences, even though the difference is no longer significant if we adopt the Bonferroni correction ($T = 79.5$, $p < .05$ but $>.017$, $r = .22$). Note that production rates correspond to entirely correct sequences, without gender errors (which we describe below). This is because what we wanted to observe was specifically the children's capacity to use correct morphological agreement on the relevant items. Regarding differences between age groups, 4–6 year-olds performed less well than 6–8 year-olds on the three types of clitic sequences (neutral: $U = 103$, $p < .01$, $r = -.43$; match: $U = 106$, $p < .01$, $r = -.42$; mismatch: $U = 113$, $p < .017$, $r = -.39$), showing a developmental effect. The two groups also showed an effect of the type of sequences (for 4–6: $r = 7.18$, $dl = 2$, $p < .05$; for 6–8: $r = 12.46$, $dl = 2$, $p < .01$). Fig. 2 illustrates that the younger group always performed less well than the older one, with the same pattern being attested in both groups, i.e., better performance for neutral sequences, followed by match sequences and finally by mismatch sequences.

Turning now to the pattern of errors produced (only on accusative clitics), Table 7 provides the distribution of these errors in the two age groups. When ACC3 were not produced, production of a lexical DP was the most common answer.[7] Recall that during this task, when the child had to reply, the only picture remaining on the screen was the one depicting the object; this can explain why lexical DP is the most frequent inappropriate response. For the other answers, the 4–6 year old group made more omission errors than the 6–8 year old group ($U = 112.5$, $p < .01$, $r = .39$), but did not differ significantly on gender errors ($p = .073$) which thus persist and were observed equally frequently in both directions (masculine into feminine and vice versa). Moreover, we observed more gender errors on ACC3 in mismatch sequences (23.6%) than match sequences (10.6%; $T = 15$, $p < .01$, $r = .30$). This confirms the specific difficulty due to the manipulation of two different morphological features in sequences containing two clitics.

Lastly, if we consider the gender errors produced only in mismatch sequences, we observe that the majority of these errors leads to a single gender marking (instead of two) of the two clitics. Indeed, of all the gender errors in mismatch sequences, 69% consist of applying one unique gender to the two clitics, as in (15). The other 31% of gender errors consist of inverting the morphological markings (16).

[7] The same pattern is observed for the various gender conditions, with a predominance of lexical DPs (25% of the responses for ACC3 production in neutral sequences, 35% in match sequences and 40% in mismatch sequences), as compared to omissions (13% in neutral sequences, 8% in match sequences and 5% in mismatch sequences). The relatively high rate of ACC3 omission in neutral sequences could be attributed to the fact that we characterize as omission any case in which the three native coders could not reach a consensus about the realization or not of the accusative clitic in sequences such as ''elle/il l'arrose" (as mentioned in Section 2.2).

Table 5
Sequences elicited by the task on gender marking (EXPERIMENT 2).

	18 test items		6 fillers
6 neutral sequences	6 match sequences	6 mismatch sequences	All intransitive verbs
3 x **il l'**	3 x **il le**	3 x **il la**	e.g.: il plonge
3 x **elle l'**	3 x **elle la**	3 x **elle le**	'he's diving'

Table 6
Examples of stimuli (EXPERIMENT 2).

Neutral sequences	Experimenter: Regarde, le garçon essuie une grosse tache sur la table. Alors tu te souviens? Que fait le garçon avec la tache? 'Look, the boy is wiping a big spot off the table. So do you remember? What is the boy doing to the spot?' Expected response: **Il l'**essuie. He it wipes 'He's wiping it'.
Match sequences	Experimenter: Regarde, la fille prend une banane. Alors tu te souviens? Que fait la fille avec la banane? 'Look, the girl is taking a banana. So do you remember? What is the girl doing with the banana?' Expected response: **Elle la** prend. She her takes 'She's taking it'.
Mismatch sequences	Experimenter: Regarde, le garçon montre une girafe. Alors tu te souviens? Que fait le garçon avec la girafe? 'Look, the boy is pointing at a giraffe. So do you remember? What is the boy doing to the giraffe?' Expected response: **Il la** montre. He her points to 'He's pointing at it.'

Note: Illustrations are given in Appendix 4.

(15) Experimenter: Que fait la fille avec le croissant? 'What is the girl doing with the croissant'
Expected response: Elle le mange.
She him eats
'She's eating it'
*STA (5;5 y.o.): **elle la mange.**
She her eats

(16) *PHI (5;5 y.o.): **il la mange.**
He her eats

Table 8 indicates, for each age group, the proportion of gender errors produced in mismatch sequences on nominative and on accusative clitics, as well as the type of errors. Two error types were possible: (1) either the child inversed the genders of the two clitics (on both nominative and accusative); (2) or s/he substituted the gender of one single clitic (the nominative or the accusative), thus leading to one unique gender for the sequence.

2.4.3. Discussion

Two observations concerning the effect of gender marking are of particular interest. Firstly, we have demonstrated that it is more difficult for children to produce clitic sequences in which gender of ACC3 is overtly marked than to produce sequences containing the form with the elided vowel **l'** where there is no overt gender marking.[8] This could be surprising

[8] Note, however, that since gender agreement is not visible on the forms with an elided vowel, we cannot know if these clitics are accurate or not with respect to this feature.

