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How Do Children Deal with Shifted Indexicals?

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1.   Introduction[†]

The topic of indexical shift has, like so many other domains in linguistics, blossomed into a domain showing extensive and unusual variation across languages. One initial goal in this project was to bring an acquisition perspective to the evolving theories early in the process. Initially we began with views derived from Hollebrandse (2000) where the idea was advanced that there is an PoV operator that jointly controls several types of indexicals such as personal pronouns, demonstratives, time and space adverbials.

In the background as well are concepts like "the Seat of Knowledge" which is articulated by Tenny and Speas (2003) and corresponds to a General Point of View (see Roeper, 2016). The concept of Point of View (PoV) operating across a sentence is much more finely nuanced when one considers the facts beyond the case of indexicals. If one imagines that each full clause has a PoV Operator in its CP, one might argue that those elements that depend on perspective are under its influence. The problem is that there are several types that behave differently across clauses: indexicals like pronouns and the spatial and temporal deictic terms act one way, typically, in English, with the matrix Point of View (by default the Speaker) exerting control. But when it comes to other forms, such as the choice of NP, or whose truth it is, the PoV Operator in the embedded clause, governed by the subject of the sentence, can take precedence (see de Villiers, 2018 for a review and

implications for acquisition). This is reflected in well-known opacity effects with complements of belief verbs, for example.

Nevertheless, is it true that at least indexicals such as pronouns behave as if they were under the coordination of a single controlling PoV in a sentence? Roberts (2015) discusses the idea of a unified "doxastic center" which can enter into virtually every domain of a sentence in principle. But she explains that the most general view does not capture all of the language variation that has been documented. In particular, in several languages the Point of View on some indexicals can shift under various complement-taking verbs, such as *want*, *say*, *tell*, *believe*, where they shift to the Point of View of the subject of the sentence rather than the speaker, even though the clause is embedded and is not direct quotation. Hence even indexicals can be shifters under embedding.

We can expect the acquisition path to reveal awareness of possibilities found in other languages, but which ones? How does the child determine the conditions in his particular language for when indexicals break the bounds of a speaker Point of View? We have just ventured a small way into all of the possible variations. Our experiments show that children can grasp fairly early that pronouns can switch together in English. There is some preliminary evidence that they allow pronoun shifts inside complements that are not English-like, but might reflect possibilities in UG. The first goal of the experimentation is to prove that these errors are more common than would be expected by chance.

1.1   Background

In this paper we address the acquisition problem concerning how children master indexicals. The topic is a neglected one, probably because the facts of the matter in adult language are decidedly hard to pin down, the explanations lie at the border of syntax, semantics and pragmatics, and the cross linguistic variation is much greater than we anticipated when we began looking at it ten years ago. We offer a retrospective account of some complications we encountered in exploring this domain, and anticipate that our preliminary studies will lead to new work in the light of more articulated recent theories.

Indexicals include pronouns, for example English *I, we, you, here, now*; the demonstratives *this* and *that*, and demonstrative uses of *he, she, her* and *his*; a range of other nominal and adverbial elements including *today, tomorrow*, *actual*, and *present*.

Roberts (2015) writes:

> All the indexicals are by default intuitively anchored to the point of view of the speaker (or her addressee) in their utterance situation: Something is here because I am here; something takes place now because I am talking now. This is why *I am here now* is always true: It is first of all a pragmatic, and not a semantic truth, about what it is to do an embodied action. (Roberts, 2015)

Should "Point of View" be grammatically encoded as an Operator in syntax? Hollebrandse (2000), Schlenker (2003), and Nevins and Pranand (2004) have all argued for some kinds of links between indexicals, deixis, and temporal phrases, under the control of an Operator that coordinates them. Tenny and Speas also (2003) introduce the important notion of a Seat of Knowledge that entails an over-arching "point of view" shared by a community (see Roeper 2016). Speas (2004) and de Villiers (2001) have argued for structural positions linking Point of View to the syntax. However, the appropriate analysis is still far from clear.

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In English, it is possible to argue that there is a PoV on the matrix clause that is the speaker's, and that therefore every indexical is coordinated by that PoV, namely, it has the speaker's perspective on self, the addressee, time and space:

(1)   I am proud of *your* performance *here* at *this* event *today*.

As Roberts points out, the addressee is also a "center," aware of her own role as an addressee. As the conversation proceeds and interactors change roles, the set of discourse referents is updated accordingly to reflect the change, so the addressee could say,

(2)   I am glad of your support

Or, turning to a third party,

(3)   She is proud of me!

Complexity arises when attitude predicates or speech acts are included in the sentences:

(4)   Edith said that she was proud of me there at that event yesterday.

It is difficult for an English speaker to appreciate that there is any coordination of Point of View in this sentence, since everything is apparently speaker-oriented, compared to a report of direct discourse:

(5)   Edith said, "I am proud of you here at this event today."

In direct discourse, or quotation, the Point of View switches to the matrix subject, the new "speaker".

1.2   The First Acquisition Problem

The first set of acquisition problems that children face is to determine:

   a) The point of view on particular indexicals (i.e. I vs you, here vs there, etc.)
   b) The coordination of Point of View across indexicals

The previous literature has focused almost entirely on a), namely the establishment of the meaning of particular deictic terms such as *here/there, this/that, my/your* and so forth (de Villiers & de Villiers, 1974; Clark, 1978). They are far from simple (Fillmore, 1969) in that the referents of all but the pronouns are a feature of many constraints such as the topic, the size of the domain, the necessity of contrast and so forth. Virtually no attention has been paid to the behavior of indexicals in more complex environments in which the Point of View must be coordinated as in problem b), since the work of Tanz, 1981, based on Jakobson's original discussion of "shifters" (Jakobson, 1971). Tanz's work was conducted at a time when the data on children's errors with complementation and direct discourse were still unexplored. It is time to re-examine the phenomena in the light of this new

linguistic and acquisition work.

