

On the Acquisition of Implicated Presuppositions: Evidence from French Personal Pronouns

Géraldine Legendre¹, Isabelle Barrière², Louise Goyet³,
and Thierry Nazzi⁴

¹Johns Hopkins University, ²Brooklyn College, CUNY & Yeled v'Yalda Research
Institute, NY, ³Université Paris Descartes, and ⁴CNRS (LPP), Paris

1. Introduction

Numerous studies grounded in spontaneous and elicited production alike have uncovered that French personal subject pronouns (e.g., clitic *je, tu, il*, etc.) as well as strong pronouns (e.g., *moi, toi, lui*, etc.) are acquired very early, by the age of 2 (Clark, 1998; Pierce, 1992; Hamann et al., 1996; Jakubowicz & Rigaut, 1997; Legendre et al., 2010a; Schmitz & Mueller, 2008; to name a few). These studies have also revealed that 3rd person singular pronouns (*il, elle*) tend to be produced first, before 1st and 2nd person pronouns. The fact that these pronouns appear in speech very early does not entail that young children can interpret them correctly.

One reason to express doubt is that personal pronouns can be used as deictic/indexical expressions which get their meaning from the extra-linguistic context of their utterance. First and 2nd person pronouns (*I, you*) respectively refer to speaker and hearer while third person (*he/she*) is traditionally defined as referring to neither (Jespersen, 1924; Lyons, 1977). Very little is known about the course of acquisition of these interpretational properties across all persons, with a few notable exceptions such as Brener (1983) for English, and Girouard et al. (1997) for French¹. The present study seeks to help fill this gap from a particular theoretical perspective in formal semantics/pragmatics pertaining to the computation of inferred meaning. In particular, we follow Heim (1991) who couches the interpretational difference amongst personal pronouns in presuppositional terms: 1st and 2nd person pronouns lexically presuppose the existence of speaker and hearer while 3rd person pronouns have only an implicated (or non-lexical) presupposition of anti-participant. In Heim's theory lexical presuppositions are part of the lexical meaning of pronouns while implicated presuppositions are derived in much the same way as implicatures. Heim posits a grammatical principle (Maximize Presupposition or MaxPresup) which forces a speaker to use the expression associated with the strongest presupposition possible that is compatible with his/her knowledge. This entails that during interpretation, a hearer computes presuppositions by comparing members of the person scale.

Computing alternatives in the domain of scalar implicatures has been shown to be hard to acquire by young children. For example, 7-9-year-olds are reportedly more likely than adults to accept the pragmatically infelicitous *Some giraffes have long legs* because they fail to generate the implicature associated with *some*, namely *not all giraffes* (Noveck, 2001; see also Chierchia et al., 2001; Papafragou & Musolino, 2003; etc.). By separating two kinds of presuppositions (lexical vs.

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¹ A second study targeting comprehension of French pronouns (Legerstee & Feider, 1986) is limited to 1st and 2nd person singular pronouns which eschews the very issue the present paper is mostly concerned with, namely the interpretation of 3rd person pronouns.

implicated), Heim's theory of person predicts a developmental asymmetry in mastering the interpretation of personal pronouns. We present evidence that 30-month-old children acquiring French as their native language do have a problem computing the meaning of *elle* 'she' but not that of *je* 'I', and *tu* 'you-sg' in an appropriate context. We also consider children's interpretation of plural pronouns and test an extension of Heim's theory to the category of number according to which plural triggers an implicated presupposition of anti-singularity (Sauerland, 2003). We show that the pattern of interpretation of plural pronouns displayed by young children supports Sauerland's treatment of plural (rather than singular) as semantically unmarked.

The present study is limited in scope and there are a number of questions it does not directly investigate. First, it does not experimentally test children's interpretation of gender differences present in 3rd person French pronouns. We tested feminine pronouns only (but see footnote 3). Sauerland's semantic markedness hierarchy of gender entails that feminine pronouns should be easier to interpret than masculine pronouns (see section 2.3.) We therefore do not think that we have introduced a bias in our results. Second, the present study does not test the comprehension of strong pronouns which have the same phi-feature make-up as clitic pronouns, but very different phonological and syntactic properties. The study is limited to clitic pronouns by virtue of the fact that it is tied to a larger program of investigating various aspects of the acquisition of French clitic pronouns.²

2. The semantic markedness of phi-features

2.1. Evidence that 3rd person is semantically unmarked

In Heim's theory, 3rd person pronouns are semantically unmarked and have no lexical meaning. On the basis of data like (2)-(9) Sauerland (2008b) argues that 2nd person is less marked than 1st, resulting in the following semantic markedness scale (from most to least marked, as indicated by their lexical featural content):

- (1) Semantic markedness scale (Sauerland, 2008b)
 1st [participant] [speaker] > 2nd [participant] > 3rd

Sauerland's original empirical observations in German extend to French. Second person agreement is required when a 3rd person DP is coordinated with a 2nd person DP in both German and French, as shown in (2)-(3). This suggests that 2nd is more marked than 3rd.

