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Locality and C-Command: The Acquisition of Principle A in Brazilian Portuguese

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This paper investigates the acquisition of Principle A of Binding Theory in Brazilian Portuguese (BP). The main goal is to determine whether children show knowledge of both restrictions imposed by this principle, namely the fact that the antecedent for the anaphor must be local and that it must c-command the anaphor. Since c-command is a general notion, involved in many operations and principles, the prediction is that children will correctly obey it and pass the test from early on. Locality, however, is not a uniform notion. Besides local anaphors, found in English and BP, languages such as Norwegian and Dutch display 'medium distance anaphors', and Japanese and Icelandic have 'long distance anaphors' (Koster & Reuland, 1991, among others). This means that the locality domain for anaphors varies from language to language and exposure to the data is necessary for complete acquisition. Thus, the prediction is that the younger children might not show complete acquisition of locality. Fifty-one children acquiring BP as their native language were interviewed. The results indicate that our hypothesis is on the right track. In section 1, I discuss the main characteristics of BP anaphor *se* 'himself/herself', arguing that its distribution is constrained by Principle A of Binding Theory (Chomsky, 1981). In section 2, I discuss the results of a previous study indicating that children know that *se* is a reflexive form in BP. In section 3, I discuss cross-linguistic differences with respect to locality and the lack of variability in the case of c-command. Section 4 presents the results of the acquisition study and discusses the problems we faced when testing the children and the solutions we came up with in order to appropriately test children on this matter. Section 5 is the conclusion.

1. Principle A and BP anaphor *se*

The distribution of anaphor *se* is regulated by Principle A of Binding Theory (Chomsky, 1981), stated below:

(1) Principle A:
An anaphor must be bound in its governing category.

Principle A requires the anaphor to be bound (c-commanded and co-indexed) by an antecedent present in its governing category. For our purposes, we will consider that the governing category for the BP anaphor *se* is its clause.[1] That is, the anaphor must have an antecedent in its clause. In what follows, I will refer to an antecedent present in the same clause as a local antecedent. An antecedent in a different clause will be referred to as a non-local antecedent.

We can divide Principle A into two parts: the requirement that the anaphor have a c-commanding antecedent and that this antecedent be local (that is, it must be in the same domain as the anaphor). Observe the sentences below:

(2) a. O João$_i$ se$_i$ admira.
The John SELF admires
'John admires himself.'

b. [A mãe d[a Maria]$_k$]$_i$ se$_{*k/i}$ admira
The mother of [the Mary] SELF admires
'Mary's mother admires herself.'

c. [$_{CP}$ A Joana$_k$ disse [$_{CP}$ que a Maria$_i$ se$_{*k/i}$ admira]]
The Joana said that the Maria SELF admires
'Joana said that Maria admires herself.'

In (2a), the anaphor *se* is c-commanded by and co-indexed with the antecedent *o João*, which is in the same clause, being local. In (2b), the antecedent for *se* can only be the DP *a mãe da Maria* 'Mary's mother', since the other DP present in the sentence, *a Maria*, does not c-command the anaphor. Observe that here, no locality issues arise: both *a Maria* and *a mãe da Maria* are in the same local domain (i.e., the same clause). The distinction lies in the c-command relation. In (2c), although *a Joana* c-commands the anaphor, it does not qualify as a proper antecedent, since it is not in the same governing category as the anaphor; that is, it is not a local antecedent. Only *a Maria* locally binds the anaphor in this case; it is therefore the only possible antecedent.

In order to investigate children's knowledge of *se*, it is thus necessary to investigate whether children know (i) that *se* is a reflexive, (ii) that it must be locally bound and (iii) that it must have a c-commanding antecedent. If children correctly reject sentences such as (2b), with *Maria* as the antecedent and (2c), with *Joana* as the antecedent for the anaphor, we will have clear indication that children obey principle A of Binding Theory.

