

Bare infinitives and external arguments

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It has been notoriously difficult to assemble evidence for the existence of NP movement in general and in particular for the correctness of a transformational rather than a lexical analysis of the passive. In this paper we show that a lexical analysis of the passive, combined with a simple account of the assignment of theta roles to external arguments, yields an interesting solution to what has been an intractable problem for transformational analyses; namely, the unexpected ungrammaticality, in northern European languages like English, German, and French, of the passives of perception and causative verbs that take small clause complements headed by bare infinitive verbs. This account can be extended in a straightforward way to explain why such passive constructions are grammatical in other western European languages, in particular, the southern Romance languages.

In English, German and French a sentence like (1), with the structure indicated, lacks the expected passive in (2):

- (1) John saw [_S Mary eat the pizza].
(2) *Mary_i was seen [t_i eat the pizza].

Under a transformational analysis, failure of this passive is extremely surprising since the small clause subject in (1) is assigned case by the matrix verb and since the passive verb 'was seen' is available in other contexts. Sentence (2) should be derivable from the structure in (3) below just as (4) is derived from the structure in (5).¹

(3) e was seen [Mary eat the pizza].

(4) Mary_i is believed [_S t_i to have eaten the pizza].

(5) e believed [Mary to have eaten the pizza].

Since under a movement analysis the passive verb and the active verb are identical in their subcategorization requirements, there is nothing ill-formed about the structure in (3) and NP movement should apply to it in the standard way. This problem has, of course, been discussed in the literature at various times (Roeper and Vergnaud 1980, Higginbotham 1982, Williams 1983, Coopmans 1985); but no generally accepted solution to the problem has emerged (see Santorini and Heycock 1987 for discussion of several proposals that have appeared in the literature).

Williams 1983 attributes the ungrammaticality of bare infinitive passives as in (2) to the fact that they violate a surface filter that rules out participle-infinitive sequences; but Williams' filter is empirically inadequate for English since it incorrectly rules out participle-infinitive sequences that arise as a result of A' binding. Also, the filter does not extend to French and German, yet bare infinitive passives are ungrammatical in these languages just as they are in English. Roeper and Vergnaud 1980 propose an analysis according to which bare infinitives need to be case-marked just like NP's. Under their analysis, the ungrammaticality of (2) reduces to a case filter violation since the passive participle is unable to assign case to the infinitive. Unfortunately, Roeper and Vergnaud give no reason why the passive participle should not assign case to the infinitive just as the active verb does. After all, in general when verbs take more than one argument, only one of these arguments fails to receive case in the passive. In the passive of English double object verbs, for instance, the goal argument does not receive case from the passive verb, while the theme argument does. In a parallel way, a passive perception or causative verb should continue to assign case to the infinitive in spite of not assigning case to the complement subject.

Higginbotham 1982 proposes a semantic explanation for the ungrammaticality of bare infinitive passives. According to his analysis, the interpretation of perception verb complements requires that an existential quantifier over events take scope over the verb of perception. This semantic structure is reflected in the syntax

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by the raising of perception verb complements at LF, which results in structures like (6):

(6) a. [Mary eat the pizza]_i [John saw t_i]

b. [t_i eat the pizza]_i [Mary_j was seen t_i]

Higginbotham attributes the ungrammaticality of (2) to the fact that the trace of the complement subject, 't_i' in (6b), is not bound at LF.

As noted above, passives of perception verbs with 'to' infinitive complements, like (7) below, are grammatical:

(7) Mary was seen to sing.

To accommodate such sentences, Higginbotham claims that since the complement clause is 'supported' by infinitival 'to', it need not be raised at LF, but will instead remain embedded. His analysis thus predicts differences in interpretation between active perception verbs with bare infinitive complements and passives like (7). In particular, he notes that passive sentences like (7) should have only an 'epistemic interpretation' (p.28). In this respect sentences like (7) are similar to those with tensed complements, and contrast with sentences with bare infinitive complements. The correctness of this prediction is illustrated by the contrast between the self-contradictory sentences (8a) and (8b) on the one hand, and the semantically coherent (8c) on the other:

(8) a. Many people saw that he was writing Japanese, but they all thought he was just doodling.

b. He was seen to write Japanese, but everyone who saw him thought he was just doodling.

c. Many people saw him write Japanese, but they all thought he was just doodling.

This contrast is entirely consistent with Higginbotham's analysis, since it can be derived from the fact that only in (8c) does the existential quantifier over events take scope over the matrix verb.