- (2) Tanja und Du sollte-**t** miteinander reden
 T and you-sg should-**2pl** with each other talk
 'Tanja and you should talk with each other.'

- (3) Pierre et toi (vous) devri-**ez** vous réconcilier
 P and you-sg (you-pl) should-**2pl** self reconcile
 'Peter and you should reconcile with each other.'

² Two broader issues are not addressed in the present paper either. First, an account of the production-comprehension asymmetry resulting from the gap between known results in production (mentioned in the introductory paragraph) and the present comprehension results is proposed in Legendre & Smolensky (to appear) whereby children, unlike adults, fail to integrate both speaker's and hearer's perspectives. From an Optimality Theory perspective they are capable of uni-directional optimization only and their constraint ranking is not adult-like. Second, the present results could be situated within the larger debate on inferred meaning, specifically whether implicatures should best be treated as a pragmatic (Gricean) phenomenon vs. a grammatical phenomenon involving a process of activation and comparison of alternatives (e.g., Heim and Sauerland's view). While our focus is on (grammatical) presuppositions the experimental results presented here bear on this larger debate because presuppositions are generated like implicatures under Heim's theory. To the extent that the same pattern of acquisition is observed for both implicatures and presuppositions a grammatical treatment of implicatures is favored over a pragmatic treatment.

Similarly, coordination of 1st and 2nd persons results in 1st person (plural) agreement on the copula *sommes* in (4), as expected if 1st is more marked than 2nd.

- (4) a. Toi et moi (**nous**) sommes d'accord
 You and I, we are-1pl in agreement
 'You and I are in agreement.'
- b. Eux, vous, et nous (**nous**) sommes d'accord
 They, you-sg/pl, and we are-1pl in agreement
 'They, you, and we are in agreement.'

In the colloquial register of French that is characteristic of child-directed speech (Culbertson, 2010) 1st person plural *nous* has been almost completely replaced by *on* which is morphologically 3rd person singular. As a result of the mismatch, *on* is not optional in (5), compared to (*nous*) in (4). In (5), morphology trumps semantic markedness, and agreement is instead dictated by the 3rd person singular morphology. We will return to this issue when interpreting the relevant results.

- (5) a. Toi et moi on est d'accord
 You and I on is-3sg in agreement
 'You and I are in agreement.'
- b. Eux, vous, et nous on est d'accord
 They, you-sg/pl, and we on is-3sg in agreement
 'They, you, and we are in agreement'

It is worth noting that the French examples, above all, contain sentence-initial strong pronouns (e.g., *toi*, *moi*, *eux*) in addition to prosodically weak clitic pronouns, as in (*nous*) *sommes* for the conjunction of *toi et moi* in (4). The strong pronouns serve to identify the relevant combinations of phi-features and evaluate the proposed semantic markedness scale which is assumed to extend to clitics because of shared interpretation.

Returning to Sauerland's original observations, additional evidence that 2nd is semantically less marked than 1st comes from examples like (6). The writer of this message placed in a bottle thrown in the ocean can also be the recipient, meaning that 2nd *you* does not exclude 1st reference.

- (6) To the finder: I have hidden a treasure for *you*

Evidence that 3rd is semantically unmarked is provided by several empirical patterns. First, (7) shows that 1st person plural *nous* in the scope of the quantifier *chacun* 'everyone' may be interpreted as referring to a group that includes the speaker, the hearer, and a 3rd person. Yet, the anaphoric possessive pronoun *sa* must be 3rd person.

- (7) Chacun d'entre **nous** doit appeler *sa* mère
 Everyone of **us** has to call *his* mother

Moreover, German makes use of the 3rd person plural pronoun *Sie* to formally refer to 'you' as opposed to 2nd person plural *vous* in French. Second person is blocked by 3rd person in German.

- (8) Könnten **Sie** bitte etwas rücken!
 Could they-pl please a little move
 'Could you please move a little!'

Note also that it is possible to use 3rd person to refer to the speaker:

- (9) Le gagnant sera un mec heureux. Ça pourrait être *moi*
 ‘The winner will be a lucky guy. He could be *me*.’

A final piece of evidence for semantic unmarkedness of the 3rd person masculine pronoun *il* is that it is used as the semantically vacuous subject pronoun in French impersonal constructions.

- (10) *Il* est possible qu’*il* pleuve
 ‘It is possible that it is raining.’