What would the best learnability initial state prediction be? This is an important and complex question. Traditionally learnability logic succeeds when the child makes the strongest initial hypothesis and discovers counter-evidence. Thus for instance Obligatory rules are shown to be false by examples of optionality. But the hypothesis that something is optional is never overturned by evidence. In that spirit we can make the following hypothesis:

> ***Hypothesis:*** All potentially indexical elements, pronouns, locative deixis, and temporal forms are linked by a sentence-initial CP-Operator. The prediction is that whether we have one clause or two, with pronouns or other forms of deixis, children should co-ordinate them all as soon as the PoV-Operator is projected.

In Study 1 we address the question:
    i)   How well do English-speaking children handle the coordination of multiple indexicals in simple and complex structures?
    ii) Are some kinds of perspective changes harder than others?

We focus, as had Tanz (1981), on multiple pronouns in different sentence contexts. The task involves translating a command into the child's point of view, across multiple pronouns. How easily can children coordinate those multiple pronouns? In particular, is there evidence of a single controlling operator (Hollebrandse, 2000) that makes it relatively easy to coordinate pronoun reference?

2. Study 1

Study 1 was designed to explore children's production of multiple pronouns and see how well they could coordinate multiple changes as the point of view changed to a different speaker.

2.1 Study 1 Procedure

A three-way conversation was arranged between an experimenter, a puppet (controlled by a second experimenter), and a child participant. Children were told that the puppet was shy and "didn't like talking to adults", so the child had to relay the experimenter's questions to the puppet. This allowed us to test different kinds of pronoun changes. By pronoun change here we mean only the conversion of each pronoun from the Experimenter's Point of View to the child speaker's Point of View. This might entail changes of pronouns from first to second person, or second to third person, for example. When multiple types of pronoun change occur within a sentence, we consider this a perspective change.

The items vary along several dimensions (See (6) for a complete list of examples). Some items required production of more pronouns than others (e.g. 1 versus 2). In addition, the child had to attend to the pronoun in the first clause in order to address his/her speech to the right interlocutor. But for items with equivalent numbers of pronouns, there

was also the dimension of how many of them had to change perspective. Take item #7 (repeated in (7), below):

(6)   *In Study 1, children were given these directives, in this order, expanding on Tanz (1981):*

1) Ask him what color his eyes are. *(Correct response: What color are your eyes?)*
2) Ask him what color your eyes are. *(Correct response: What color are my eyes?)*
3) Tell him to ask me what my favorite color is. *(Correct response: Ask her what her favorite color is.)*
4) Tell her that I am too shy to ask. *(Correct response: He is too shy to ask.)*
5) Tell him that his eyes are my favorite color. *(Correct response: Your eyes are her favorite color.)*
6) Ask him if his eyes are his favorite color. *(Correct response: Are your eyes your favorite color?)*
7) Ask him to tell me what his favorite color is. *(Correct response: Tell her what your favorite color is.)*
8) Ask me if I like the color purple. *(Correct response: Do you like the color purple?)*
9) Tell me to ask you what your favorite color is. *(Correct response: Ask me what my favorite color is.)*
10) Tell him to ask you about more of your favorite things. *(Correct response: Ask me about more of my favorite things.)*
11) Ask me if I like your favorite song. *(Correct response: Do you like my favorite song?)*
12) Ask him to tell me something about fish. *(Correct response: Tell her something about fish.)*
13) Ask me to tell you what the blue fish are called. *(Correct response: Tell me what the blue fish are called. [Also correct: "What are the blue fish called"?])*
14) Ask him to tell me what color blue and yellow makes. *(Tell her what color blue and yellow makes.)*
15) Ask me if I like my shirt. *(Correct response: Do you like your shirt?)*
16) Ask him where he got his shirt. *(Correct response: Where did you get your shirt?)*
17) Ask me to whisper to you what time it is. *(Correct response: Whisper to me what time it is.)*

(7)   E: Ask him to tell *me* what *his* favorite color is.

The correct response is for the child to say to the puppet:

(8)   C: Tell *her* what *your* favorite color is.

Notice that two pronouns have changed: *me* to *her* and *your* to *his*. This is a case of multiple different changes of person. Compare this with item #6 (9):

(9)   E: Ask him if *his* eyes are *his* favorite color.

The correct response is for the child to say to the puppet:

(10)   Are *your* eyes *your* favorite color?

In this case, the changes are congruent: switch *his* to *your, i.e. 3rd person to 2nd person,* so there is a single perspective change applied to both.

2.2   Study 1 Scoring

The intention was to code each pronoun in the sentence: the first, second, and in the two clause cases, the third, as correct or not, namely, did the child control the necessary change in pronoun as the speaker and addressee shifted. The speaker was the child, but the addressee might be the E or the puppet, and pronouns had to be calculated with respect to them. The question was how readily could children 1) follow the directions, which meant ascribing appropriate reference to each pronoun in the E's directions and 2) change the pronouns to his/her point of view.

2.3   Study 1 Results:

One of the central motivations for the experiment was to consider whether children could handle pronouns across multiple clauses, but the design created difficulties in knowing how to code answers. In this study, to a directive such as, "Ask him what color your eyes are", they answer "brown". We know that children at these ages tend to answer the medial question in a wh-question such as (11):

(11) Where did he say what he ate?

