Specificity, acquisition of DPs and the development of a theory of mind

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0. Introduction

One of the basic assumptions of generative grammar is the modularity of syntax, i.e., the belief in grammar as an independent module of the mind. This approach has proved fruitful in furthering our understanding of the variant and invariant structural properties of human languages, but modest in articulating the interaction between general cognition and language. The goal of this paper is to explore the relation between two proposed modules of the mind: grammar and theory of mind. We would like to consider some of the following questions: What is the relationship between our cognitive complexity and our ability for language? In which ways, by providing a scaffolding, does language makes possible certain varieties of reasoning that are more complex than those available to non-linguistic organisms? This papers offers some speculations concerning the possibility of developmental links between one aspect of the syntax of noun phrases, specificity, and one aspect of cognition, theory of mind reasoning. In particular, I propose that theory of mind failure explains an unusual type of relative clause produced by children learning Spanish.

I proceed by first discussing the notion of specificity, then by considering different claims in the area of language development where specificity has been invoked as a determinant factor in grammatical development. Last, I consider some data from a case study in the acquisition of Spanish which suggests interactions between acquisition of the semantics of specificity and cognitive development in the theory of mind.

1. Specificity in natural language

Specificity is the ability to characterize an NP as pointing to a unique referent which the speaker has in mind (Ioup 1977). This can be achieved via the referential use of definites, but it is also available as one possible interpretation of indefinites (Enç 1991; Partee 1972):

(1)   a. Melinda wants to buy a motorcycle
       b. ... she will buy it tomorrow
       c. ... she will buy one tomorrow   (From Ioup (1997))

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Example (1a) is ambiguous. The interpretation of the indefinite as an individual constant is the one shown in (1b), whereas (1c) shows the 'type' interpretation. Fodor (1970) demonstrated that specificity ambiguities stem not just from the interpretation of the NP or of the context, but of the interaction between those two. Specific indefinites in transparent contexts give rise to existence entailments (i.e., the specific reading of (1a) entails the existence of a motorcycle that Melinda wants to buy, but not in opaque contacts. Thus, (2) can be a true sentence without entailing the existence of dragons:

(2)   Alberta believes that a certain dragon ate her petunias

Additionally, specific NPs carry out an implicature of wide scope when uttered out of contact perhaps because the option of using non-specific NPs for unambiguously narrow readings is always available:

(3)   I talked to a certain logician

(4)   Each husband had forgotten a certain date--his wife's birthday

Formal semanticists have debated whether specificity (in indefinites) can be equated to definiteness. In this respect, Enç concludes:

"...natural language semantics contains principles that determine whether or not NP denotations are linked to previously established referents, and about how this linking can be achieved. Definiteness involves a strong link, that of identity of reference, whereas specificity involves a weak link, that of being a subset of or standing in some recoverable relation to a familiar objects." (Enç 1991: 24)

It has been assumed that language acquisition proceeds by articulating the language specific features (i.e., the lexical items as well as the morphology) that instantiate grammatical contrasts. Let's consider the case of specificity. The determiner systems in different languages vary, and there are possibility for specificity to be marked in special ways in the morphology of the various languages. Take, for instance, the above described indefinite ambiguity illustrated by (1). If the NP is further described by a relative clause, the mood of the relative serves to disambiguate the indefinite. Indicative relative clauses in Spanish carry a presupposition of truth, and entail the specific reading of an indefinite relativized noun:

(5)   Melinda quiere una motocicleta que tiene calefacción
        M   wants a motorcycle that has-IND heating

Descriptions of specific entities are expressed with indicative relative clauses, while subjunctive relative clauses only have what Quine has referred to as a 'notional sense' of the description (Martinich 1985), also referred to as a non-specific sense (Gonzalo 1990; Rivero 1990) or non-individuated sense (Guitart 1994). Example (6) cannot have the specific interpretation for the indefinite, and therefore (6c) is the only possible continuation (6a) can have.