2.2. Evidence that Plural is semantically unmarked

In contrast to person (and gender), the semantic markedness status of the two number categories – singular vs. plural – is controversial. The more traditional view is that singular is the unmarked category, which allows a strict form/meaning markedness relation to be maintained (e.g., Horn, 2001; Farkas & de Swart, 2010). Sauerland (2003), however, argues that plural is semantically unmarked and triggers an anti-singularity implicated presupposition. In support of his analysis, Sauerland appeals to the empirical evidence in (11)–(13). He notes, for example, that plural, rather than singular, is used in the absence of number knowledge as shown in (11), even if the referent turns out to be singular – this is known as the ‘inclusive’ plural reading.

- (11) a. You are welcome to bring your children
 b. #You are welcome to bring your child

Plural is used to address a single individual formally in some languages, including French and German.

- (12) a. Pourri-**ez vous** vous déplacer un peu s.v.p.?
 Could-2**pl** you-2 move over a bit please
 b. Könn**t-en Sie** bitte etwas rücken?
 Could-3**pl 3pl** please a bit move over
 ‘Could you please move over a bit?’

Plural is also routinely used in English to denote an indefinite, singular possessor.

- (13) Someone left **their** umbrella.

Our experimental results will document that the more traditional view of singular as semantically unmarked cannot straightforwardly account for the acquisition pattern under discussion.

2.3. Gender markedness

In contrast to his analysis of number, Sauerland’s proposal for gender follows the traditional analysis, at least for languages which distinguish masculine from feminine gender only (e.g., French). Masculine gender is analyzed as semantically less marked than feminine gender, supported by evidence from masculine agreement in the presence of mixed genders, as shown in (14).

- (14) Un père et une mère heureux / *heureuses
 A father and a mother happy-masc.pl / * happy-fem.pl
 ‘A happy mother and father.’

More marked pronouns being characterized by a lexical (rather than an implicated presupposition) it is predicted that feminine pronouns should be easier to interpret than masculine ones. We return to this point in our general discussion of the experimental results.

3. Implicated presuppositions and their acquisition

Heim (1991) argues that there are two kinds of presuppositions: lexical or strong presuppositions that are part of lexical meaning vs. implicated presuppositions. The latter are not part of lexical meaning; rather they are generated like implicatures via a grammatical principle – MaxPresup – which forces the speaker to use the expression associated with the strongest presuppositions possible that are compatible with his/her knowledge.

- (15) MaxPresup (Heim, 1991): Make your contribution presuppose as much as possible

For example, MaxPresup is used to explain the oddness of (16b). The definite determiner *the* has two lexical presuppositions (existence and uniqueness). The indefinite determiner *a* has no lexical presuppositions though it has an implicated presupposition of non-uniqueness. If a speaker uses (16b) rather than (16a) the hearer is entitled to infer that there is more than one Queen of England, which is not in accord with a westerner's knowledge of the world.

- (16) a. The Queen of England is visiting Egypt
b. #A Queen of England is visiting Egypt

Sauerland (2008a) proposes to incorporate MaxPresup to his account of personal pronouns differing in semantic markedness: 1st and 2nd person have lexical presuppositions of speaker (1st) and participant (1st, 2nd); 3rd has an implicated presupposition of anti-participant. Under MaxPresup, 3rd person can only be used when the speaker knows that it does not refer to a discourse participant. The Heim/Sauerland presuppositional account of personal pronouns makes a clear prediction: 3rd person pronouns should be more difficult to interpret by children than 1st/2nd because they trigger an implicated presupposition. Similarly for plural pronouns compared to singular ones: in general plural pronouns should be harder to acquire than singular ones, and 3rd person plural pronouns should be the hardest because they trigger two implicated presuppositions.

Little is known about the acquisition of implicated presuppositions (as opposed to scalar implicatures). One study by Yatsushiro (2008) examined the acquisition of the German universal quantifier *jeder* 'every' which under the presuppositional theory has both a lexical presupposition of existence and an implicated presupposition of anti-uniqueness associated with it. Using a Presupposition Judgment task she provides evidence that while 6-year-old children have acquired the (lexical) existence presupposition they haven't mastered the implicated presupposition of anti-uniqueness. Subjects were shown pictures depicting, for instance, a family composed of a mother, a father, and three siblings. An additional sibling, *Jonathan*, was represented at the top right corner of the picture with a speech bubble emerging from his mouth and acting as a commentator on the scene. Subjects were asked to identify whether (true or false) statements like (17a-b) read by an experimenter could be attributed to Jonathan by asking them to place or not a corresponding sticker inside the speech bubble. (17a) tested for understanding of the existence presupposition because there is no uncle present in the picture while (17b) tested for the understanding of the anti-uniqueness presupposition because there is only one mother present in the picture.

- (17) a. Jeder Onkel von mir sitzt auch auf einem Stuhl.
every uncle of mine sits also on a chair
'Every uncle of mine is also sitting on a chair.'
b. Jeder Mutter von mir sitzt hier auf einem Stuhl.
every mother of mine sits here on a chair
'Every mother of mine is sitting on a chair here.'