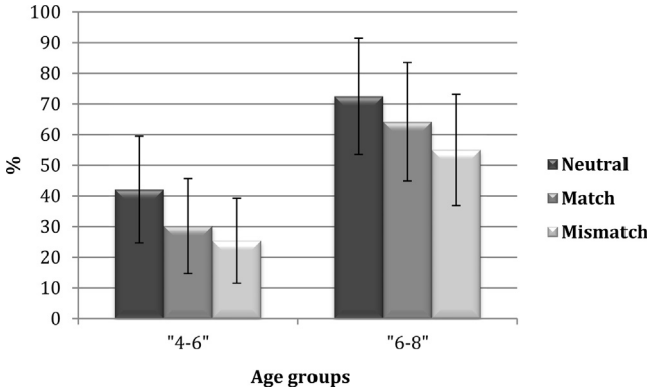


Fig. 2. Correct production rates (%) and standard deviations for neutral, match and mismatch sequences in 4–6 and 6–8 age groups (EXPERIMENT 2).

Table 7
Distribution (% and number) of unexpected answers produced instead of ACC3 in 4–6 and 6–8 age groups (EXPERIMENT 2).

	Lexical DPs	Omissions	Gender errors
4–6 y.o.	**65%** (157/240)	**25%** (59/240)	**10%** (24/240)
6–8 y.o.	**69%** (87/126)	**10%** (13/126)	**21%** (26/126)

Table 8
Characterization of gender errors appearing on mismatch sequences containing both nominative and accusative clitics (EXPERIMENT 2).

	Locus of gender errors		Type of errors	
	Nominative clitics	Accusative clitics	One unique gender	Inversion of genders
4–6 y.o.	**53%** (17/32)	**47%** (15/32)	**58%** (11/19)	**42%** (8/19)
6–8 y.o.	**30%** (6/20)	**70%** (14/20)	**81%** (13/16)	**19%** (3/16)

since the so-called neutral condition actually involves resyllabification and the deletion of the vowel which could be assumed to be additional processing operations (Levelt and Wheeldon, 1994). It has previously been claimed that gender on clitics is difficult for young children (Zesiger et al., 2010, a.o.), although this marking is unproblematic when occurring on articles (Jakubowicz and Nash, 2003). For the first time, we have been able to bring to light the difficulty associated with gender on clitics through a comparison with clitics without this overt agreement. This confirms the strong impact of gender marking on ACC3. Moreover it is noteworthy that the form of the clitic with the elided vowel is still abstractly specified for the gender feature as can be seen from its triggering of participle agreement in the target grammar (e.g. *il l'a prise* 'he it took[feminine]). However, the elided form is crucially not overtly marked for the gender feature, which affects the children's performance. This testifies to the complexifying role of overt gender marking in production, as does the fact that 6 to 8-year-olds continue to make a significant rate of gender errors on ACC3.[9] Note also that results of both Pirvulescu and Belzil (2008) and Avram et al. (2015) provide support for the view that complexity is increased with **overt** gender marking in sequences of nominative and accusative clitics. Hence, Pirvulescu and Belzil (2008) provide experimental data showing that French-speaking children aged 1;10 to 2;10 produce ACC3 significantly more often when the subject is ''tu'' 'you' which is void of morphological agreement. Avram et al. (2015) reported results for a task which focused on the role of gender match/mismatch in ACC3 production in Romanian, which is a null subject language. They reported very few

[9] Another argument comes from the gender errors produced on nominatives clitics (11% in sequences containing an overt agreement on ACC3, versus 4% in sequences without such agreement).

gender errors and did not find any difference between clitic production in responses to gender match/mismatch contexts. This suggests that the complexity of match/mismatch sequences is the result of the two clitics (nominative + accusative) being **overtly** marked for gender.

Secondly, we have also demonstrated the effect of combining two different morphological gender markings through the inclusion of structures with both a match and a mismatch in gender on the nominative and accusative clitics. What our results illustrate is that the mismatch sequences (**il la/elle le**) are more difficult than match sequences (**il le/elle la**) in production. This is the first time that this has been formally tested for clitics (with overt agreements). How can we account for this? Could this be related to interference created by the mismatch in features between the object clitic chain and the intervening trace left by the moved subject (see also Avram, 2011; Zesiger et al., 2010)? This seems unlikely in light of a recent study by Belletti et al. (2012) showing that only features functioning as attractors for syntactic movement enter into the computation of intervention. As gender is not part of the phi-feature complex that determines movement in French, it is not expected to affect locality constraints on chain formation.[10] Another possible explanation is in terms of cognitive load: during production, one not only has to keep in mind the morphological markings that are linked to the corresponding referents[11] but also needs to apply this marking on another relevant element, the pronoun in our case. One strategy to deal with this is to re-apply a featural marking previously activated by another element in the utterance. Recall that our predominant error pattern is consistent with this perspective, namely that a single morphological marking was often erroneously applied across elements in the clitic sequence for both age groups tested. That working memory is highly taxed by such constructions and can thus bring about gender mismarking was already suggested in Tuller et al. (2011:436).[12] More precisely, these authors evoked the idea that the most recently used gender would lead to favoring this gender in the child's response. Similarly, Pirvulescu and Strik (2014) showed that 3 year-olds tended to use the most recently mentioned noun to determine the clitic's reference and attributed this recency effect to working memory limitations. We also found this pattern frequently amongst our youngest group, aged 4–6 (see Table 8). However, this is not the predominant pattern, notably in the older group, aged 6–8, since they were able to accurately realize gender on the nominative clitic, plausibly because their working memory is significantly better at this age. Nevertheless, they continued to make gender errors on the accusative clitic. This could be due to the fact that the subject in our task is always a boy or a girl, whose gender is natural, compared to the grammatical gender of the object which is either an animal or an inanimate object. This specificity of this task (with only natural genders) renders the gender of the subject the most salient one and thus it primes the gender of the object. Recall that in our task children performed better in the match condition, and precisely in this condition, the stimuli which the child heard contained *four* instances of either feminine or masculine gender, such as: ''Look, the girl (feminine1) is taking the banana (feminine2). What is the girl (feminine3) doing to the banana (feminine4)?'' This may arguably have yielded a priming effect, i.e., where participants are more likely to use a particular form if it has recently been employed (see e.g. Bock, 1986; Weiner and Labov, 1983 for these priming effects in syntax). Given this, the multiple instances of feminine or masculine gender in the match condition may well have increased the child's accuracy as compared to instances where no such predominance of a specific gender was present in the preceding stimuli.