This tendency to answer the medial question may reflect grammatical possibilities in universal grammar (Roeper & de Villiers, 2011). The phenomenon here might be more pragmatic, in that the likelihood of answering it is modulated by whether it is a question to which they can provide the answer. For example, such answers were much fewer to prompts for which the child could not know the answer, such as in (12):

(12)   Tell him to ask me what my favorite color is

Hence it is interpretable as a kind of pragmatic shortcut to the desired answer. Children similarly used shortcuts in cases where the "tell" was inert, such as in (13):

(13)   E: Ask me to tell you what the blue fish are called.
        C: What are the blue fish called?

The problem for scoring is that no pronouns are left to score after such a move. Yet these are not "errors" of the sort we were interested in. In almost every case, the child must have understood the direction and its pronouns correctly to get to their response, they just didn't show us in production. If we just exclude all such case, we are left with a paltry amount of data, especially on production of the two clause sentences: For two clause sentences, only 40% of the data is left that contributes to the question, compared to 92% of the data for one clause sentences.

Because we wanted to know whether children make errors when they attempt to produce a pronoun, in the analyses below we only consider cases where children produce a pronoun in their response. We excluded from analysis any cases where children produced a pragmatically appropriate shortcut, such as correctly answering the medial question or producing a shortcut as in (13). It was necessary to consider the data separately for one and two clause sentences as the children reacted very differently to them. This might be expected under the variable conditions for pronouns in embedded clauses cross linguistically, as Study 2 will explore.

2.3.1   One clause sentences

The table in (14) shows shows the breakdown of how children responded to the different pronouns in one clause items. This is presented below.

Overall, children made few errors in comprehending or producing pronouns in one-clause sentences. Children only produced incorrect pronouns on between 6% and 9% of these trials.

We also examined factors that influenced whether a child would produce a completely correct response (i.e. correct response to pronoun 1, correct syntactic formulation, and correct production of pronouns). Excluding those cases where children did not attempt a response or provided a response that was a pragmatically appropriate "shortcut", children did not have any more trouble producing two pronoun tokens than one pronoun token ($t(17) = .2, p = .84$).

In addition, it made no difference how many pronoun types children had to produce for a correct response (i.e. producing both a first person and a second person pronoun in their response) on trials where two pronouns were required ($t(17) = 1.38, p = .19$). There was a non-significant difference in the number of exchanges back to addressee or moves to address the third party (i.e., number of perspective shifts); $t(17) = 1.8, p = .09$. It made no difference whether the interaction was a two-way exchange between the experimenter and the child or a three-way exchange involving the puppet ($t(17) = .26, p = .8$).

(14) *The percentage of correct responses for children responding to one-clause sentences in Study 1.*

	1 pronoun (54 responses)	2 pronouns (86 responses)
Comprehending 1st pronoun (Did child direct the response to the correct person?)	Correct direction: 93% **Incorrect direction: 7%**	Correct direction: 94% **Incorrect direction: 6%**
Comprehending 2nd pronoun (Did the child produce the first pronoun correctly?)	Correct pronouns: 87% Avoid producing pronouns: 4% **Incorrect pronouns: 9%**	Correct pronouns: 88% Avoid producing pronouns: 3% **Incorrect pronouns: 8%**
Comprehending 3rd pronoun (Did the child produce the second pronoun correctly?)	NA	Correct pronouns: 79% Avoid producing pronouns: 12% **Incorrect pronouns: 9%**

2.3.2 Two clause sentences

The table in (15) illustrates the breakdown of how children responded to the different pronouns in one clause items. Again, these analyses exclude cases where children did not produce pronouns due to pragmatically appropriate responses such as (13); this was much more common in two clause items, so much of the data have been excluded for these analyses.

(15) *The percentage of correct responses for children responding to one-clause sentences in Study 1.*

	1 pronoun (17 responses)	2 pronouns (28 responses)
Comprehending 1st pronoun (Did child direct the response to the correct person?)	Correct: 94% **Incorrect: 6%**	Correct: 86% **Incorrect: 14%**
Comprehending 2nd pronoun (Did the child produce the first pronoun correctly?)	Correct: 76% Avoid producing pronoun: 12% **Incorrect: 11%**	Correct: 21% Avoid producing pronoun: 71% **Incorrect pronouns: 7%**
Comprehending 3rd pronoun (Did the child produce the second pronoun correctly?)	NA	Correct pronouns: 54% Avoid producing pronouns: 11% **Incorrect pronouns: 36%**

As can be seen, there is more difficulty in general with the embedded clauses, though the low percentage of subject pronouns is caused by avoidance of the very structure in which we would evaluate those. The second pronoun is poorly produced and errors are high, i.e., when the child's response must be something like this to the puppet:

(16)   Ask her what my favorite color is

In these cases, children are prone to mistakes on the embedded pronoun.

2.4   Study 1 Discussion

In general, children's performance is quite high (74-94%), if one examines all but the embedded pronouns in the two clause sentences. There was no discernible difference between "deictic" (I→you) and those involving 3rd person pronoun changes (me→him). We argue that in this kind of scenario with three participants, each pronoun is in fact deictic, in the sense of accommodating to different speakers and addressees. As Roberts (2015) writes, "An indexical is an expression whose interpretation conventionally presupposes a relation to the doxastic point of view of a contextually available discourse center, its anchor."