Children's knowledge on Principle A has been investigated for English. In Wexler & Chien (1985), in a task where children had to pick the picture matching a sentence, sentences with complex DP subjects were tested (*Cinderela's sister is touching herself*) and in this case it was possible to check what antecedent

(*Cinderela* or *Cinderela's sister*) children assigned to the anaphor. The younger children had a low percentage of correct responses. Wexler and Chien have speculated that children's difficulty with reflexive *himself/herself* is related to its morphological complexity. McDaniel, Cairns & Hsu (1990) report that in their study some children in fact produce forms such as *his self*, indicating that they are analyzing this form as 'possessive + self'. McDaniel et al. suggest that children go through a stage where (p. 132):

> 'Reflexives are not recognized as a separate category of NP. In this grammar, *himself* is treated like a *possessive + self*. Therefore, Binding Principle A will not apply, and there is no reason to reject *himself* in subject position on structural grounds. The child might do so, however, on semantic grounds if it would be odd to state that 'his body' was performing a particular action.'

McDaniel et al. detect another stage of development where children do categorize reflexives as NPs, being subject to Principle A, but they can still consider the domain for the reflexive to be the incorrect one (thus allowing the reflexive to be bound by the non-local c-commanding DP). Another study which investigated the requirements imposed by Principle A was Zukowski, McKeown & Larsen (2008). Children acquiring English (5;0 and older) were interviewed in a grammaticality judgment task and correctly showed knowledge of both requirements. The children tested were older, and adult-like performance was obtained.

In general in these studies, children younger than 5;0 do not show complete mastery of both requirements of Principle A, but this is probably due to the morphological complexity of the anaphor in the language studied. In the case of BP *se* this difficulty does not arise, since the anaphor is morphologically simplex, with no person or number agreement. In fact the only three possible simplex reflexives in BP are: (a) *me* (1st person singular), (b) *nos* (1st person plural) and (c) *se* (2nd and 3rd person singular and plural).[2] Due to this fact, the present study can be relevant in bringing data from younger children bearing on this issue without the morphological complexities found in English. It could be possible then to get evidence of children's knowledge from an earlier age.

2. *Se* is a reflexive form

In order to investigate children's knowledge of Principle A, the first issue that needs to be assured is that children know that *se* is a reflexive form. There seems to be abundant evidence in the input about it. In Grolla (in press), 18 children acquiring BP, between 4;0 and 4;11 were interviewed in the "Simon-says game" (modeled after Chien & Wexler (1990) – experiment 1). The materials used in the experiment contained sentences with *se* and children had to act out whatever the puppet ordered.[3] An example of the condition is shown below (X is to be

understood as the name of the child being tested. If the child was a boy, the puppet was a male donkey named Billy. If the child was a girl, the puppet was a female dog named Pinky):

(3) {O Billy/a Pinky} mandou X **se** coçar.
Billy/Pinky ordered X se scratch
'Billy/Pinky ordered X to scratch himself/herself.'

The verbs used were: *coçar* 'scratch', *beliscar* 'pinch', *cheirar* 'smell' and *abanar* 'fan'. The results show that children correctly performed the action on themselves 79,2% of the time. In 20,8% of the time, children gave the incorrect response, performing the action in the puppet. These results differ from what is found for English. In Chien & Wexler's (1990) study (using the same methodology), 4-year-olds gave the correct response only 57,5% (versus 79% in PB) and the incorrect one 41,5% (versus 21% in PB). For BP at least, we can conclude that 4;0-year-old children show knowledge that *se* is a reflexive form.

3. On the variable notion of locality and the invariability of c-command

Across languages, it is widely attested that anaphors can take antecedents in different domains. In what follows, I illustrate how different languages can be on this aspect. In Icelandic, for example, the anaphor *sig* can be long distance bound. In the example below, it is shown that when *sig* is in the embedded clause, it can take an antecedent in the matrix clause if the embedded clause is subjunctive:

(4) Jón_k segir að Maria_i elski $\text{sig}_{i/k}$.
Jon says that Maria loves(subjunctive) Refl

The same happens if the embedded clause is infinitive (5) or if the anaphor is inside a DP (6) (data from Manzini & Wexler, 1987, p. 417):

(5) Maria_k skipaði Haraldi_i að PRO raka $\text{sig}_{i/k}$.
Maria ordered Harald to shave Refl

(6) Jón_k heyrði lysingu Mariu_i af $\text{sér}_{i/k}$.
Jon heard description Maria(gen) of Refl
Jon heard Maria's description of Refl

The only restriction concerns embedded clauses in the indicative. In this case, the anaphor must take an antecedent in the same clause. This is illustrated below:

(7) Jón$_k$ segir að Maria$_i$ elskar sig$_{i/*k}$.
Jon says that Maria loves Refl

Another language where long distance anaphors are found is Japanese. In this language, the anaphor *zibun* can have its antecedent not only in contexts similar to those found for Icelandic *sig*, but also in cases where the embedded clause is indicative (data from Manzini & Wexler, 1987, p. 419):

(8) John-wa$_k$ [Bill-ga$_i$ zibun-o$_{i/k}$ nikunde iru] to omotte iru.
John Bill Refl hates that thinks
John thinks that Bill hates Refl

(9) John-wa$_k$ [Bill-ga$_i$ zibun-no$_{i/k}$ syasin-o mihatte iru] to omotte iru.
John Bill Refl pictures is watching that thinks
John thinks that Bill is watching pictures of Refl

These cross-linguistic data shows us that it is not the case that anaphors behave uniformly with respect to locality. There can be two anaphors in the same language with different binding domains. In Danish, for example, the anaphor *sig* can be both long and short distance bound and the anaphor *sig selv* can only be bound locally (see Jakubowicz, 1994). In Korean, *casin* is a long distance anaphor and *caki-casin* is the anaphor which can only be locally bound (see Cole and Sung, 1994, among others). This cross-linguistic variability with respect to locality (or different binding domains) makes it clear that exposure to the data is crucial for complete acquisition to occur. Children must figure out for each anaphor in their language, what is its correct binding domain.

On the other hand, nothing has to be checked with respect to c-command: being a universal notion, it constrains anaphor binding universally. Children do not need to rely on their experience in order to know it. There is independent evidence that children respect the c-command relation in different kinds of structures. Lidz & Musolino (2002, 2003), for example, bring evidence from experimental studies which investigated young children's interpretations of ambiguous sentences containing quantified NPs and negation. Their results suggest that children acquiring English and Kannada compute scope relations on the basis of the abstract relation of c-command from an early age.

4. Acquisition data from Brazilian Portuguese

As discussed above, although locality is a variable notion, c-command isn't. It is a fixed structural relation that does not vary from language to language. Besides its uniformity, it is quite general, used in many principles and operations. Therefore,

we could conjecture that it is wired in and does not need to be learned. On the other hand, the binding domain for anaphors is a different matter: it does vary from language to language, requiring exposure to the data in order to be acquired.

Thus, given these general and uniform properties of c-command, when testing on this requirement with respect to Principle A, we predict that children will correctly obey it and pass the test from early on. On the other hand, we predict that children will not show complete knowledge of binding domain early on. Since some learning is required, it is possible that they will not have the binding domain completely figured out at 4;0 years of age.

4.1 Subjects

We interviewed 51 monolingual children, from 3;0-6;4 years of age. They attended a day care center in São Paulo. 10 adults, native speakers of BP, were also tested.

4.2 Method

In order to test our predictions, we conducted two tests: one targeting c-command and another targeting locality. The method was a truth-value judgment task, where children judged the sentences uttered by a puppet after short stories were acted out in front of them.[4] The child was interviewed in a separate room, where there were only the child and two experimenters. Firstly, the child was presented to the puppet. The experimenters then explained to the child that the puppet was easily distracted. The child's job was to help the puppet pay attention to the stories. After each story was told, the puppet should say something that happened. The child should check whether he had paid attention by informing him if what he said was right or wrong. Then, in order to be sure that the child understood the task, a training session was undertaken, in which the child heard short stories and the puppet said what he thought had happened. Children then gave him feedback. When the experimenters felt the child had completely understood the task, a pretest was applied. The child had to provide 4 correct answers (out of 6) in order to be included in the study.

After each test sentence there was a filler sentence, with stories that did not involve *se* or reflexive actions. The child had to judge the puppet's sentences in these filler cases as well.