(6)   a. Melinda quiere una motocicleta que tenga calefacción...
           M   wants a motorcycle that has-SUBJ heating
        b. #... la comprará mañana
              'she will buy it tomorrow'
        c. ... comprará una mañana
              'she will buy one tomorrow'

Interestingly, it is possible in Spanish to combine a definite determiner with a subjunctive relative clause, in a particular type of semantic context. This construction combines both the existence claim of the definite as well as a non-specific reading of the subjunctive. Example (7) can only be used in a context where there is a set of motorcycles, the speaker does not have one specific motorcycle in mind, only the requirement that it has heating. Furthermore, the speaker is aware that there is at least one of such type, even if he doesn't know which one it is.

(7)   a. Melinda quiere la motocicleta que tenga calefacción…
           M   wants a motorcycle that has-SUBJ heating

That definite NPs with subjunctive relatives carry a truth presupposition is evident from examples such as (8), as pointed out by Jorge Guitart (p.c.):

(8)   en esa escuela expulsan a los que copien, y son muchos
        in that school, of those that cheat, and there are some

        In sum, specificity is an important dimension of natural language, with multiple consequences in the visible syntax. Since there are important aspects of variation, it is reasonable to accept that some learning must take place for the system marking specificity to be in place.

2.   Specificity effects in language development

        One important consequence of recognizing the linguistic variation in expressing specificity is that some language specific learning must occur in each case. In consequence, one may assume that, to some extent, early grammars must be underspecified for the feature of specificity. Some possible consequences of such underspecification in the linguistic capacities of the child has been pointed out in different places in the developmental linguistics literature:

        One instance of acquisition where specificity appears to play a role relates to object clitic placement in early child Italian, and optional scrambling in child Dutch (Schaeffer 1997). Schaeffer points out how young Italian children initially omit object clitics. When the clitic is present in the utterances of 2 year olds, the object triggers participle agreement, but not when it is absent. By the age of 3, her data shows that children have acquired this aspect of the grammar of Italian, and have made clitics and object agreement obligatory.

(9)   ha lavato   M 2;1
        has washed-MascSg (it)   (no agreement)

(10)   l'ha mangiata   G 2;6
        has eaten-FemSg   (agreement)

        Schaeffer explained optionality in clitic placement by arguing that specificity is optionally marked in early child Italian. Romance clitics are positively marked for specificity, so she suggests that what children lack is not a complete syntax of clitics, but the discourse rule which incorporates preceding discourse and knowledge of interlocutor into representations. Access to a discourse representation is necessary for certain use of definites: i.e., when the definite is discourse related ('the book') but not when it is discourse unrelated ('the sun').

        DeVilliers and Roeper (1995) examined the role of DP in acquisition as jointly a) a binding domain, and b) a barrier to *wh*-movement. The context of their study is the small

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class of English nouns which allow a definite article to be non-referential, such as *way, chance, decision, time, help*:

(11)   a. Every boy knows the way to fool his teacher
        b. Every soldier must make the decision to fight

In these contexts, the definite does not carry the specific reading (i.e., it is not a specific decision that is made), nor is the complex NP a barrier and a binding domain. The same complex NPs in different contexts can receive a specific reading and function as a barrier to movement and as a binding domain:

(12)   a. how did John make the decision to shave him?
        b. how did John like the decision to shave him.?

(13)   a. every boy made the decision to shave him
        b. every boy liked the decision to shave him.

In their study, they found a coincidence in the acquisition of complex NPs as a barrier to *wh*-movement, and as a separate binding domain. They argue that children initially treat all complex NPs as NPs and that only later do they learn that some of these nominal phrases project a DP. In their account, the semantic nature (specific and referential) is linked to the syntactic projection (a full DP structure, which creates a barrier and a binding domain) in acquisition.