2.5. EXPERIMENT 3: Discourse-participant independence

We now oppose discourse-participant dependent accusative clitics (i.e., 1st or 2nd person clitics whose reference is directly tied to the speech act) and discourse-participant independent clitics, namely 3rd person clitics whose reference is necessarily other than the speech act participants. We predict discourse independence to play a role in the acquisition of ACC3, particularly due to the resources necessary in working memory to keep in mind the syntactic referent. Thus we expect to observe better performance in sequences with ACC2 compared to those with ACC3.

2.5.1. Task and stimuli

In order to elicit ACC2 and ACC3 naturally and particularly those with discourse-participant dependence (ACC2), we created a task in which the child has to deal with tangible actions and real characters (inspired by Pirvulescu and Hill's study, 2011). This natural context facilitates the production of discourse-dependent ACC and moreover seems to be highly motivating for young children. As with the previous task, this one also elicits sequences of clitics, the nominative always being 3rd person singular (**il** 'he') and the second (accusative) being either 2nd person singular (ACC2: **te** 'you',

[10] Note, however, that other features which do not clearly function as attractors for syntactic movement have been recently argued to modulate the comprehension of object relative clauses in French (see Durrleman and Bentea, 2015).

[11] In our task, this marking always corresponds to grammatical gender and not to conceptual gender, i.e., linked to the sex of the referent.

[12] Note that Delage and Frauenfelder (2012) empirically verified the relationship between complex syntax (i.e., embedding) and working memory in children with typical language development.

Table 9
Sequences elicited by the task on discourse-participant independence (EXPERIMENT 3).

16 item tests		6 fillers
8 sequences with discourse-participant dependence (ACC2): **Il te**	8 sequences with discourse-participant independence (ACC3): **Il l'**	All intransitive verbs e.g.: il baille 'he's yawning'

whose phonological form is the same for a feminine or masculine referent) or 3rd person neutral[13] (ACC3: **l'** 'it'). We chose to evaluate only neutral 3rd person accusative clitics in order to avoid effects due to differences in morphological gender marking between sequences being compared. Indeed, this marking is neutralized for both 2nd or neutral 3rd person accusative clitics; sequences of clitics were thus distinguished only by the effects of discourse-participant (in)dependence and not by morphological gender features. The task contains 16 test items altogether (see Table 9), preceded by 5 pre-test items and mixed with 6 fillers. Before testing, children were familiarized with the actions (and the corresponding verbs) to be presented during the task. Appendix 6 provides the complete list of all target items.

As already explained, the procedure involved an interactive situation. One experimenter, a man, performed an action either on the second experimenter[14] (a woman with eyes covered) or on an object such as a Barbie doll, a plastic flower, a flashlight, an apple or even a small box. The woman then asked the child what the man had done. The initial instructions are given in (17).

(17) Femme: *Regarde, je me bande les yeux, je ne vais plus rien voir !* (Nom de l'expérimentateur homme) *va faire des choses mais comme je ne vois rien, je ne saurai pas exactement ce qu'il fait ! Toi, tu peux tout voir alors tu vas me dire ce qu'il fait, soit à moi, soit à la Barbie ou à un objet, soit il fait des choses tout seul ! Tu as compris?*
Woman: 'Look, my eyes are covered, I can't see anything! (Name of the male experimenter) will do some things but as I cannot see, I won't know exactly what! YOU can see everything, so you will tell me what he is doing, either to me, or to a Barbie or to an object, or even what he is doing all by himself! Do you understand?'

When questioning, the woman always mentioned the object that the man was manipulating. If she herself was this ''object'', she used the strong pronoun **moi** 'me' in order to avoid producing a clitic pronoun. Examples in Table 10 illustrate this procedure for sequences with ACC2 and with ACC3.

2.5.2. Results

Results obtained by the 41 children showed a difference between the two items, ACC2 (M = 75%, SD = 30) being more frequently produced than ACC3 (M = 66%, SD = 32). This difference does not attain statistical significance (p = .068). This effect thus appears to be weaker than those observed for the properties studied in the previous experiment. Furthermore, the difference was no longer detectable when each age group was considered separately, confirming the weakness of the ACC2/ACC3 gap in our population. Turning now to differences between these age groups, it is interesting to note that 4–6 year-old children performed significantly less well that 6–8 year-olds on ACC3 (U = 107.5, p < .01, r = −.35), whereas inter-group difference only revealed a marginal trend toward significance for ACC2 (p = .057). Fig. 3 illustrates these differences for ACC2 and ACC3.[15] When ACC were not produced, omissions were the most frequent non-expected responses. Thus, out of all the non-expected answers (N = 179), 83% were omissions, followed by the production of lexical DPs (15%).