4.3 Material

There were four conditions. The first one was *local antecedent*, where the anaphor had an antecedent in its binding domain and the sentence was true in the context of the story. In the *non-local antecedent* condition, the antecedent for the anaphor was

in the matrix clause, while the anaphor was in the embedded clause. This non-local relation is impossible for BP *se*. The sentence was therefore false. On the *c-command* condition, the antecedent for the anaphor was local and c-commanded the anaphor. The test sentence was true. And finally, on the *non-c-command* condition, the antecedent depicted in the story was local (being in the same clause) but it did not c-command the anaphor. The test sentence was therefore false. There were 3 trials for each condition, totalizing 12 sentences tested (the sentences used in the experiment are listed in the Appendix). Examples of trials for each condition are listed below:

(10) a. Local Antecedent:
A vovó$_i$ pediu pro pônei$_k$ se$_k$ pentear.
The Grandma asked to pony self to comb
'Grandma asked pony to comb himself.'

b. Non-local antecedent:
* A fada$_i$ pediu pro dinossauro$_k$ se$_i$ cheirar.
The fairy asked to dinosaur self to smell
'The fairy asked the dinosaur to smell herself.'

c. Antecedent c-commands *se*:
[O amigo d[a passarinha]$_i$]$_k$ se$_k$ mordeu.
[The friend of [the bird]] self bit
'The bird's friend bit himself.'

d. Antecedent doesn't c-command *se*:
*[O menino que estava brincando com [o Batman]$_i$]$_k$ se$_i$ limpou.
The boy that was playing with [Batman]] self cleaned
'The boy that was playing with Batman cleaned himself.'

The indexing shown in the sentences corresponds to the reading provided in the stories acted out for children. The story leading up to sentence (10a), for example, has Grandma asking the pony to comb himself. The anaphor has a local binder and the sentence is true with this background. In the case of (10b), the story has the fairy asking the dinosaur to smell the fairy. The sentence uttered by the puppet is false, because *se* cannot take the non-local *fairy* as its antecedent. In (10c), the friend of the bird bit himself, which makes the sentence true in the context. And finally, in the story leading up to (10d), it is Batman who cleaned himself, not the boy. Therefore, the sentence is false. There were three items with a non-c-commanding antecedent. Two of them had a complex possessive DP as the subject (*O amigo do Buzz se machucou* '[Buzz's$_i$ friend]$_k$ hurt himself$_i$') and only (10d) had a relative clause inside the subject DP. We included this structure in order to

check if this would bring some difficulty to the task. We ended up finding no difference between children's performance in this item in comparison to the other two.

4.4 Results and discussion

The results are summarized in the tables below.

Table 1: Results for 3 year-olds (N = 7)

	True	False
Local	85%	15%
N-local	47,30%	52,70%
C-com	89,50%	10,50%
N-c-com	40%	60%

Table 2: Results for 4 year-olds (N = 13)

	True	False
Local	76,20%	23,80%
N-local	33,30%	66,70%
C-com	89,50%	10,50%
N-c-com	24,10%	75,90%

Table 3: Results for 5 year-olds (N = 19)

	True	False
Local	94,90%	5,10%
N-local	29,60%	70,40%
C-com	97%	3%
N-c-com	14,50%	85,50%

Table 4: Results for 6 year-olds (N = 12)

	True	False
Local	100%	0
N-local	6,30%	93,70%
C-com	100%	0
N-c-com	0	100%

The shaded cells indicate the correct responses. In order to evaluate children's behavior, we considered that a rate of 85% of correct responses indicates mastery of the restriction. Observing the *local* and *c-command* conditions first, we can see that children behave in an adult-like manner. Even for 3 year-olds, the rates of correct responses are 85% (for the *local* condition) and 89,5% (for the *c-command* condition). However, when we observe the *non-local* and *non-c-command* conditions, the results are not the same. 3 year-olds have only 52,7% of correct responses for the *non-local* condition and 60% of correct responses for the *non-c-command* condition. Performance improves a little for 4-year-olds, who have 66,7% and 75,9% for the *non-local* condition and the *non-c-command* condition respectively. 5-year-olds have 70,4% and 85,5% for the *non-local* and the *non-c-command* condition respectively. It is only for 6-year-olds that we have adult-like performance, with rates of correct responses above 90% for each condition.

A relevant fact to observe is that children do better on the conditions where the correct response is "yes".[5] That is, it is easier for them to respond affirmatively than negatively. This is a well-known fact, observed in general. Analyzing the table for the two more problematic conditions, we see that children fare better on the *non-c-command* condition than on the *non-local* condition. That is, children are more prone to correctly reject a sentence violating the c-command condition than the local condition. As mentioned above, this could be due to the fact that children have nothing to learn about c-command (because it is already wired in), while they are still checking what is the locality domain for the anaphor *se* in BP.