Passives like (7) pose something of a problem for Higginbotham's analysis in other respects, however. In Section 2 of his paper, he discusses the contrast between the valid argument in (9a) and the invalid argument in (9b).

- (9) a. John saw someone leave. Hence, someone left.
 b. John saw no one leave. Hence, no one left.

He notes that in general arguments of the form 'X saw Q do Y. Hence Q did Y' are valid just in case 'Q' is a restricted quantifier that is monotone increasing, and he shows that this result too follows directly from his analysis of the bare infinitive complement as a generalized quantifier with scope over the matrix verb.

Higginbotham fails to observe, however, that exactly the same pattern of inference holds for passives like (7). Compare, for example, the valid arguments in (10a) and (10b), which contain the monotone increasing quantifiers 'someone' and 'everyone', with the invalid arguments in (10c) and (10d):

- (10) a. Someone was seen to leave. Hence, someone left.
 b. Everyone was seen to leave. Hence, everyone left.
 c. No one was seen to leave. Hence, no one left.
 d. Exactly one woman was seen to leave. Hence, exactly one woman left.

This parallelism shows that the pattern of inferences illustrated in (9) cannot be considered independent evidence for Higginbotham's analysis of bare infinitives. This point is further strengthened by the behavior of '-ing' complements to perception verbs. Higginbotham does not discuss these at any length, but indicates that they are not to be considered unsupported clauses (p.3). Under his analysis, this is consistent with the grammaticality of passivization in this construction. But these complements too pattern like the bare infinitive complements with respect to the types of inference under discussion: (11a) and (11b) are valid arguments, in contrast to (11c) and (11d).

- (11) a. John saw someone leaving. Hence, someone was leaving.
 b. John saw everyone leaving. Hence, everyone was leaving.
 c. John saw no one leaving. Hence, no one was leaving.
 d. John saw exactly one woman leaving. Hence, exactly one woman was leaving.

The exact parallelism demonstrates again that this phenomenon cannot be used to support the particular distinction Higginbotham wants to make between bare infinitive and supported clauses.

Finally, the most serious problem with Higginbotham's analysis is that it cannot be extended to explain the contrast between the northern European and the southern Romance languages with respect to bare infinitive passives. In order to account for their grammaticality in the latter group of languages, Higginbotham would have to

assume, as we do below, that apparently bare infinitives in these languages behave syntactically like 'to' infinitives. But this immediately raises difficulties for his analysis with regard to the interpretation of the infinitival complements. In Italian, for instance, passives of perception verbs are epistemically neutral. That is, neither of the sentences in (12) is self-contradictory:

- (12) a. Molti hanno sentito Gianni cantare, ma tutti pensano sempre che si stia lamentando.
 many have heard Gianni sing, but all think always that refl is groaning
 'Many people have heard Gianni sing, but all of them always think that he is groaning.'
 b. Gianni è stato sentito cantare da molti, ma tutti pensano sempre che si stia lamentando.
 Gianni has been heard sing by many, but all think always that refl is groaning
 'Gianni has been heard singing by many, but all of them always think that he is groaning.'

This shows that Higginbotham's analysis cannot be extended to Italian, since the structure he would have to assign to passives like (12b) would preclude the epistemically neutral interpretation.

If we treat the passive as a lexical process that alters the subcategorization requirements and thematic role assigning properties of the verb to which it applies, we can distinguish the ungrammatical (2) from the grammatical raising passive (4) since, in the former case, the passive verb would subcategorize for a bare infinitive while in the latter it subcategorizes for a 'to' infinitive. We assume, uncontroversially, that the bare infinitive phrase is a VP; and, following the proposals on phrase structure in Lasnik and Saito 1984 (see also Chomsky 1986), we assign the 'to' infinitive phrase to the category I(nfl)P(hrase), where 'to' realizes INFL, the head of IP, and INFL takes VP as its complement. Given these structures, the theta criterion entails that (2) and (4) should be grammatical only if the external theta roles of their infinitive verbs could somehow be assigned to matrix subject position. If we can show that such indirect assignment of the external theta role of the infinitive is possible in (4) but not in (2), we will have succeeded in differentiating between the two cases. If we can further show why the distinction between (4) and (2) does not extend to those languages in which the equivalent of (2) is grammatical, we will have provided significant empirical support for our analysis. To these tasks, we now turn.