Six-year-old subjects rejected (17a) 90% of the time (=adult rate of acceptance) whereas they rejected (17b) only 34% of the time (compared to 90% for adults). Yatsushiro concluded that the lexical presupposition of existence is acquired earlier than the implicated presupposition of anti-

uniqueness. Note that the youngest children tested were 6 given the nature of the task. The present study focuses on much younger children who are known to already use personal pronouns in spontaneous speech (Clark, 1998; Pierce, 1992, among others) and a task which can engage two-and-a-half-year-olds.

4. Procedure

To test children's comprehension of person and number reference, we adapted the Fishing Task from Girouard et al. (1997), consisting of a game played by a child and two experimenters fishing for pictures out of a basket. In the singular condition, subjects were asked to identify by naming or pointing the objects that participants referred to by a singular personal pronoun (*je* 'I', *tu* 'you', *elle* 'she') had selected. Data was obtained for sixteen 30-month-olds, eight additional children refusing to complete the task. The children were tested at the LPP (Laboratoire Psychologie de la Perception) in Paris.

In our version of the Fishing Task, the children were tested individually, sitting at a table in a parent's lap, across from two female experimenters.³ Parents were asked not to prompt their child or otherwise participate except in the plural condition (see below). Answers were coded on-line. The task consisted of three phases.

Preparatory phase: First, the two experimenters taught the child their first names until the child was comfortable identifying both of them. The child was then asked to name pictures from a set of 21 commonly known animals and objects (based on parental reports). If a child was unable or unwilling to name the pictures, one of the experimenters asked her to point at the right picture by saying for example *Montre-moi la vache* 'show me the cow'. All correctly identified pictures were placed in a basket. Thirty-month-olds typically identified most, if not all pictures.

Familiarization phase: The two experimenters and the child then picked one picture each out of the basket in preparation for the familiarization phase of the experiment.

(18) Familiarization (talking to the child):

Experimenter 1: Qu'est-ce que "nom de l'enfant" attrape?
'what is "name of the child" catching?'

Experimenter 2: Qu'est-ce-que "nom de Exp 1" attrape?
'what is "name of Experimenter 1" catching?'

Experimenter 1: Qu'est-ce-que "nom de Exp 2" attrape?
'what is "name of Experimenter 2" catching?'

Regarding the stimuli a number of decisions were made to insure that no other person cue but the personal pronoun itself was provided to the child in the test phase. First, the present tense was used rather than the perfective past tense which would have provided two cues: the pronoun + auxiliary: *j'ai attrapé* 'I have caught', *tu as attrapé* 'you have caught'. To compensate for this choice, questions were asked while everyone was still in the process of fishing for a picture. Second, the question strategy with the question marker *est-ce-que* was used to insure both a colloquial register and no special prosody. Third, *attraper* 'catch' was used rather than *pêcher* 'fish' for both lexical and phonological reasons: (i) the former, but not the latter, is understood at 30 months (Legendre et al., 2010b), (ii) *attraper* is used interchangeably with *pêcher* by adults to mean 'catch' in the context of fishing, (iii) *attraper* belongs to the first conjugation class and does not contribute any inflectional person cue in the singular, and (iv) it is vowel-initial, hence 3rd person singular and plural are differentiated by 'liaison'

³ One male experimenter had to replace a female one at the last minute for one session (one child). As a result the 3rd person results include 2/32 instances of *il* 'he' and 2/32 of *ils* 'they-masc/fem' (two singular and plural blocks per subject; 16 subjects). Since this involved a very small proportion of the stimuli and the child in this session did not exhibit a different pattern of responses we submit that the use of *il(s)* rather than *elle(s)* in one session does not affect the general results and claims regarding 3rd person.

with the clitic pronoun. Liaison is a phonological process whereby the coda consonant of the pronoun (/l/ in the singular, /z/ in the plural) is resyllabified with the initial vowel of the verb, resulting in singular /ɛ.la.trap/ ‘she is catching’ vs. /ɛ(l).za.trap/ ‘they-fem are catching’. This is especially relevant to the second part of the experiment examining the interpretation of plural pronouns. Finally, we used first names to refer to all participants in the familiarization phase given that young children tend to use their own name to refer to themselves in early speech. Moreover, in a game situation with children it is not uncommon to identify participants by their name.

Test phase (singular): Two singular blocks were run involving two rounds of fishing for new pictures out of the basket. The order of the questions (1st, 2nd, or 3rd person) was randomized across the two blocks. French subject pronouns are prosodically weak. Despite being common in the colloquial register (Culbertson, 2010), no subject doubling with a strong pronoun (e.g., *et moi/toi, qu'est-ce que j'/tu attrape(s)*) was used however because it would have provided an additional person/number cue. We were particularly interested in finding out in this initial study whether stressless pronouns could be interpreted correctly in the presence of one cue only – the clitic – at such a young age.