There is a third domain in the developmental literature with interesting connections to the semantics of specificity, and that is the use of determiners by autistic individuals. Autistic individuals' language is characterized by deficits in their language production, to the extent that linguistic deficits are considered part of the diagnostic/definition of autism. Most of the relevant deficits have been attributed to an underlying pragmatic basis. One possibility raised is that the pragmatic deficits involved depend on autistic persons as lacking the ability to attend to interlocutors' mental states, which has been known as the theory of mind hypothesis of pragmatic deficits in autism (Tager-Flusberg 1994).

By theory of mind development psychologists refer to young children's inability -- and their subsequent learning--to make correct predictions about individual's behaviors in false belief contexts (Wellman 1990; Wimmer and Perner 1983; Wimmer and Weichbold 1994). One well known task involves asking an experimental subject to predict the actions of a character who is looking for an object which he has seen placed in one location and which later, in his absence, has been moved to a second location. Young children typically predict that the character will look for the object in the location where it really is, not in the location where the character should believe it to be. This has been interpreted as evidence that children do not understand the representational nature of belief, suggesting that children treat mental states as copies of (instead of representations of) reality.

Autistic subjects are noticeably poor at theory of mind tasks, being surpassed in performance by their mental and verbal age mates (Baron-Cohen, Leslie, and Frith 1985). A study of naturalistic language production by autistic individuals shows important error rates in the use of pragmatic markers linked to mental inferences made about the other participants in discourse (Hewitt 1997). Among other things, Hewitt studied the use of definite determiners. Excluding from her sample non-discourse related uses of the definite article as well as idiomatic uses, she found substantial errors in use of definite articles. Over extensions of definites imply that the speaker is not taking into consideration prior knowledge of his/her interlocutor, by introducing a new referent marked by the definite as discourse related. These can be seen in the following conversation between an autistic individual (A) and the researcher (L).

(14)   A   (I I I) I went on *the train ride*
     L   Oh, you went on *the train ride* too?
     A   Come out of *the tunnel*, train
     L   Was there *a tunnel*?
     A   Train.

Here A correctly produces the definite phrase *the train ride* (it was previously identified in discourse) but also overextend the use of definites when making a reference to *the tunnel*, which was not present in previous discourse. Introducing new referents with a definite article (unless they are non discourse related appropriate use of indefinites) requires an understanding that both speaker and listener agree on an specific referent for the expression, as previously indicated by the discourse context.

As predicted by the theory of mind approach to pragmatic deficit in autism, more errors were produced with definite than with indefinite articles because the former but not the latter is based on mental inferencing about discourse participants. In her data, Hewitt found 27% of errors among the total number of definite articles produced, in contrast with only a 3% of errors in the use of indefinites.

The evidence from autistic language raises important questions regarding the connections between theory of mind development and language acquisition. Some of the issues have been addressed in intriguing experimental work by deVilliers and colleagues which suggests that the ability to tell that embedded complements are false precedes theory of mind reasoning (deVilliers and Finetva 1996; deVilliers, Gale, and Pyers 1996). In their work, they compare understanding of opaque domains (sentential complements) to understanding of opaque containers, as in one of the standard theory of mind tasks, in which a closed container, such as a box of candy, is filled with an unexpected object (crayons). When asked what another person X will think is in the box, young children respond with predicting that such person will think that the box contains crayons (the actual content), whereas adults will predict that X will think the box to contain the expected content, i.e., candy. This is schematized in (15):

(15)   Closed box of candy which contains crayons
       child prediction--->   X will think there are crayons
       adult prediction---->   X will think there is candy

They suggest that understanding that an embedded complement is false, as in (16), could be the trigger for the ability to representing the content of other's minds as independent.

(16)   He thought he found his ring but it was really a bottle cap   (deVilliers et al (1996))

I would like to propose that specificity represents an additional dimension of connection between the grammatical module and the cognitive representation of other's mind. Understanding of specificity is the ability to link NPs and denotations both in transparent as well as in opaque domains, i.e. to understand that (17a) entails the existence of a dragon, but (17b) doesn't.

(17)   a. A certain dragon lives in the garden
      b. He thinks a certain dragon lives in the garden

Understanding false complements is the ability to dissociate truth of complements in opaque domains, i.e., to understand that the sentence:

(18)   he thinks he found his ring

does not presuppose that the ring was found.