An important issue to be considered is that all the sentences tested for the *non-local* condition had the main verb *pedir* 'ask' followed by an infinitive clause. One could argue that this structure could have been problematic for children, since they might be having problems with control structures rather than locality. This point has been investigated by Chien & Wexler (1990). They tested both finite and infinitive sentences in an act out task (their experiments 1 and 2). The sentences tested were like the following (where Kitty is the puppet ordering and Sarah is the child being tested):

(11) a. Kitty says that Sarah should point to herself.

b. Kitty wants Sarah to point to herself.

They found that the results with *want*-sentences basically replicated what they had found with *say*-sentences, with children showing better performance with infinitive sentences. In their words (p. 245): 'We found that the knowledge that the reflexive must have a local antecedent was revealed at a slightly earlier age with these *want*-reflexive sentences than the *say*-reflexive sentences, which involved tensed complements.' Therefore I will consider that having infinitive sentences might be worrisome, but could not be the only factor responsible for children's non-adult behavior.

We did consider using test sentences with the embedded clause in the indicative, as shown below:

(12) O João disse que a Maria se cheirou.
The John said that the Maria self smelled
'John said Maria smelled herself.'

Without an infinitive clause, the control problem vanishes and it should be easier to test the locality restriction. This type of sentence was not tested due to the nature of the experiment. Usually, in truth-value judgment tasks, children watch short stories and then a puppet says what he thinks happened. In this kind of set up, it is hard to have a character in the story saying that someone did something. For example, for the sentence in (12), we would need to have John saying '*Mary smelled herself*'. The problem here is that the reflexive is used in the story and this might bias children to a certain kind of response.

In seeking for a better verb, we tried testing sentences with *achar* 'think', as the example below:

(13) O João acha que a Maria se lavou.
The João thinks that the Maria self washed
'João thinks Maria washed herself.'

The problem here is to act out the verb *think*. We had the relevant character saying that he thought something had happened, but 3- and 4-year-old children seem not to understand this psychological verb. Besides this problem, there is also the difficulty mentioned above for the verb *say*, given that we would have to use the anaphor in the story. These are the reasons why the verb *pedir* 'ask' was used instead.

Concluding, the BP data on the *non-local* condition brings some interesting results, despite the fact that the truth-value judgment task might make it difficult to test the relevant verbs. Nonetheless, the results in general are revealing: 5- and 6-

year-old children acquiring BP do show knowledge of both restrictions of Principle A, while 3- and 4-year-olds are still in the process of acquiring them.

5. Concluding remarks

The results of the test carried out with children acquiring BP indicate that 5- and 6-year-olds already show knowledge of the two requirements of principle A. On the other hand, 3- and 4-year-olds do not show complete knowledge of this principle, when we consider its requirements separately. C-command is mastered before locality, something observed for other languages as well. Once these children already know that the form *se* is reflexive, we cannot attribute the relatively low rates of correct responses to a lack of lexical knowledge. It could only be the difficulty associated with detecting the local domain for anaphors the reason for such a delay.

Notes

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[1] Defining precisely the binding domain for an anaphor is not a trivial matter. In general, it is assumed that the minimal domain is its governing category, which must contain: the anaphor and a subject (or SUBJECT) accessible. For an introduction, see Haegeman (1994). For discussion and modifications on this definition, cf., Aoun (1986), Brody (1985) and Manzini (1983). For the different cross-linguistic differences on the governing categories, see Burzio (1991), Hermon (1992) and Manzini & Wexler (1987).

[2] There is a second form for 1st person plural: *a gente*. This form is semantically 1st person plural, but the verb agreeing with it carries 3rd person singular inflection. In this case, the corresponding anaphoric form is *se* as well.

[3] Besides the condition with the anaphor, the test included sentences with the emphatic proform *ele mesmo* (him-self) and with the non-emphatic proform *ele* (him). Examples of these conditions are shown below:

(i) ELE MESMO: {O Billy/a Pinky} mandou X cheirar **ele mesmo/ela mesma**.
Billy/Pinky ordered X smell him-self/her-self
'Billy/Pinky ordered X to smell herself/himself.'