(19) Singular (2 blocks, identical except for different randomized orders of questions):

- Experimenter 1: Qu'est-ce que tu attrapes?
‘what are you catching?’
Experimenter 2: Qu'est-ce-que j'attrape?
‘what am I catching?’
Experimenter 2: Qu'est-ce-qu'elle attrape?
‘what is she catching?’

Test phase (plural): During the single session children visited the lab, they were tested on both singular pronouns *je* ‘I’, *tu* ‘you’, *elle* ‘she’ as well as plural *on* ‘we’, *vous* ‘you-pl’, and *elles* ‘they-fem’ in two separate blocks, using the familiarization and test phase procedures described in (18) and (19). *On* (rather than *nous*) was used because the colloquial register children are exposed to makes almost exclusive use of *on* for 1st person plural. The main difference concerned the speakers engaging the child. The parent holding the child in their lap asked the plural 3rd person pronoun question while the two experimenters asked the *on* and *vous* questions, respectively. Plural blocks were identical to (19), except for the pronouns, as shown in (20). All children were first tested on singular pronouns.

(20) Plural (2 blocks, identical except for different randomized orders of questions):

- Experimenter 1: Qu'est-ce que vous attrapez?
‘what are you-pl catching?’
Experimenter 2: Qu'est-ce-qu'on attrape?
‘what are we catching?’
Parent: Qu'est-ce-qu'elles attrapent?
‘what are they-fem.pl catching?’

5. Results

We separately discuss two facets of the results, the children’s overall performance on singular and plural pronouns first, followed by a discussion of the types of errors made.

5.1. Overall performance

The results, totaled over the 2 blocks, are illustrated in Figure 1 for singular pronouns.

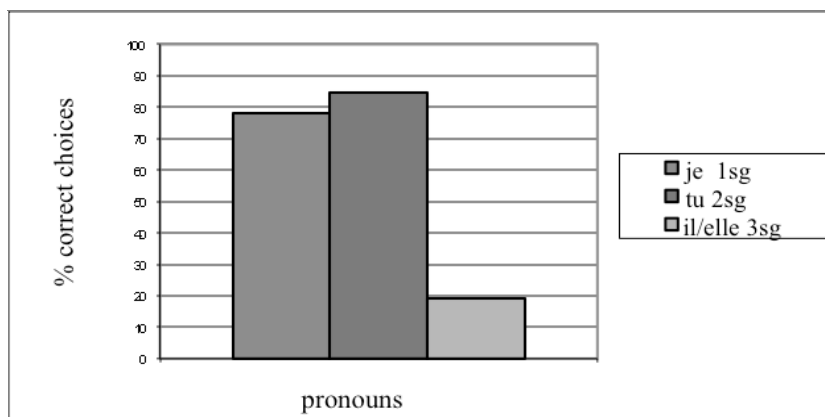


Figure 1. Percent of correct choices for singular pronouns at 30 months of age (out of 2 responses for all 16 subjects)

Overall, 30-month-olds performed the task successfully. In the singular condition, they were comfortable switching reference from themselves to the experimenter and vice-versa upon hearing 1st person *je* and 2nd person *tu* (*je* 'I': 25/28 correct responses/CR, 4 non-responses/NR; *tu* 'you-sg': 27/27 CR; 5 NR). However, they struggled with switching reference to a non-participant for 3rd person *elle* (*elle/il* 'she/he': 6/18 CR; 14 NR). Only the results for 1st and 2nd person singular are significantly above chance level, $p < .001$.

As predicted by the presuppositional account of person, French-learning children failed to show comprehension of 3rd person pronouns, which is consistent with a failure to generate the implicated presupposition. The results also show that lexical presuppositions associated with 1st/2nd are in place by age 30 months, a much younger age than the one tested in Yatsushiro (2008). In the general discussion section, we consider a possible alternative account in terms of the additional challenge of processing gender in the 3rd person.

Our attempts at testing 24-month-olds under similar conditions failed. Most participants refused to do the task entirely, despite efforts to engage them in alternative ways by using small animal figurines rather than pictures, verbs other than *attraper*, etc. However, 6/15 children showed a distinctive willingness to appropriately answer a *tu* 'you'-question referring to their choice of picture/animal but otherwise refused to cooperate. In contrast, Girouard et al. (1997) report that they successfully tested Canadian-French children as young as 21 months of age, using several pragmatic comprehension tasks, including the original Fishing Task. Similarly to us, this researcher team used randomized 1st, 2nd, and 3rd person singular questions asking children to identify who was fishing what out of a bowl. However, their reported results conflate subject and object pronouns across several tasks. Therefore it is impossible to retrieve information relevant only to subject pronouns in one task and to pursue further comparison with our results.