How do we explain this array of findings? The most natural account is one in which there is a Point of View operator established that takes scope over the whole sentence and maintains the same perspective over all pronouns in its scope. Essentially once that PoV is established, the child is able to switch each pronoun in the appropriate fashion

As experimenters, all of us struggled on paper and in scoring to work out the right answers and what the switches were, though we found it was relatively effortless in real conversation. There must be a coherent operator that makes agreement across the pronouns natural in production.

Nevertheless, the errors children make in two clause sentences must be addressed. Evaluating the pronouns meant discarding large amounts of data in which children avoided doing the complex thing we intended. Many, but not all, of those responses were pragmatically sensible in that they reached the goal of the conversation though they skipped steps. While this suggests that children may have comprehended the prompt, we are unable to tell if they were in fact evasive, in the sense of giving the child an escape hatch. Certainly those particular conditions in which evasion occurred resulted in a greater error rate on pronouns when children *did* attempt our complex speech act.

The broader problem of indexicals in embedded contexts is the topic of Study 2.

3.   Shifting indexicals

It is in embedded contexts that cross linguistic variation comes in for indexicals, and the matter is far from straightforward. We became aware of it first in Peggy Speas' work in Navajo (Speas, 2000), where she reported that it was possible to say the equivalent of:

(17)   Edith$_i$ said I$_i$ had dinner

where Edith is co-referent with the first person pronoun "I". By a series of tests it can be ascertained that the clause is not a direct quotation. Speas reports for example, that locatives, temporal expressions and demonstratives stay anchored to the speaker in Navajo, therefore allowing the following, where there and yesterday are from the speaker's perspective:

(18)   Edith$_i$ said I$_i$ had dinner there yesterday.

But Navajo is not the only variation. Roberts (2015) provides a succinct review of the variations described to date. In Amharic, studied by Schlenker (2003), 1st person singular pronouns vary in interpretation in embedded clauses with *say*, optionally referring either to the speaker or the embedding subject's denotation. However other indexicals do not shift.

In Zazaki, studied by Anand and Nevins (2004), unlike in Navajo, all the classic pure indexicals (I', 'you', 'today', 'now', etc.) shift in embedded clauses under 'say'. In Slave, studied by Rice (1986), the picture is even more lexically specific. Under complements of 'say' and 'want', 1st person pronouns optionally shift, as in Navajo. However under 'tell', both 1st person and 2nd person pronouns shift obligatorily. No other indexicals shift.

In Deal (2013), Nez Perz is reported to allow 'I' and 'you' to be optionally shifted in embedded contexts, but unlike Navajo, crucially they shift together. If both occur in the same embedded clause, they both shift together or neither one does. 'Here' also may be shifted in such contexts. If locative shift occurs then so also must person shift, but person shift can occur without locative shift.

In Signed languages, this has been extensively studies and here too there is variation. Signed languages permit a device called role shifting (RS), usually a change in bodily orientation reflecting that the signer is "taking on the role" of a speaker other than the self, identified by their allocated location in the signing space. In LSC (Catalan Sign Language; Quer, 2011), and DSG (German Sign Language) Hubl (2013), 1st and 2nd persons obligatorily shift in the RS-marked complements of certain verbs of saying and attitude predicates. Though the indexicals 'this' and 'tomorrow' can also shift, the locative 'here' never does, In American ASL, 1st and 2nd persons as well as other indexicals are reported to obligatorily shift in the RS-marked complements of verbs of saying, and optionally under RS-marked attitude predicates (Koulidobrova & Davidson, 2014). The shift is coordinated, with all moving together.

In summary, it appears that across languages, it is not just first person pronouns that shift, though those seem most likely to shift if anything does. Next come second person pronouns, but only if the first person also shifts. Finally, locatives shift but only if pronouns do. If locatives shift, everything shifts in a coordinated way.

Anand & Nevins (2004) propose that the shifting is accomplished by operators associated with the verbs in question, that is, "context shifting operators", that replace the global context and replace it with the reported-speech context to which the verb (e.g. say) shifts. They propose a constraint called "Shift Together" in which "all indexicals within a speech-context domain must be bound by the same context". Yet in Roberts' (2015) review, it is clear that there is more variation and lexical specificity to be explained. There are language-specific distinctions between types of attitudes (verbs of saying, or telling, or a broader set) and also differences across particular indexicals in their susceptibility to

shifting under different attitude verbs.

The forest of variation seems inevitably confusing which is why it has only slowly risen to the point of recognition by linguistics - whereas the basic properties of deixis (Jacobson, 1927; Fillmore, 1975) leap out immediately to everyone. What then would be a natural acquisition path? One guess is that indeed the pronominal variation is grasped before these other varieties---yet still we are in need of a system to describe the variations in a way that would make cross-linguistic variation more systematic than isolated lexical differences.

3.1   Pragmatics and Indexicality

Our starting point had been that there are tight mechanical principles controlling Point of View: A PoV Operator at the head of a clause- perhaps in CP- controls the indexicals.