Finally, understanding a theory of mind consists of the ability of dissociating the truth from the representation of others mind, i.e., to understand that a person would be likely to think that a candy box has candy even if it actually has crayons.

The link between the semantics of specificity and theory of mind is very concrete. I have argued elsewhere (Pérez-Leroux 1997) that full understanding of the lack of existence implicature in the non-specific reading of indefinites (as in subjunctive relative clauses in Spanish) requires access to computation of truth values in multiple possible worlds. That is, if I say that Melinda wants a motorcycle with heating, in a non-specific sense, I understand that the sentence is valid even if no such motorcycle exists. That is, I can conceive both of actual worlds (without heated motorcycles or dragons in the garden) and possible worlds where such things may indeed be. Similarly, to understand false belief I need to be able to compare worlds that are actual (with disappointing crayons as the content of tempting candy-boxes) and worlds that are not, worlds where someone may mistakenly but naturally think that candy boxes have candy.

3.   The acquisition of mood in relative clauses in Spanish

An earlier study on the acquisition of mood choice in relative clauses in Spanish, established that 3 and 4 year old children produced a variety of responses which differed from that of their older counterparts in an elicited production task targeting subjunctive relative clauses (Pérez-Leroux 1993). In that study, Spanish speaking children aged 3 to 6 were read a story in which a character was looking for something or someone. As in standard relative clause elicitation protocols, there were other items present in the context, similar to the target object, in order to create the need for an elaborate description. Crucially, the story provided strong indications that the target object did not exist, by listing all the failures in finding the object. For instance, in one of the stories, given in (19), the illustration accompanying the story only depicted two knives.

(19)   La cocinera tiene que cortar una carne. Coge un cuchillo pero no corta bien. Coge otro pero ese es para untar mantequilla.
        Prompt: ¿Qué busca la cocinera?
        'The cook has to cut the meat. She takes a knife but it is dull. She picks up another one but that one is only to use butter
        Prompt: What is the cook looking for?

This task resulted in the production of subjunctive relatives for adult speakers. All the older children in the study produced subjunctive relatives but some of the younger children failed to do so. It was not the case that these children had difficulty using subjunctive or producing embedded clauses, since all of them were able to use subjunctive mood with purpose clauses, which were elicited in a follow-up question. Thus, clearly they had knowledge of subjunctive form, but not of its use with relative clauses. Table 1 shows the analysis of the data produced.

Table 1
Mood and Determiners in Child Relatives

Age	DI	II	DS	IS	QS
3 years	1	-	3	-	-
4 years	2	6	-	6	-
5 years	5	-	1	11	1
6 years	-	-	-	15	3

When the relative clauses produced were analyzed by content of the determiner head (definite/indefinite/quantifier) and mood of the relative clause (indicative/subjunctive), it was clear that the older children were more likely to produce the expected indefinite/quantifier with a subjunctive relative, whereas the younger children produced several non-adult responses. Among the youngest group, some children produced the infrequent sequence of a definite determiner followed by a subjunctive relative.

(20)   Definite + Subjunctive (DS)
        a. al niño que no esté trabajando eso
          to-the boy that not is-SUBJ working that
          'The boy that is not working on that'   (Maria Rosa, 3;11)
        b. A otra gallina, a la que esté poniendo huevos de bebé
          to other hen, to the that is-SUBJ putting eggs of baby
          'The other hen, the one that is laying baby-eggs' (Maria Rosa, 3;11)

Interestingly, the same children who produced DS produced explanations that suggested that they were attributing existence to the referent, despite all biasing against that interpretation in the story. One such response was the definite + indicative combination, as in (21):

(21   a. A la rana. A la que está brincando (Jose Tomás, 5;10)
            to the frog to the that is-IND jumping
            'the frog. the one that is jumping.'