2.5.3. Discussion

Our results suggest a tendency toward better performance with pronouns whose reference is linked to the discourse (*Il **te***). This can be explained by the fact that identifying the referent for these elements is facilitated because potential referents are restricted to those involved in the speech act: the speaker (***me***) or the interlocutor (***te***). However the weak effect of this property that we observed may be due to the fact that it is mastered earlier in acquisition. With this in mind, we

[13] Amongst these items, half include items with [non animate] features (e.g., apple) and half the Barbie puppet which could be considered by children as animate. We come back to this in footnote 15.
[14] Such as putting on make-up, tapping, tickling, pointing to, sprinkling, etc.
[15] Recall in footnote 13 we pointed at that half of our ACC3 with discourse-independence referred to inanimate entities where the other half refereed to inanimates. No statistical relevant differences were identified between these two conditions (p = .45).

Table 10
Examples of stimuli (EXPERIMENT 3).

ACC2	Context: The man is tickling the woman. Experimenter: Et à moi, qu'est-ce qu'il fait? 'And to me, what is he doing?' Expected response: Il te chatouille. He you tickles 'He's tickling you'
ACC3	Context: The man is dressing the Barbie. Experimenter: Et à la Barbie, qu'est-ce qu'il fait? 'And to the Barbie, what is he doing?' Expected response: Il l'habille. He it dresses 'He's dressing it'

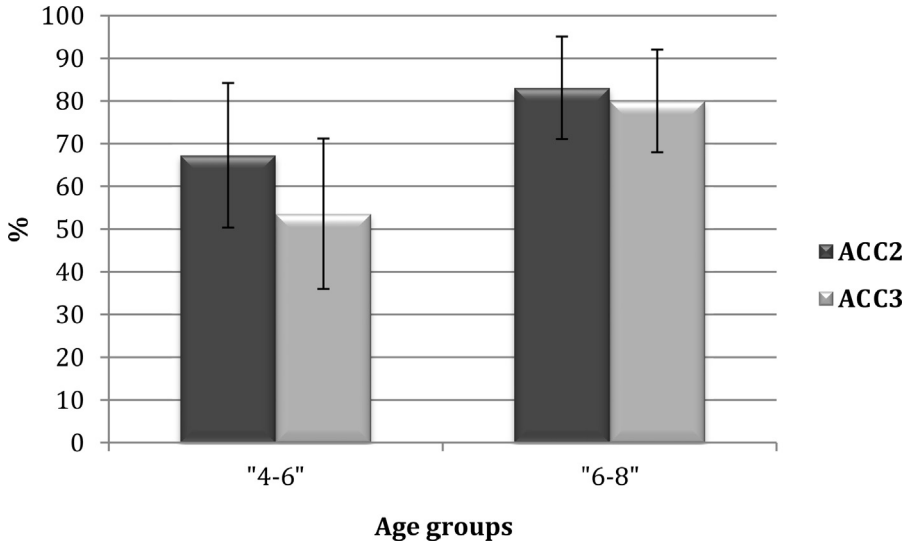


Fig. 3. Correct production rates (%) and standard deviations for ACC2 and ACC3 in 4–6 and 6–8 age groups (EXPERIMENT 3).

conducted a follow-up study focusing specifically on 4-year-olds for whom we predicted a stronger difference in performance between ACC2 and ACC3. We evaluated the performance of 10 additional (French-speaking monolingual) children aged from 4;5 to 4;10 and their results, as expected, showed a clear and significant difference in favor of discourse-participant dependent clitics ACC2 (*correct production rate* = 70%, SD = 24), compared to ACC3 (39%, SD = 25; $T = 2$, $p < .05$, $r = .54$). This argues in favor of an effect which is present at an early age and whose impact already tapers off around age 5–6. Therefore this factor seems to contribute to making ACC3 more complex than ACC2, although the effect is more easily detectible in earlier stages of language acquisition, unlike the previously discussed impact of gender, which appears to persist more robustly during later stages.[16] It is worth recalling that the UCC account predicted difficulty with both ACC3 and ACC2 to stem from the same underlying need to check more than one uninterpretable feature (leading to participle agreement) and thus did not predict more difficulty with one than the other.

[16] Recall that in experiment 1, the difference between ACC1 and ACC3 was significant in both age groups, but here the factors of gender and of discourse-participant independence were confounded.

This approach cannot obviously account for the discrepancy in performance between the two clitic subtypes reported here.

2.6. EXPERIMENT 4: Optionality in spoken French

As pointed out in the Introduction, ACC3 can be omitted legitimately in spoken French if (1) it is used with specific verbs and subsequently (2) it is linked to a sufficiently salient discourse topic. We predict this legitimate omission to contribute to the difficulty of ACC3. We therefore collected grammaticality judgments on this phenomenon and expected these judgments to correlate with the production rates of ACC3 in the elicitation tasks. We also predicted these judgments to negatively correlate with omission rates of ACC3 obtained by analyses of children's productions. The intuition is that if a child has not yet mastered ACC3, this can be manifested in two ways which would logically be related: omission in production and acceptance of non-grammatical omission in judgment. This is reminiscent of the study by Pérez-Leroux et al. (2008), who showed that children exposed to a variety of null object contexts as it is the case in French, are later to restrict the distribution of these null objects than children learning a language with an obligatory object. We cannot necessarily conclude that this implies a null object representation, but we can speculate that this leads to difficulties in ruling out inappropriate ACC3 omissions. In addition, if the improved performance with ACC3 across age is in part due to a better understanding of the contexts where this element is obligatory (as well as when it is optional), then we also expect an age effect in our grammaticality judgment task.

2.6.1. Task

Our grammaticality judgment task included sentences containing both legitimate and illegitimate omission of ACC3 (classified on the basis of adult judgments). As already noted, ACC3 omission is regulated by both lexical and discourse restrictions. Hence, all sentences with a legitimate ACC3 omission respect a double constraint: they comprise specific verbs allowing such omission (such as 'connaître' 'chercher' or 'adorer') and a reference for the omitted clitic which is sufficiently salient in the discourse. For sentences with an illegitimate omission of ACC3, either the verb does not allow such omission (such as 'habiller', 'rencontrer' or 'laver'), or the reference of the clitic is not sufficiently salient at the discursive level. These considerations were taken into account in our choice of two types of sentences containing an ACC3 omission, as explained in (18a) and (19a), with concrete examples provided in (18b) and (19b).