[CP PoV-op
      Pronouns   I you, he ..
      Locatives   here, there
      Temporals   now, then, tomorrow
      Verbs: come, go

If the PoV-Operator is present in the CP, then it can govern the entire sentence. But embedded contexts may or may not introduce a second CP depending, for instance, on whether there is a small clause, an infinitive or a Tensed clause, or perhaps the presence of a complementizer. Therefore the question arises as to whether or not the CP_2 involves a change of PoV

    $[CP_1$ PoV..............$[CP_2$ PoV   ]]

A first hypothesis is that there is a single PoV which governs the whole sentence and the presence and content of the second PoV requires language particular information. The second PoV could allow a shift from Speaker to the Subject of CP_1 to be the anaphoric link.   This makes it possible in a language to have which occurs in Navajo:

(19)   John thinks that I did it => $John_1$.....that I_1

We have already seen that all perspective-changing elements are not like indexicals in English (de Villiers, in press). Peggy Speas' data on Navajo (2000), and now the enlarging range of phenomena from other spoken and signed languages make it clear that across languages, not even indexicals behave uniformly as Speaker-oriented. Furthermore, all indexicals are not alike in the probability that they will shift. Do we continue to search for specific factors that govern the alternatives within grammar, or do we seek the explanation in another domain, such as pragmatics?

Just as one example, there has been debate about appositives in Potts (2005), who claimed that all appositives were Speaker-oriented, for instance, expletives and expressives, as in:

(20)   Mary praised her boss, an idiot, to the skies.

Here it is the Speaker who considers her boss an idiot. This holds for even relative clauses in embedded constructions, as in:

(21)   John said that the dog, which is big, is small.

Note that Subject PoV is ruled out here by the contradiction. Nevertheless critics (Amaral, Roberts & Smith, 2007) have pointed out that Appositives can maintain the higher subject PoV as well and not revert to Speaker-perspective:

(22)   Joan is crazy...she believes that a chip, which was installed last month in her brain, controls her mind"

This means that the relative clause inside a complement can be ambiguous between the Subject PoV and the Speaker PoV. More troubling still are cases with comparatives:

(23)   Alice thought Sara was taller than she is.

Clearly, Alice could not have the thought, "Sara is taller than she is". Something shifts inside the comparative itself to allow both PoVs inside one clause.
     Harris and Potts (2010) offer extended corpus and experimental evidence that these options exist and are affected by attitude verbs and other factors like negativity. They conclude:

> Whatever indexicality inheres in these phenomena seems to more closely resemble the discourse-based logophoricity of Kuno (1987) and Pollard & Sag (1992) ……. than the bound indexicals of Schlenker (2003), von Stechow (2003), Anand & Nevins (2004), and related work (Harris & Potts, 2010).

This suggests that there might exist a division between the indexicals we have been discussing as bound to a PoV operator, and other effects that are directly tied to pragmatic computations.
     In general, the diversity of evidence that Roberts summarizes suggests that a very large acquisition challenge remains for the child in determining which system, the pragmatic or the PoV-BV system to apply to indexicals. It seems to us that there are two possible acquisition routes:

a) A child could begin assuming as we did, that everything in the sentence is under the control of a single doxastic center, a singular. Speaker-oriented PoV, until proven otherwise.
b)   The pragmatic system may be a default which is overruled (or highly limited) whenever a Bound Variable PoV system can be applied. It is immediately dropped when the child experiences the BV nature of indexicals in ways that are independent of any particular context.

Our second study had a more limited scope, but we offer the evidence in the light of these

larger theoretical possibilities to which we return.

3.2   The Second Acquisition Problem

Virtually no attention has been paid to the behavior of indexicals in more complex environments in acquisition. It is time to re-examine the available acquisition phenomena in the light of this new linguistic work. In particular, do children's errors follow a pattern that might be predicted by these cross linguistic patterns?
    Here we address two questions:

   a) Do English-speaking children allow shifting in embedded contexts, and if so,
   b) Are they more likely to allow shifted pronouns than other indexicals?

In the case of b) it means recognizing that different attitude verbs may have different effects depending on the language. But more fundamentally, even in English the child must recognize the syntactic difference between adjuncts and complements, and between direct and indirect speech, because the syntax will make a difference in term of the control of Point of View in the clause. Much work has suggested that preschool-age children in English may make interesting mistakes with complements in other ways, so it cannot be assumed that this is all established by age 3. For example, children who are asked:

(24)   What did the mother say she bought?

will answer what the other actually bought, not what the mother said she bought (for extensive analysis, see de Villiers, 2005; Roeper & de Villiers, 2011). In other work, Hollebrandse (2000) found children insensitive to markers of direct discourse such as inversion (and pronoun switch) in standard English, allowing wh-extraction across a quotation:

(25)   When did the girl ask can I ride the bike?

by answering *when she rode the bike*, not *when she asked*.

4.   Study 2

Notice first, the switches observed across languages are often optional, as in Navajo, not obligatory. Second, they apply differentially to different indexicals across languages. We have assumed a default in production would be to maintain the speaker point of view across the entire utterance, rather than switching under certain conditions (e.g. certain attitude verbs) and certain indexicals (e.g. first person pronouns) or only in certain positions (subject). Would children adopt this default, or would they maintain an open set of alternatives from the outset? Given the degree of cross linguistic variation and the errors children make in identifying the differences in direct and indirect complements, we anticipated that the complexity under embedded clauses of different types might cause considerable difficulty for English-speaking children. First, we needed to find out how they handle two different types of indexicals in a single sentence. Then we could explore

embedded forms, and see if English children ever entertain a "Navajo"-style grammar, allowing shifting say, or first person subject pronouns but not of demonstratives, or possessive pronouns.

The prediction was that English-speaking children may allow the pronouns but not other indexicals in embedded expressions to take subject rather than speaker perspective, as in Navajo. In the final procedure we also tested whether children would allow switches in subject pronouns in complements headed by a wh, another condition that was reported to be restricted in Navajo (Speas, p.c., 2007). In addition, we reasoned that if a PoV operator in the top CP were controlling the shifts throughout the sentence, then a blocking effect could occur if the medial CP was occupied by a wh-operator. Previous research has suggested constraints on interpretation when there is intervening material in the medial CP. The most obvious case is with wh-questions:

(26)   Where did the boy ask what to bring?