Other, more peculiar responses included negating the search, as in (22), or going against the story, as in (23), where it was specifically stated that the mother was not going to be the person to read the book.

(22)   a. A nadie, porque nadie no está ahi. (Gaby, 3;8)
            to nobody, because nobody not is-IND there
            'Nobody, because nobody is there'
        b. A nadie, porque todo el mundo no pinta carritos. (Gabriela, 5;11)
            to nobody, because all the world not paint-IND little-cars
            'Nobody, because nobody would paint little cars'

(23)   a. A la mamá. Para que le lea el cuento. (Maria Rosa, 3;11)
            to the mother. for that her-DAT read-SUBJ the story
            'The mother, to read her the story"
        b. A la mamá, porque no está ocupada. (Raul, 5;5)
            to the mother, because not is busy
            'The mother, because she is not busy'

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I suggested the possibility that, for those children in particular, an individual's desire for something (which was the basis for the elicitation story) is necessarily translated into the existence of the thing. To test whether the failure of younger children to produce subjunctive relatives was due to constraints on interpretation of the search as referring to a non-actual entity, I conducted a follow-up correlational study of theory of mind and production of subjunctive relative clauses. In this study, 22 children between the ages of 3 and 6 were given the same 8 stories as in the earlier elicitation protocol for subjunctive relative clauses, this time accompanied by two items of the standard action prediction theory of mind protocol, similar to the Maxi and the chocolate cake story mentioned in section 2, above.

The overall results indicated a modest positive association between children's age and their ability to pass the cognitive test, as measured by a point biserial correlation coefficient ($r=0.4155$, t= 2.04286, df=20, $p<0.05$). However, the correlation between age and ability to produce a subjunctive relative clause, although positive, was not statistically reliable ($r=0.35$ t=1.67093, df=20, $p>0.05$). The strongest result of the study was the high correlation between ability to pass the cognitive test and ability to produce subjunctive relative clause, as estimated by a gamma coefficient (estimated $\gamma = 0.852$).

Table 2 represents the observed number of individual children arranged by their performance in the theory of mind task (failed both/passed one/passed both) and their performance in the subjunctive relative elicitation task (as measured by the number of subjunctive relatives produced. As this table indicates, not a single child who failed both tests of theory of mind was able to produce a subjunctive relative clause.

Table 2

Observed counts of children according to performance on the false belief task and the number of subjunctive relatives produced

False belief test	Number of SRCs produced						
	0	1	2	3	4	5	6
Failed both	4	0	0	0	0	0	0
Pass one	3	1	0	1	0	0	0
Pass both	2	0	4	1	2	1	3

These results were interpreted as indicating a strong link between children's ability to use the subjunctive mood in relative clauses and their capacity for understanding false beliefs. This relationship was attributed to the same underlying representational limitations in young children. This representational limitation is not, I believe, specific to children's folk psychology (i.e., their beliefs about others' minds), but is instead the general consequence of limitations in considering actual and non-actual worlds at once.

The results of this experiment can be interpreted as evidence of incomplete semantic representation available for specificity. In particular, one could say that younger children, because they have a bias for representing events strictly with reference only to the actual world, have failed to notice the full semantic implication of non-specificity. One must be cautious on how far to interpret this position. On one hand, it is well known that young children understand and use commands. Indeed, the first domain in which subjunctive

mood is used in early child Spanish is in direct and indirect commands (Hernández-Pina 1984; López-Ornat et al. 1994). Note, however, that commands, as purpose clauses, can be interpreted as future but actual, and not necessarily as diverging from the actual world. On the other hand, there is evidence in Maratsos (1976) indicating that most 3 and 4 year olds could attend to specificity in preceding linguistic context and achieve correct use of definite and indefinites in a second mention of an NP:

(24)   Bill bought a cat and a dog,   (specific)
        but the children only like *the* dog

(25)   Bill wanted a cat and a dog,   (non-specific)
        but he couldn't find *a* dog he really liked