(18a) Null object permitted by referential interpretation – recovering of object via pragmatics, i.e., with salient discourse topic.

(18b) T'as déjà vu Dora à la télé? Dora? Oui je connais _.
'Did you ever see Dora on TV? Dora? Yes I know _'

(19a) Null objects permitted by generic interpretation – recovering of object via lexical semantics of verbs, i.e., optionally intransitive verbs.

(19b) Qu'est-ce que tu fais avec une voiture? Je conduis _.
'What do you do with a car? I am driving _.'

We also added another type of sentence with a subject omission permitted by an impersonal construction, explained in (20a), and illustrated in (20b).

(20a) Null expletive subjects permitted in impersonal constructions – a common phenomenon in spoken French, which is not determined by either a discourse or a lexical constraint. Including such sentences enables us to have a control condition whereby both children and adults should have no difficulty in judging for grammaticality.

(20b) Qu'est-ce qu'on doit avoir si il pleut? _ faut avoir un parapluie.
'What does one need to have if it's raining? _ needs to have an umbrella.'

We also selected sentences with the illegitimate omission of an object (21) and a subject (22). In the case of object omission, it then becomes impossible to recover the object either via lexical semantics or pragmatics.

(21) Si ton chien est sale, qu'est-ce que tu fais avec ton chien? * je lave _.
'If your dog is dirty, what do you do with your dog? * I wash _.'

(22) S'il a faim, qu'est-ce qu'il fait le bébé? * _ pleure beaucoup.
'If he is hungry, what does the baby do? * _ cries a lot.'

In order to be certain of the (un)grammatical status of the sentences selected, we first presented the stimuli to 52 adults (aged 16 to 40). The initial stimuli consisted of 40 audio-recorded sentences containing legitimate and illegitimate omission of object and subject pronoun clitics. The instructions given to adults emphasized the fact that the language to be judged was spoken and familiar (i.e., not formal). After analysis, we selected only sentences for which inter-rater agreement was equal or superior to 90%. This resulted in 23 sentences which were subsequently used with the children who participated in our study. The final task contained 20 sentences altogether, 14 with null objects and 6 with null subjects, preceded by 3 pre-test items. Appendix 7 provides the complete list of sentences. The procedure involved a grammaticality judgment task adapted for young children (inspired by Maillart and Schelstraete, 2007, see also Rice et al., 1999). We used a puppet learning how to speak. The male experimenter asked the puppet a question, and then it answered (via an audio recording). The puppet's voice was that of a woman with an attractive prosody for children. If the child thought that the puppet's answer was grammatically correct (i.e., was said properly), then it took a marble and put it in the puppet's mouth. Thus the child did not need to give an oral answer. If the child judged the sentence was wrong, it did not give the puppet anything.

2.6.2. Results – Judgment task

All children together (aged 4 to 8 years) provided correct judgments (i.e., accuracy rates in accordance with those of adults) equivalent to 82% (SD = 17) for null subjects and 75% (SD = 16) for null objects. The difference between both judgment rates was significant ($T = 238$, $p < .05$, $r = .23$). The fact that children performed well for null subjects (whose omission is systematically optional in impersonal constructions) suggests that our task was not too difficult for young children. The weaker results for null objects could thus not be attributed merely to a misunderstanding of the task. We then compared rates of correct judgments for null objects between the two types of sentence (i.e., with a referential interpretation or a generic interpretation). No difference was found between these two conditions ($p = .67$).[17] We then considered accuracy rates for legitimate and illegitimate omission of ACC3 whatever the type of sentence and observed differences in performance between age groups: The 4–6 year-old group performed significantly less well than the group aged 6–8 years ($U = 127$, $p < .025$, $r = -.33$).[18] Results of children are illustrated in Fig. 4 which shows accuracy rates in grammaticality judgment both for (3rd person) nominative (NOM3) and accusative clitics (ACC3).

Finally, we compared the scores for legitimate and illegitimate ACC3 omission in each age group. Interestingly, 4–6 year-olds did not show any difference between these two conditions (71% vs. 69%, $p = .8$), whereas 6–8 year-olds performed significantly better for the rejection of non-grammatical ACC3 omission, as compared to the acceptance of grammatical omission (89% vs. 73%, $T = 35.5$, $p < .05$, $r = .32$). This is a major argument against the children being biased toward accepting items, as described by Rice et al. (1999).

2.6.3. Results – Correlations between judgment task and the other tasks

We then considered performance across tasks because we expected to observe positive correlations between accuracy in this grammaticality judgment task and rates of correct ACC3 production (i.e., without gender errors or unexpected answers such as lexical DPs). We also predicted negative correlations between accuracy with grammaticality judgments and ACC3 omission rates. Indeed, if the legitimate omission of ACC3 in certain contexts increases its difficulty (because children become more likely to overgeneralize this omission), we expect that poor mastery of the contexts allowing this omission (characterized by low accuracy in our grammaticality judgment task) will correlate with difficulties in production of ACC3 in obligatory contexts. In order to conduct these analyses, we calculated unit-weighted scores for each of our measures (i.e. we combined each variable with a z score). Indeed, given the different tasks, the respective scores were not on the same scale (i.e., rates of production, of omission and of correct judgment), meaning that these differences had to be taken into account in order to arrive at a comprehensive analysis. We did not obtain any correlations between the accuracy rates in grammatical judgment (i.e., % correct judgments) and (i) rates of ACC3 production or (ii) rates of ACC3 omission in the production tasks (namely in probes: 'ACC1/ACC3 gap', 'Morphological marking for gender' and 'Discourse-participant independence'). However, considering that ACC3 production was always elicited for referential entities in our tasks, it made sense to dissociate those null objects which were permitted with a referential interpretation from those permitted with a generic one. Moreover, as an anonymous reviewer helpfully suggested, we focus our analysis on correlations between the acceptance of illicit referential null object in the grammaticality judgment task and ACC3 omission in production tasks. Very interestingly, for this specific analysis, we were able to establish strong