In which the where is blocked from having its trace in the complement clause (Chomsky, 1986) which is a Strong Barrier in classic linguistic arguments.
Considerable evidence suggests children respect this constraint (de Villiers, Roeper & Vainikka, 1990; de Villiers, Roeper, Bland & Seymour, 2012) In the current study we asked if the children considered these two complement types to differ in acceptability with the pronoun switch:

(27)   John$_i$ said I$_i$ bought a car

(28)   John$_i$ said what I$_i$ bought

In addition, we introduced locative demonstratives this/that to understand if they would switch them as readily as the pronouns under a hypothesized single PoV Operator.

4.1   Study 2 Participants

The participants were 20 typically-developing children between 4 and 6 years (4 boys, 16 girls), and 11 children (6 boys, 5 girls) average age 7 years. In addition, 20 adult college students were tested on the video tasks.

4.2   Study 2 Procedures

4.2.1   p.1: Two deictics in one simple sentence

The child and experimenter sat across a small barrier and each had an identical set of toys: ball, box, broom, bag etc.**.** The child was given directions to carry out (Comprehension) and then asked what she was told to do (Production). In this latter case, pronoun switches would be required to repeat the direction from the child's point of view. Children received 16 trials such as the example shown in (28) across 2 sessions.

(29)   E: Put **my** ball in **this** box.

(Child acts)

E: What did I tell you to do?

Required Answer:
"Put **your** ball in **that** box".

4.2.2 p.2 (Videos): Two embedded deictic terms in an embedded sentence

The child was told that some animals were now playing a similar game to p.1, and that sometimes the one listening gets it right and sometimes they get it wrong.

(30)   Bunny: [puts **Mouse'**s duck in **Bunny'**s hat.]
                          I put   **your** duck in   **this** hat.

          Mouse: I get it, Bunny said that
                          she put **my** duck in   **that** hat.

          Experimenter: Did Mouse get it right? (answer: correct)

4.2.3   p.3 (Videos): Single embedded deictic term in sentence

(31)   *Screenshot of video shown in p.3:*

(32) Correct
       Bunny: [eats Cat's apple.]   **I'm** eating **your** apple.
       Cat: I get it, Bunny said that **she** is eating **my** apple.
       Experimenter: Did Cat get it right?

(33)   Navajo-type pronoun use: 1st person pronoun shift (Navajo)
       Bunny: [eats Cat's apple.]   **I'm** eating **your** apple.
       Cat: I get it, Bunny said that **I am** eating **my** apple.
       Experimenter: Did Cat get it right?

(34)   **Personal pronoun shift -2nd person only shift (non-Navajo)**
        Bunny: [eats Cat's apple.]   **I'm** eating **your** apple.
        Cat: I get it, Bunny said that **she** is eating **your** apple.
        Experimenter: Did Cat get it right?

In an attempt to make the videos more interactive, children were given a score sheet. They could then give Bunny, Mouse, or Cat a happy face if they got it right and a sad face if they got it wrong. We needed to be sure they were judging the speech, not the action itself, which was always correctly described by the first participant.

4.2.4   p.4. Live Judgment:

Experimenter introduces child to "Chicken" – a puppet - who is just learning how to speak English. The child was asked to help Chicken learn.

Type 1: Navajo-style pronoun use

(35)   E.g.: Experimenter is wearing a bow on and chicken is wearing a hat.
      Experimenter: I have a bow on.
      Chicken (to child): Did E say that I have a bow on?

Type 2: Spatial deictic error

(36)   Experimenter has a red apple; chicken has a yellow apple.
      Chicken: That apple is red
      Experimenter: This apple is red
      Chicken to child: Did E say that this apple is red?

Type 3: Pronoun switch under *what* complement

(37)   Experimenter has a cap on. Chicken has a scarf on.
      Experimenter: I have a cap on.
      Chicken to child: Did E say what I have on?

Type 4: Demonstrative switch under *what* complement

(38)   Experimenter has a broken crayon. Chicken has a regular crayon.
      Chicken: That crayon is broken
      Experimenter: This crayon is broken
      Chicken to child: Did E say what this crayon is?

4.3   Results

The children were surprisingly poor both at comprehending and producing the spatial deictics "this" and "that". The children were only 78% on average correct on this task, with

20% of the responses being errors on the spatial terms. Only about 2% of the responses involved errors with the pronouns. This is the first indication that the PoV-Operator operates on the pronominal class and the deictic demonstrative class differently. That is, most errors involve e.g.

(39) "Put your ball on this box"—child chooses right ball, but puts it on the box next to him.

In this "error" the child appropriately switches the pronoun to mean *my* but does not switch *this* to mean *that*.

2) We then asked the child, "What did I tell you to do?" hoping for a reversal of the indexicals. A child who heard "Put your ball on this box" should say "You said (to) put my ball on that box".

 Children did *very poorly* by this standard. Only 8% were fully correct by the standard we had set, 17% were "quotes", i.e. child repeats just what was said (especially the 5 year olds), and 75% were changes that we found hard to categorize. That is, we couldn't tell if it was a part quote or a gist e.g. if the child says, "Put my ball on this box" or "Put the ball on my box" or "Put your ball on your box".

 In consequence, we could not use the data on the p.2. video to compare the likelihood of a Navajo-style pronoun switch with the corresponding non-Navajo demonstrative switch, because control of the simple demonstratives was too "unreliable". To put it differently, the separation between the pronoun and demonstrative system allows no conclusion about their different behavior.