(ii) ELE: {O Billy/a Pinky} mandou X beliscar **ele/ela**.
Billy/Pinky ordered X pinch him/her.
'Billy/Pinky ordered X to pinch her/him.'

Children had great difficulty with the complex form "ele mesmo". They had only 65% of correct responses. This is considered low, compared to 80% of correct responses for the 'se' condition mentioned in the text.

As for the 'ele' condition, it should be noted that BP does not use 3rd person clitics in oral registers. The form used is a strong proform, which I argue is not a pronoun subject to principle B (see Grolla, in press, for details). In BP, it is perfectly possible to have 'ele' with a local binder, as shown below:

(iii) A Maria$_i$ fez a lista de convidados, mas pro$_i$ não incluiu ela$_i$.
The Maria did the list of guest, but not included her
'Maria did the guest-list, but didn't include herself.'

So, for condition "ele", it was possible to have either the local DP (the child) or the non-local DP (the puppet) as the antecedent. Adults chose the local DP (themselves) in 40% of the trials and children made this choice in 55% of the trials. In this case, there is no right or wrong answer. Since both options are acceptable in adult BP, this condition had only the purpose of checking children's preferences; that is, to check whether they matched the adults' preferences. In this case, it seems that they do match. What at first glance looks like a guess pattern, is analyzed instead as an indication that children are aware of the possibilities in the language. We concluded that 4-year-olds show knowledge of *ele*; more specifically, they know that this form can be locally bound in BP.

[4] Extra care was taken when telling the stories to children, in order not to use pronouns or anaphors. We made use of the fact that BP displays null objects: when a character asked another to smell or comb himself, the sentence had a null element in the object position. For example, for a test sentence like "Gradma asked the pony to comb himself" (see (10a) in the text), the story was like the following:

(i) Gradma was walking around the neighborhood when she met the pony, who was playing with his friends. The pony had his hair all messy because of the play. Grandma told him that he did not look nice: "Pony, you are all messy! Go comb now!"

[5] One reviewer comments "while the two conditions are not fully acquired, one would expect that children's behavior is optional in the matching and in the non-matching conditions. That is, there is no a priori reason for one to obtain better performances with the local condition than with the non-local condition." I agree with the reviewer and I attribute the better performance with the grammatical items to a "yes bias". That is, it could be the case that children fare better with the grammatical cases due to their tendency to say "yes" when in doubt. Given that for the grammatical items this is the correct response, we get a better performance for them. That is the reason why children's responses to the ungrammatical cases (where the correct response is "no") were taken into consideration as more reliable data. If a child says "no", s/he is going against her tendency to say "yes" and this should be a better indication of her stage in development.

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Appendix
Sentences used in the experiment

a. Local condition

A vovó pediu pro pônei se pentear.
The grandma asked to pony self to comb
'Grandma asked pony to comb himself.'

O Pato Donald pediu pra Kelly se coçar.
The duck Donald asked to Kelly self to scratch
‘Donald the Duck asked Kelly to scratch herself.’

A Dora pediu pra Lily se cobrir.
The Dora asked to Lily self to cover
‘Dora asked Lily to cover herself.’

b. Non-local condition

A fada pediu pro dinossauro se cheirar.
The fairy asked to dinosaur self smell
‘The fairy asked the dinosaur to smell herself.’

O tigre pediu pro Woody se lavar.
The tiger asked to Woody self to wash
‘The tiger asked Woody to wash himself.’

O Júlio pediu pra Polly se limpar.
The Julio asked to Polly self to clean
‘Julio asked Polly to clean himself.’

c. C-command condition

A amiga da Sininho se penteou.
The friend of-the Tinker Bell self combed
‘Tinker Bell’s friend combed herself.’

O amigo do Buzz se machucou.
The friend of-the Buzz self hurt
‘Buzz’s friend hurt himself.’

O amigo da passarinha se mordeu.
The friend of-the bird self bit
‘The bird’s friend bit himself.’

d. Non-c-command condition:

O menino que tava brincando com o Batman se limpou.
The boy that was playing with the Batman self cleaned
‘The boy that was playing with Batman cleaned himself.’

A amiga do Dino se coçou.
The friend of-the Dino self scratched
‘The Dino’s friend scratched himself.’

A namorada do Fred se molhou.
The girlfriend of-the Fred self wet
‘Fred’s girlfriend wet himself.’