The results concerning the interpretation of plural pronouns by 30-month-olds are very different. In the plural condition, children identified possible referents less than 50% of the time (*on* 'we': 13/28 CR, 4 NR; *vous* 'you-pl': 5/24 CR, 8 NR; and *elles* 'they-fem': 8/21 CR; 11 NR) and performed worse on 2nd person and 3rd person plural pronouns than 1st person *on*.⁴ Note that *on* 'we' may have several alternative interpretations, including speaker and hearer; speaker, hearer, and other; speaker and other. We counted as correct any of these interpretations.

⁴ The denominator varies because it corresponds to the number of actual responses (correct or incorrect) given.

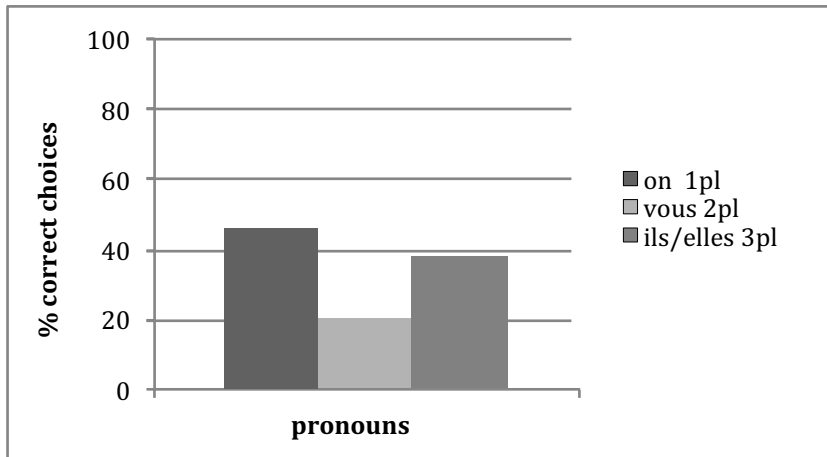


Figure 2. Percent of correct choices for plural pronouns at 30 months of age (non-responses were excluded, see text for details)

The basic results, overall, support our two main hypotheses – namely the Heim/Sauerland’s theory of 3rd person and plural as triggering implicated presuppositions, on the one hand, and the more general claim, on the other, that computing inferred meaning is hard for young children. However, these results do not shed light on which aspect of computing inferred meaning is hard. Is it that children do not have MaxPresup yet? Is it the scales $\{1^{st} > 2^{nd} > 3^{rd}\}$, $\{sg > pl\}$? Or both? Next, we analyze errors in assigning reference to shed some preliminary light on these questions.

5.2. Patterns of errors

In the preceding section, we documented the challenge of acquiring inferred meaning under the simplifying assumption that singular pronouns only carry a person feature. They obviously also carry a number feature (plus a gender feature in the 3rd person, which we set aside for now but return to in the general discussion). Under Sauerland’s analysis of plural as semantically unmarked, acquisition of plural pronouns is predicted to be more difficult than singular ones because MaxPresup applies to all plural pronouns on the basis of the scale $\{sg, pl\}$. Acquisition of 3rd person plural pronouns is predicted to be especially difficult because they trigger two separate implicated presuppositions (given that MaxPresup also applies to 3rd person on the basis of the scale $\{1,2,3\}$).

We computed the number of comprehension errors involving implicated presuppositions in both singular and plural pronouns, and report them in terms of the number of presuppositions to be computed. In both Tables 1 and 2, errors are listed per number category (Sg/Singular or Pl/Plural, if any) and referent given (self/child or Hearer; Exp_S/Experimenter asking the question or Speaker; Exp_O/Other experimenter; or combinations of referents present).

When no implicated presupposition had to be computed (1st, 2nd person singular), a few person errors were made – 3/28 *je* questions (~10%) were answered by children as referring to themselves rather than to the experimenter asking the question; no person errors were made for *tu*. Interestingly, no number errors were made for either: children did not mistakenly interpret singular pronouns as having plural reference. The details are given in Table 1.

Table 1

Pattern of errors with singular pronouns (16 children, 2 attempts)

Pro	Correct	Incorrect Sg - self	Incorrect Sg - Exp _S	Incorrect Sg - Exp _O	Responses (out of 32)
<i>je</i>	25	3			28
<i>tu</i>	27				27
<i>elle</i>	6	7	5		18

A single implicated presupposition had to be computed in some instances (*elle, on/vous*). Specifically, an anti-participant presupposition had to be computed for 3rd person singular *elle*. 12/18 person errors (67%) were made, showing that children struggled with assigning proper reference to 3rd person. The overall result for singular pronouns is clear: Children made absolutely no number errors while they mistakenly gave the wrong person (most frequently self reference) as the referent to a 1st person question (to the level of 10%, which might be construed as noise) and a 3rd person question.