[17] More precisely, the rate of correct judgments for null objects in sentences with a referential interpretation was equal to 75.8% (SD = 18.3), and the corresponding rate in sentences with a generic interpretation was of 74% (SD = 24.2).

[18] Note that these results were also found if we adjust for a child's potential bias toward accepting items, with the use of A'-scores (see Rice et al., 1999). With this adjusted measure of sensitivity, we find again the differences between the 4–6 and the 6–8 year-old groups (means A' = 60% vs. 70%; $U = 133$, $p < .025$, $r = -.31$).

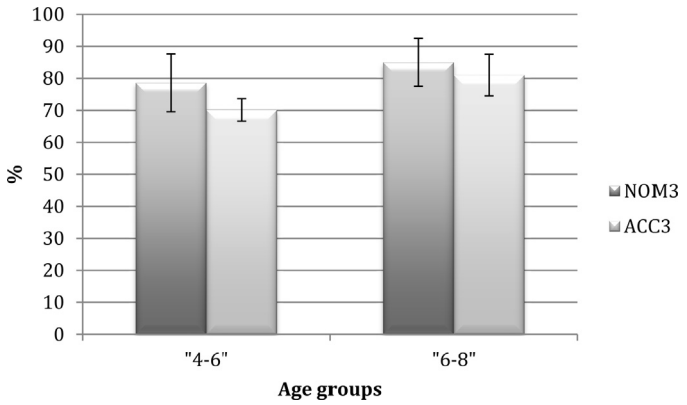


Fig. 4. Accuracy rates (%) and standard deviations in grammaticality judgment task on NOM3/ACC3 production or omission in 4–6 and 6–8 age groups (EXPERIMENT 4).

Table 11
Correlations between accuracy rates in acceptance of illicit referential null object and rates of omission of ACC3 obtained in the elicitation tasks in the 4–6 y.o. group.

	Rates of omission of ACC3 in production tasks		
	ACC1/ACC3 gap	Morphological marking for gender	Discourse-participant independence
Accuracy rates in grammatical judgment	**.63** ***p* = .002**	**.52** ***p* = .015**	**.64** ***p* = .002**

Note that these correlations remain significant after correcting for multiple testing (Bonferroni correction)

correlations in our younger group (aged 4–6), as reported in Table 11. Note that even proceeding in this fashion, no correlation was found with the older group of 6–8 year olds.

2.6.4. Discussion

These results of the grammatical judgment task on ACC3 omission have shown, as would be expected, an age effect on general performance, with differences between younger and older children. Even if accuracy rates were relatively high (between 78% and 85%), this age effect indicated a slight difficulty for young children to know when one can or cannot omit ACC3. We predicted that this weakness in mastering discourse-salience and lexical restrictions (which allow for legitimate ACC3 omission) may also be related to difficulties in ACC3 production and in particular may arguably give rise to an over-generalization of null objects. We indeed found this relationship but only for null objects permitted by referential interpretation in the 4–6 year-old group. Even though the link was less strong than expected, its existence still suggests that the mastery of discourse restrictions associated with ACC3 omission plays a role in the early mastery of ACC3 production.

3. General discussion

Our goal in this study was to investigate the respective roles of three properties, previously claimed to be potential sources of difficulty for the production of ACC3. These are morphological marking for gender, discourse-participant independence and legitimate omission. Our results show that these properties indeed influence ACC3 production in early acquisition (see Table 12 for a summary of the main findings, ranked by the more to the less persistent effect). Most robustly, the morphosyntactic feature of gender plays a strong role, while the other properties such as discourse-participant independent reference and legitimate omission under varying discourse/lexical conditions play a weaker role which is nonetheless detectible in early acquisition with appropriate experimental methods.

We have thus confirmed that the properties hypothesized to impact ACC3 production (Tuller et al., 2011) do indeed affect their acquisition, and we have further clarified the time course of this influence in language development. We have also speculated that working memory may play a role in determining these effects and suggest that future work examining the acquisition of accusative clitics also explore the memory capacity of children and its relation to syntactic

Table 12
Synthesis of the main results.

Property	*Observed effect*	*Developmental persistence* Ages: 4 5 6 7 8
Morphological marking for gender	Better performance for neutral sequences (with ACC without overt morphological marking) compared to ACC marked in gender Better performance for match sequences (NOM and ACC share same gender) compared to mismatch sequences (NOM/ACC differ in gender)	
Optionality in spoken French	Correlations between the acceptance of illicit referential null objects and omission rates of ACC3 in production tasks –	
Discourse-participant independence	Better performance for discourse-dependent ACC compared to discourse-independent ACC	