 On p.3. videos we were able to compare the likelihood of accepting a Navajo-style switch on the subject pronoun with the error on the personal possessive pronoun. (39) shows that the switch was judged slightly more acceptable on the subject pronoun than the other personal pronoun. Clearly children allow more switches than adults, but they also sometimes disallow correct English Speaker-oriented pronoun use.

(40) *The error rate on different pronoun uses in embedded contexts*
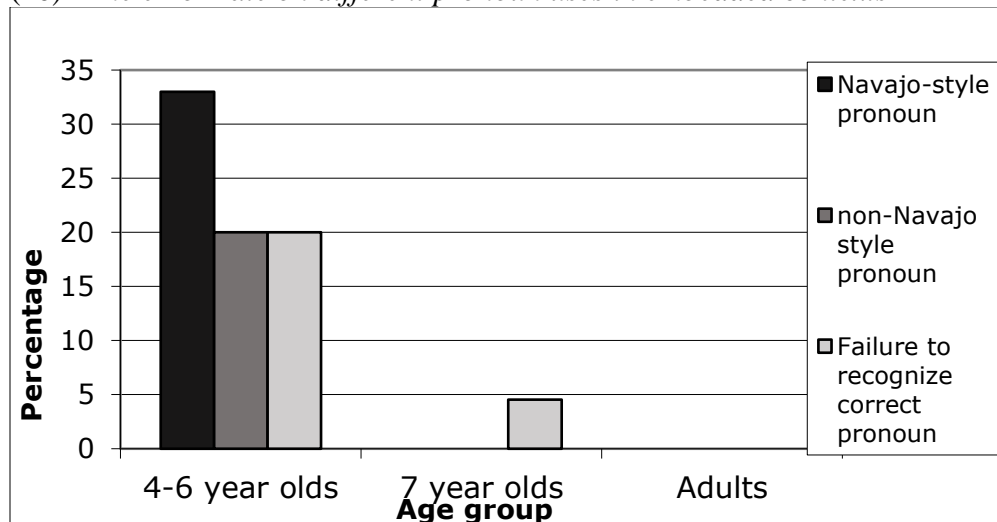
p.4. provided us with another way to test whether the errors that children make reflect a Navajo-style grammar, or just a general tolerance for pronoun switches in embedded sentences. It was predicted that children should find pronoun switches acceptable in the ordinary embedded sentences but not in the embedded *what* complements (Speas, p.c., 2007) if the *what* forces a new CP and new PoV into existence.

 (41*) Errors of accepting subject pronoun switches in two kinds of embedded CPs*
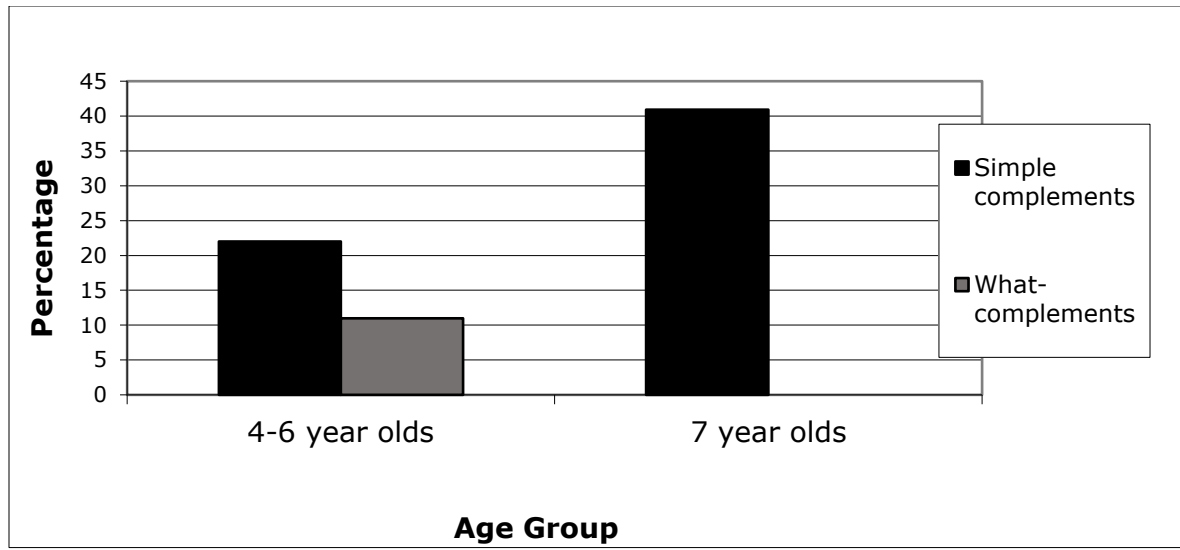
As (40) demonstrates, the error in p.4. of allowing a pronoun switch on the first person pronoun was blocked, especially at age seven, when *what* was present in the medial position.

4.4   Discussion

It is clear from our results that pronouns and the deictic demonstratives do not get mastered together. Given that the deictics involve many more factors, this should not be too surprising. The pronouns *I* and *you* just switch, but the demonstratives are a function of many other considerations such as the size of the domain under discussion (Fillmore, 1975). They might entail things in the immediate vicinity:

(42)   "hand me that screw"

versus a much larger scale:

(43)   In this country we hardly ever….".