The second case of single implicated presupposition computation concerns 1st and 2nd person plural *on* and *vous* for which an anti-singularity presupposition had to be computed, resulting in a total of 25 singular errors out of 52 responses given (48%). Note that this result is expected under Sauerland's account of plural as semantically unmarked but not straightforwardly so under the traditionally held view that singular is semantically unmarked (e.g., Horn, 2001; Farkas & de Swart, 2010). The Hornian view would predict that assigning reference to 1st and 2nd person plural pronouns should be easiest – no implicated presupposition would need to be computed –, contrary to fact.

Table 2

Pattern of errors with plural pronouns (16 children, 2 attempts)

Pro	Corr.	Incorr. Sg-self	Incorr. Sg- Exp _s	Incorr. Sg- Exp _o	Incorr. Pl- Exp _s + self	Incorr. Pl- Exp _o + self	Incorr. Pl- Exp _s + Exp _o	Incorr. Pl- Exp _s +Exp _o +self	Responses (out of 32)
<i>on</i>	13	7	6	1		1			28
<i>vous</i>	5	11			3		3	2	24
<i>elles</i>	8	4	1	1		4		3	21

As discussed earlier, *on* might be expected to be especially challenging because it is morphologically a 3rd person singular form. *On* has multiple adult interpretations, including the 1st plural meaning which we tested. Other interpretations include indefinite meanings and the availability of any of these interpretations (plural vs. indefinite) may ultimately depend on verb type (Legendre, 1989). It has proven difficult to systematically distinguish the indefinite and 1st person plural interpretation in the input. There is thus a potential for confusion with respect to person which is broadly supported by the results in Table 2. Compared to plural *vous* which involves the same anti-singularity computation, *on* elicited number errors (singular instead of plural reference, as per the presuppositional account), plus 'unexpected' person errors almost exclusively in combination with number errors (compared to *vous* discussed below). These person errors in 1st and 2nd person plural pronouns are not predicted by the presuppositional account. In the case of *on*, we suggest that they may result from the morphology/semantics mismatch resulting in a 3rd person form which children may wrongly interpret as subject to an implicated anti-participant presupposition on the basis of form rather than meaning, which hasn't been mastered yet (see results for *elle*). Alternatively or additionally, the multiple possible interpretations of plural *on* – speaker and hearer; speaker, hearer, and other; speaker and other – vs. indefinite are unlikely to be mastered by 30 months of age. The roughly equal number of Hearer/self vs. Speaker reference errors may in fact be preliminary evidence of hesitation between these two main referent components constituting the core meaning of plural *on*.

In contrast to *on*, *vous* elicited 'unexpected' person errors in both presence and absence of number errors. Again the number errors are expected under the presuppositional account, the person errors are not. Like *on*, *vous* brings along (a different) set of complications which may be at play here. *Vous* is very infrequent in the input (compared to *on*) and its presence is likely to vary across children, based on family configuration. It is used either to address a group of hearers (e.g., a group of siblings) or to formally address a single (or multiple) hearer(s). Under the later singular formal interpretation *vous* = *tu* in person and the 11 errors listed under Self errors in Table 2 might potentially be reinterpreted as correct person assignment. However, the quasi-total absence of formal *vous* in the input does not support this reinterpretation. It remains that some exposure might lead to confusion which affects the results in the Fishing Task.

Person errors were observed with all plural pronouns, both in combination with a number error and without, suggesting an overall challenge when confronted with the 3-point person scale. There is also a clear asymmetry among phi-features in these results: while children make person errors both with singular and plural pronouns even when there is no presupposition to compute (1st and 2nd person singular), they make number errors only with plural pronouns. These number errors, we propose, uniquely follow from Sauerland's treatment of plural as the semantically unmarked number necessitating computation of an implicated anti-singularity presupposition.

Note that the results overall are similar for a single implicated presupposition, either person or number, given the 3-level person scale vs. the 2-level number scale: both 67% errors in 3rd person singular pronouns vs. 48% errors in 1st and 2nd person plural pronouns correspond roughly to chance performance. This result shows that 30-month-olds have not mastered MaxPresup for either person or number.

Finally, two implicated presuppositions had to be computed in one case – 3rd person plural *elles*. Both person and number errors were made (a single answer may have included both errors). However, a surprising pattern emerges from comparing these errors in the context of computing two implicated presuppositions vs. errors of the same kind (person or number) when computing a single implicated presupposition. Person errors when interpreting *elles* (two presuppositions) reached 62% (13/21 responses) vs. 67% for 3rd person singular *elle* (one presupposition). Number errors for *elles* reached 29% (6/21 responses) vs. 48% for 1st and 2nd person plural pronouns (one presupposition). Children do not perform worse computing two separate implicated presuppositions compared with merely computing one. However, caution is called for in interpreting these plural results because the children were all tested on singular pronouns first, followed by plural ones, and the numbers of responses are small and below chance-level.