processing. Indeed, if the complexity of the factors that we have investigated places a burden on working memory, then difficulty with ACC3 should correlate with working memory limitations. As we already suggested, the storage of both the specific gender and the discourse referent of ACC3 may tax working memory. We would then predict that ACC3 performance in young children is selectively linked to working memory measures, which would not be the case for 1st/2nd person ACC or for neutral ACC3. Although we did not include an independent measure of working memory in this study, we have conducted another study focusing on accusative clitics in children with autism and with SLI, using exactly the same material as in the present experiment 1. Here we did uncover a significant positive correlation between the production of ACC3 (**not ACC1**) and working memory measures, more precisely on nonword repetition, forward and backward digit span in children with autism, and backward digit span in individuals with SLI (Durrleman and Delage, in press). Interestingly, this correlation was obtained after controlling for non-verbal reasoning, thus supporting the existence of a specific relationship between complex syntax and working memory capacities (and not general intelligence). These findings are consistent with the hypothesis that object clitic omission is affected by short-term memory limitations (e.g. Pirvulescu and Strik, 2014; Prévost, 2006; Tuller et al., 2011), and are in line with recent studies highlighting a link between independent measures of verbal working memory and clitic production (Grüter and Crago, 2012; Mateu, 2015).

Another striking finding of the present study concerned children's difficulty in producing clitic sequences involving a mismatch in gender, as compared to those involving a match in this feature. If, as we noted, the difficulty with gender mismatch in clitic production indeed stems from other underlying sources than the locality constraints on chain formation, we would expect to find this same effect surfacing with clitics that do not involve movement and subsequent intervention. In order to empirically verify this hypothesis, the eliciting of structures with two nominative clitics of different genders would be useful, for example: *Il (Jean) a vu qu'il (Pierre)/elle (Marie) a lavé la voiture*' He (John) saw that he (Pierre)/she (Mary) washed the car'. According to the view that gender mismatch complicates production independently of locality and movement, it is predicted that the child will perform worse with sequences involving both a masculine and a feminine nominative clitic than with sequences involving two masculine or two feminine ones. A related prediction is that similar results to those found for neutral sequences will emerge with plural accusative clitic **les** ('them') which is also neutralized for gender. We leave these investigations for our future research.

Finally, on a more general note, it is worth underlining that the linguistic analyses that have been proposed to date to explain the specific difficulty of ACC3 (whether in terms of internal merge, chain crossing or the UCC) cannot account for the specific properties of 3rd person accusative clitics studied here, namely morphological marking for gender, discourse-participant independence and optionality in spoken French, which clearly shows the limits of these hypotheses. The goal of this paper was not to develop a new theory in the field of clitic acquisition but rather to empirically test the effect of potential factors of difficulty assumed to impact this acquisition. Our results however underscore the need to elaborate a theoretical framework which may account for the fine-grained properties we have shown to impact ACC3 acquisition.

Appendix 1. Comparisons (*t*-tests) between mono- (*N* = 17) and bilingual (*N* = 24) children: measures focused on ACC3 in the different tasks used

Tasks	Variables	Monolingual children	Bilingual children	*t*	*dl*	*p*
	Age (year;month)	6;4	6;6	0.46	39	***.65***
ACC1/ACC3 gap	% ACC3	76.4%	73.9%	0.31	39	***.7***
Morphological marking for number	% ACC3 in neutral sequences	52.9%	59.7%	−0.54	39	***.6***
	% ACC3 in match sequences	46%	47.2%	−0.09	39	***.9***
	% ACC3 in mismatch sequences	39.2%	40.2%	−0.09	39	***.9***
Discourse-participant independence	% ACC3	61.7%	70.8%	−0.85	39	***.4***
Judgment task	Accuracy rates for (il)legitimate ACC3 omission	73.7%	76.6%	0.55	39	***.6***

Appendix 2. List of target items for the 'ACC1/ACC3 gap' task

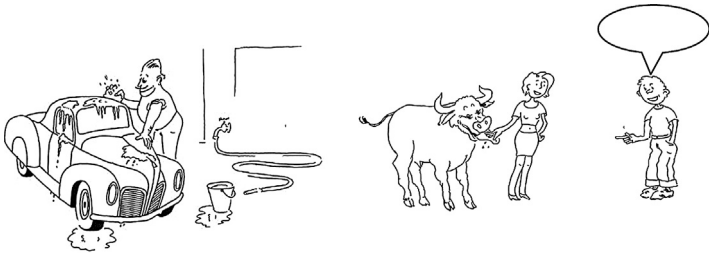
ACC1:

Il me lèche	'He is licking me'
Elle me mord	'She is biting me'
Elle me lèche	'She is licking me'
Elle m'éclabousse	'She is splashing me'
Il m'écrase	'He is crushing me'
Il me pique	'He is biting me'
Il me poursuit	'He is chasing me'
Elle me pique	'She is stinging me'

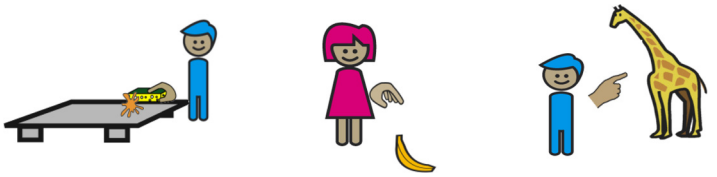
ACC3:

Il le pèse	'He is weighing him'
Elle la regarde	'She is looking at her'
Il la coiffe	'He is combing her (hair)'
Il la réveille	'He is waking her (up)'
Elle le coupe	'She is cutting it'
Elle le lave	'She is washing him'
Il le cache	'He is hiding it'
Elle la maquille	'She is making her up'

Appendix 3. Illustrations corresponding to examples of stimuli in Table 4



Appendix 4. Illustrations corresponding to examples of stimuli in Table 6



Appendix 5. List of target items for the 'Morphological marking for gender' task

Neutral sequences:

Il l'épluche 'He is peeling it'
Elle l'épluche 'She is peeling it'
Il l'arrose 'He is sprinkling it'
Elle l'arrose 'She is sprinkling it'
Il l'essuie 'He is wiping it'
Elle l'essuie 'She is wiping it'

Match sequences:

Il le montre 'He is pointing at it'
Elle la montre 'She is pointing at it'
Il le regarde 'He is watching it'
Elle la regarde 'She is watching it'
Il le prend 'He is taking it'
Elle la prend 'She is taking it'

Mismatch sequences:

Il la montre 'He is pointing at it'
Elle le montre 'She is pointing at it'
Il la regarde 'He is watching it'
Elle le regarde 'She is watching it'
Il la prend 'He is taking it'
Elle le prend 'She is taking it'

Appendix 6. List of target items for the 'Discourse-participant independence' task

Sequences with discourse-participant dependence (ACC2):

Il te coiffe 'He is combing you'
Il te maquille 'He is making you up'
Il te pince 'He is pinching you'
Il te chatouille 'He is tickling you'
Il te montre 'He is pointing at you'
Il te mouille 'He is sprinkling it'
Il te regarde 'He is watching you'
Il te filme 'He is filming you'

Sequences with discourse-participant independence (ACC3):

Il l'épluche 'He is peeling it'
Il l'essuie 'He is wiping it'
Il l'ouvre 'He is opening it'

Il l'habille 'He is dressing it'
Il l'écoute 'He is listening to it'
Il l'essuie 'He is wiping it'
Il l'arrose 'He is sprinkling it'

Appendix 7. List of sentences for the 'Optionality in spoken French' task

Grammatical omissions of subjects:

- Tu as acheté de la farine, des œufs et du sucre... Et maintenant, qu'est-ce qu'il faut faire? → Reste plus qu'à faire le gâteau !
'You have bought flour, eggs and sugar... And now what do you have to do? → Just make the cake!'
- Qu'est-ce qu'on doit avoir si il pleut? → Faut avoir un parapluie !
'What does one need to have if it's raining? → Needs to have an umbrella!'
- Si le réveil sonne mais que tu ne te lèves pas. Qu'est-ce que Maman pourrait dire? → Eh ! Faudrait se réveiller !
'If the alarm goes off but you don't get up, what could mom say? → Hey ! Have to get up!'

Ungrammatical omissions of subjects:

- Si tu donnes un os à un chien, comment il réagit? → *Oh ! Est content.
'If you give a dog a bone, how does he react? → *Oh ! Is happy.'
- S'il a faim, qu'est-ce qu'il fait le bébé? → *Pleure beaucoup.
'If he's hungry, what does the baby do? → *Cries a lot.'
- Qu'est-ce qu'un garçon pourrait faire pour éviter de tomber malade? → *Devrait mettre un manteau.
'What should a boy do to not get sick? → *Should wear a coat.'

Grammatical omissions of objects:

- T'as déjà vu Dora à la télé? → Dora? Oui je connais.
'You've already seen Dora on TV? → Dora? Yes, I know.'
- Tu connais la cachette secrète de Batman? → Sa cachette secrète? Non, pourtant, j'ai cherché...
'You know Batman's secret hideout? → His secret hideout? No, but I've looked...'
- Imagine un monsieur qui attend le train, il lui reste une seule cigarette. Qu'est-ce qu'il va faire avec cette cigarette? → Il va fumer.
'Imagine a man who is waiting on the train, he has one cigarette left. What is he going to do with that cigarette? → He is going to smoke.'
- T'as déjà goûté du chocolat? → Oui, le chocolat, j'adore !
'You've already tasted chocolate? → Yes, chocolate, I love!'
- Si maman t'achète un livre, qu'est-ce que tu vas faire avec ce livre? → Bah je vais lire.
'If mom buys you a book, what do you do with this book? → Well, I'm going to read.'
- Tu connais la musique du roi lion? → Oui, j'ai déjà entendu.
'You know the theme song for The Lion King? → Yes, I've already heard.'
- Imagine que tu veux une autre part de gâteau. Mais...t'aurais pas oublié le mot magique? → Le mot magique? Ben j'ai déjà dit !
'Imagine that you want another piece of cake. But... could you have forgotten the magic word? → The magic word? Well I already said.'

Ungrammatical omissions of objects:

- Si tu veux aider ton petit frère à mettre ses vêtements, qu'est-ce que tu vas faire avec ton frère? → *Bah je vais habiller.
'If you want to help your little brother to get dressed, what are you going to do with him? → *Well, I 'm going to dress.'
- Comment tu as fait pour avoir un papillon chez toi? → *J'ai attrapé.
'How did you manage to get a butterfly at home? → *I caught.'
- Tu connais ma maman? → *Oui j'ai rencontré.
'You know my mom? → *Yes, I've met.'
- Imagine que ta poupée est mouillée. Qu'est-ce que tu fais avec ta poupée? → * Ah je sèche.

'Imagine that your doll is wet. What do you do with your doll?→*Ah, I dry.'
- Si ton chien est sale, qu'est-ce que tu fais avec ton chien? → *je lave.
'If your dog is dirty, what do you do with your dog? → *I wash.'
- Imagine que je demande: Mais où est passé la carte postale qui était sur la table? → *Ben, j'ai envoyé. . .
'Imagine that I ask: What happened to the post card that was on the table? → *Well, I sent . . .'
- Imagine que ta maman a oublié de se réveiller et qu'il est l'heure de se lever? Qu'est-ce que tu fais avec ta maman? → *Je réveille.
'Imagine that your mom forgot to wake up and it is time to wake up? What do you do with your mom? → *I wake.'

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