Of course we limited the domain of reference in the experiment and also introduced a clear contrast by using a barrier (see de Villiers & de Villiers, 1974), but that does not solve the large acquisition problem in which children are surrounded by potentially ambiguous circumstances of use.

Jakobson's first recognition in 1971 of "shifters" pointed at pronouns and deixis where lexical items demand a pragmatic dimension. We cannot interpret reference for *I, you, this, that, here*, there without contextual information. Children likewise receive immediate evidence that these words have unstable reference. The word "I" is used by two different people, "here" is not the same place always. When we add verbs and other contextual features, the linguistic variation becomes more obvious and both the theory and the acquisition demands become more obscure. For instance, "come" and "go" vary with the speaker. However their connection to the deictics can undergo subtle variation: *come here/go there* would seem to indicate that they are linked to a common Operator which can mark not only nominal but verbal elements. Children at 2yrs and parents commonly say "c'mere" and "I didn't go there", but not *"come there". However, it is possible to say, after someone says: "You go to NY first, then I will "come there" later". Nonetheless it is strange, once you are in NY to call up and say: *"I cannot wait until you go here." Yet under other circumstances one can, and both parents and children do, say things like "does this [button] go here". That is, it is possible to say both *"come there" and *"go here", but the pragmatic situations are very narrow. A single PoV Operator account of these would have difficulty with these facts.

The important point about the final result about pronouns in embedded contexts is that it demonstrates that the children's errors are not just random, but governed by linguistic factors. This is suggestive evidence that children – even at seven - may permit a Navajo-style shift option selectively for *subject* pronouns in embedded sentences, at least in acceptability judgments.

5.   General Discussion

In sum, there is an effect of whether the multiple indexical switches occur in a single versus an embedded clause. This is also not surprising if one looks at the kind of cross linguistic evidence for indexical shifts: the diversity of solutions occurs precisely under verbs of communication or attitude, so that children ought to have greater uncertainty about whether pronouns change Point of View in embedded conditions. Although Study 1 was a production task, it relies on the child following the commands of the experimenter, so comprehension of pronouns in embedded contexts was also entailed. To the extent that the child entertains other possibilities for how the subject pronouns could refer, then she will be unable to execute the command appropriately. In Study 1 this becomes very difficult to tease apart, suggesting a new design is needed. However every experimental design seems to have its own cost. In Study 2, when judgment but not translation into speech production was required, the child faced the difficult of adopting *two* others' perspectives to judge a) what person A meant and b) whether person B carried it out properly from her own perspective. It is astonishing to reflect that these operations go on relatively seamlessly in the daily life of young children. The "doxastic center" must be operative from a surprisingly early age.

Study 2 attempted to determine whether children were more likely to make errors that reflected UG than other errors, at a time when the full panoply of possibilities for shifting were still not well understood, nor are they now. We naively assumed that only first person pronouns could be shifted, not the spatial indexicals, and while that it is still true probabilistically across languages, it is not a sufficient basis for the experimental design

we attempted. Furthermore, the conditions of use of terms like *this* and *that, here* and *there*, as Fillmore (1975) famously discussed, are highly complex and still under mastery at the ages we tested. The puzzling thing is how it is that children can establish these conditions during the same time period they are figuring out whether their own language allows their meaning to shift in embedded contexts. We had assumed early control over meaning in simple sentences would be established such that children could detect shift in complex clauses. Instead, the processes proceed in tandem. It suggests that a pragmatic basis for deixis---just as very young children can point and say "there"--- remains a default until replaced.

Despite that, we found evidence that children were more permissive about subject pronoun shifts than possessive pronoun shifts occurring in the object position. This surely means they have kept open, even at seven, a possibility for certain shifts in their grammar. Their confusion with pronouns in two clause sentences in Study 1 may well reflect the same option.

If we take a step back, we can see that what look at first like experimental design flaws are reflecting the complexity of the theoretical choices between a straightforward use of an Operator on indexicals, and a different account in which other pragmatic factors can influence shift. Our results reveal how experimentation and theory can co-evolve.

Although we can not trace out our results in full technical detail, they provide evidence for some basic principles, which we can outline in broad terms.

1. Children can adjust to Speaker perspectives. Therefore a Default Speaker perspective is justified.
2. Children can grasp and represent discontinuously linked variable items which co-vary, as the early switching of pronouns indicates. Therefore a PoV-OPerator may be easy to project.
3. All linkable systems are not grasped simultaneously---and they should not be since they are subject to language variation.
4. It is plausible that the locative deictic system, temporal deictic system, verbal deixis and perspective-taking systems are not all immediately linked.
5. The syntactic distinction between Main Clause and Embedded clause alters the range of the PoV Operator. This suggests that as with cyclic rules generally, a PoV-Operator projection must be instantiated at each Clause (CP boundary), with possible variation between, for instance, Tensed, Infinitive and Small clauses.
6. Therefore there must be a systematic acquisition path whereby what falls under a single Operator becomes evident to a child.
7. Embedding changes the success of PoV switches. This fits the possibility that the embedded PoV can take a Subject perspective on subject pronouns, which is what Navajo allows, unlike English.

What predictions can we make for future work? First, is the default assumption "no shifts" in embeddings? To test that prediction requires data from children speaking languages where shifts occur. If children speaking such languages do permit shifts, do they only allow shifts in pronouns, or in all indexicals together? If they speak a language where only some indexicals shift, do they make mistakes by applying "Shift together"? Do children show more rigidity in production, and permissiveness for comprehension, given the optionality of shifts often reported? Our preliminary studies reveal the design difficulties that must be overcome, but the opportunities for further experimental work are

rich indeed.

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