6. General discussion

Overall, the results obtained in the comprehension task support Heim's presuppositional theory of person as well as Sauerland's extension to number. In particular, children were at chance assigning reference to 3rd person *elle* but had no major difficulty assigning speaker and hearer reference to 1st person *je* and 2nd person *tu*, respectively. We attribute the difference to the fact that while 30-month-olds have basically acquired the lexical presuppositions associated with 1st person and 2nd person, they are unable to compute the inferred meaning of 3rd person involving an implicated presupposition of anti-participant. With respect to number, 30-month-olds were basically at chance interpreting plural pronouns (ignoring the possibility of an enhancing effect of computing both number and person in the case of 3rd person plural *elles*). Note that this result is predicted by a presuppositional theory which takes plural, rather than singular, as the semantically unmarked member of the scale. In other words, the present results fail to support the more traditional view that singular is semantically unmarked advocated by Horn (2001) and Farkas and de Swart (2010), amongst others.

The at-chance results when computing any implicated presupposition (person or number) support the overall conclusion that 30-month-olds do not have the principle MaxPresup in place yet. In addition, the general difficulty they appear to have assigning person reference to all pronouns except *je* and *tu* (if the few *je* errors are construed as noise) suggests that a 3-point scale is especially challenging at 30 months. Other factors that are hard to pinpoint on the basis of the present experiment may involve morphology/semantics mismatches, multiple interpretations for some plural pronouns, and input frequency. The more general claim is that young children have problems computing over alternatives, as is the case in the context of the Fishing task with all possible referents being participants in the game. Other contexts of interpretation of 3rd person pronouns, such as in a preferential looking task where children were prompted to match a visual display with a singular vs. plural 3rd person pronoun, do not involve this computation over alternatives. And indeed 30-month-olds have no problem with the latter; see Legendre et al. (2010b).

A reviewer suggests an alternative account of the 3rd person singular results whereby the difficulty could be attributed to the additional processing of gender in the 3rd person. As mentioned earlier, we were unable to test this alternative hypothesis for practical reasons. We used only the feminine 3rd pronouns *elle* and *elles*, except in one session (see footnote 3). From the perspective of Sauerland's

semantic markedness hierarchy, masculine gender (in languages such as French) is less marked than feminine gender, which results in computing a ‘non-feminine’ implicated presupposition with masculine *il*. The prediction is therefore that *elle* should be easier to interpret than *il*. In our study, the children were tested on the ‘easier’ 3rd person pronoun, which fails to support the alternative account of their difficulty with 3rd person. Results from a previous comprehension study of English 3rd person pronouns (Brener, 1983) indicate that gender is initially used to identify human referents in a similar comprehension task and that person is only used later. It is unclear whether this order of acquisition is due to gender vs. person per se rather than the difference between a 2-point vs. a 3-point scale, or both.

Brener’s overall results on the basis of English pronouns do conform to ours in establishing the challenge of interpreting what she calls the deictic role OTHER. Her youngest group included children ranging from 2;6-3;3 who were tested twice, 4 months apart with the following percentage of correct responses (t1 = Time 1; t2 = Time 2): 1st person singular, t1/t2: 98/99%; 2nd person singular, t1/t2: 83/93%; 3rd person singular, t1/t2: 56/74%. The results are very similar at about the same age (2;6, t1). One difference with our study is that these children were tested on singular subject pronouns (*I, you, (s)he*), singular object pronouns (*me, you, her/him*), as well as possessives (*my, mine, your, yours*, etc.). The saliency of the possessives combined with the large number of items (90) each subject was exposed to over several sessions on succeeding days may have played a role in reversing the results for 1st and 2nd person, compared to our pared down stimuli. If our interpretation of the existing results is on the right track we predict further specific difficulties in French with the concept of ‘other’ of the sort tested in Brener (1983) and beyond. We also predict the same timing differences if strong pronouns were used along with clitics, though the effect might be attenuated by the presence of an additional and salient cue (by virtue of their sentential position and phonological stress, much in the same way an English pronoun would be stressed in this context).

Returning to our results, we did observe some asymmetry across person and number. Children made some ‘noisy’ person errors when interpreting 1st person singular *je* for which no implicated presupposition had to be computed. However, no number errors were made when interpreting singular pronouns. Children also did better computing the number than the person presupposition when interpreting 3rd person plural *elles*. We provisionally attribute this asymmetry to the scales themselves and to the fact that the 3-way category of person is inherently more complex than the 2-way category of number (French has no dual category).

An overarching conclusion of the present comprehension study is that in the domain of person and number, lexical presuppositions are acquired quite early. Our results thus complement Yatsushiro’s results obtained in a different domain (universal quantifiers) with older children. In both domains – phi-features (person, number) and quantifiers – lexical presuppositions are acquired before implicated presuppositions. This is not a surprising result; yet it supports the overall claim made originally on the basis of scalar implicatures that computing inferred meaning of any sort is hard for young children.

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