It is possible, however, that children could have an early understanding of the relation between definiteness and discourse (perhaps at around the time they acquire object clitic placement in Italian), without understanding the full implications of the semantics of non-specific indefinites. Understanding the distinction between definites and indefinites in (24) above only requires understanding that there is an identity of referent (the same dog that Bill bought is the one that the children liked). With respect to the use of the indefinite in (25), all a child would need to know in order to correctly use the indefinite is that *a dog that he likes* is not the same as any previously identified dog. The non-specific preceding context provides sufficient information for that inference, without the required extension to the possibility that the world contains no dog that Bill might really like. In other words, they can construe (25) as meaning that Bill's ideal dog has not been found and identified yet but that it does exist out there.

One additional step needs to be taken to strengthen the link between specificity and theory of mind, and it is to see if theory of mind has an impact on the number of specific interpretations that children make of the not-yet-found object in the subjunctive relative elicitation task. In order to do so, one is limited to considering the use of definite articles, given that indefinites are in principle ambiguous with respect to specificity. This is a reasonable approach considering the evidence from Maratsos that children understand when to use definite articles appropriately, under not only presupposition of existence but also identity of reference. The prediction is that the use of definite NPs (which is incorrect for the situations depicted in the subjunctive relative elicitation task) should decrease with development of a theory of mind. Table 3 reflects the data on use of the different types of NPs for each child, along with their performance on the theory of mind task.

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Table 3
Definiteness and Theory of Mind

Age	TMpass	Indef NP	Def NP	Indef Subj	Def Indic	Indef Indic	Def Subj	Other
3;5	0	2	5	0	0	0	0	1
3;6	1	1	3	3	0	0	0	1
3;7	1	2	5	0	0	0	0	0
3;7	2	2	6	0	0	0	0	0
3;7	1	2	5	1	0	0	0	0
3;7	2	0	0	1	0	2	5	0
4;0	0	2	5	0	0	0	0	1
4;0	0	6	2	0	0	0	0	0
4;1	0	3	3	0	0	2	0	1
4;3	2	3	0	4	0	0	0	1
4;3	2	5	2	0	0	0	0	1
4;5	2	1	0	0	1	6	0	0
4;5	2	3	0	3	0	0	0	2
5;1	2	4	2	2	0	0	0	0
5;7	2	3	2	1	0	0	0	2
5;7	2	3	0	5	0	0	0	0
5;7	1	4	3	0	1	0	0	0
5;9	2	7	0	1	0	0	0	0
5;10	0	2	6	0	0	0	0	0
6;1	2	2	0	6	0	0	0	0
6;5	2	3	2	2	1	0	0	0
6;11	2	5	0	3	0	0	0	0

The responses were classified in simple NPs, definite and indefinites, and NPs (also definite and indefinites) with relative clauses (indicative or subjunctive) and other responses. Only simple definite NPs and Definite + Indicative relatives were considered for the correlation. The Definite + Subjunctive relatives identified were excluded from the data on the basis that they are non-specific but still carry the existence presupposition. This exclusion is not significant, since one single child in this study is responsible for producing all the DS relatives elicited. A strong negative correlation was found between passing the theory of mind test and using a definite determiner (r=-0.636, p <0.05).

In sum, theory of mind is not only highly correlated to the ability to produce subjunctive relative clauses, but also negatively correlated to the use of definite NPs in this task. Both of these results suggest that the links between specificity, existence and DP acquisition deserve further exploration.

4.   Conclusion

What is the relationship between our cognitive complexity and our ability for language? In which ways does language make possible certain types of reasoning that are more complex than would otherwise be available? These have been considered to be some of the central questions about language (Jackendoff 1997).

The speculations in this paper suggest that theory of mind reasoning is an area with strong connections to the syntax of DPs. I have suggested also that definiteness and

specificity are not acquired simultaneously by children, and that full access to the semantics of specificity, like understanding of theory of mind, requires representation of actual and non-actual worlds in the mind. These assumptions provide an explanation of the unusual responses given by children in a study of elicited production of Spanish subjunctive relative clauses.

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