Let us suppose, as is often done, that the passive is a lexical rule under which the non-oblique internal theta role of a verb becomes its external theta role while the original external theta role becomes a syntactically optional ('implicit' in the terminology of Roeper 1983, 1987) internal argument. Then an ordinary passive sentence like (13) becomes syntactically equivalent to a simple intransitive like (14); that is, it has a single argument which is external at both deep and surface structure:

(13) John was killed.

(14) John has died.

Under such lexicalist assumptions, it is easy to see why a sentence like (2) would be ungrammatical. Since the subject of the complement small clause receives no theta role from the matrix verb, there is no internal theta role for the passive rule to externalize. Hence, the subject of the passive sentence receives no theta role and the sentence is ungrammatical. In particular, the theta role that the subject of the small clause receives in the active sentence by virtue of its being the structural subject of the embedded verb cannot be assigned to the passive matrix subject because it is no longer associated syntactically with the embedded constituent.

One might argue that the assignment of the external theta role of the embedded verb should be passed up to the matrix subject position by some process of theta role composition (see, for example, Taraldsen 1987). After all, such non-local assignment of external argument theta roles seems to occur in sentences with modals, like (15) below, where the external theta role of the infinitive apparently composes with the external theta role of the modal, this composed theta role then being assigned to the subject by the modal in the standard way.²

(15) John can swim a mile without resting.

The need for composition of external theta roles is particularly clear in a language like German, in which modals taking bare infinitive complements, presumably VP's as in English, can iterate. Thus, in a German sentence like (16) the external theta role of the verb 'schwimmen' must first be composed with that of 'können' and then this combined role must be composed with that of 'müssen':

(16) Um Rettungsschwimmer zu werden, muß man sehr gut schwimmen können.

'In order to become a lifeguard, one must be able to swim very well.'

This sort of theta role composition, however, could not apply in a case like (2)

because the matrix verb, being the passive of a verb that assigns no theta role to the passivized NP, has no external theta role to compose with the role passed up from the complement verb. Theta role composition is apparently possible only when both verbs involved have external theta roles to assign. That this constraint holds is indicated by the contrast in grammaticality between the sentences in (17) and (18) below:

(17) Der Rettungsschwimmer soll gut schwimmen müssen.

'The lifeguard is said to have to swim well.'

(18) *Der Rettungsschwimmer muß gut schwimmen sollen.

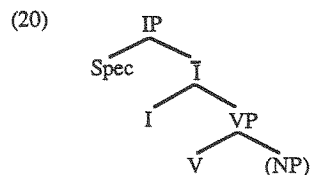
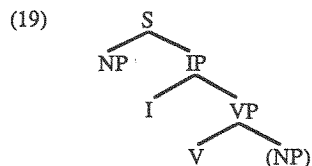
'The lifeguard must be said to swim well.'

In (17) the embedded modal 'müssen' is a root modal with an external theta role to assign. This theta role can, therefore, compose with the theta role to be assigned by 'schwimmen' and the result will be passed up to the inflected modal 'sollen'. As we will see, the inflected verb, because it is immediately dominated by INFL (compare the passive participle, which does not have this property), need not participate in theta role composition. Hence, epistemic modals, which have no external theta role to assign, can appear as the highest verb in a sentence. In (18), by contrast, an epistemic modal appears in an embedded position, which leads to ungrammaticality, as theta role composition is blocked and the external theta role of the main verb 'schwimmen' does not get assigned.³

Having explained the ungrammaticality of (2) in a direct way, we seem to be faced with the exact converse of the problem facing a transformational analysis; namely, accounting for the grammaticality of (4). Just as it seems that what is easy to capture in a lexical analysis is hard to state in a transformational analysis, so it appears that what is easy for the transformational analysis will be hard for the lexical treatment. There is, however, a natural solution to the problem that the lexical analysis faces, once we pay serious attention to the nature of external theta role assignment. We will discover that the grammaticality of passives like (4) can be maintained if we take external theta role assignment to occur in two steps. First, the verb (via its phrasal projection, VP) assigns its external theta role to the AGR element in INFL; and then, by the sort of predication that occurs in copular sentences and relative clauses (Chomsky 1977), AGR is coindexed with the subject (Chomsky 1981). This coindexing, rather than government, is responsible for the nominative case that appears on overt subjects in tensed sentences, so that subjects, like predicate nominals, receive case by agreement with a coindexed element rather than through government by a case assigner.

There are several reasons for thinking of external theta role assignment in this

way. First of all, it allows us maintain that theta role assignment is always to sisters, since in configurations like Lasnik and Saito's (19) or Chomsky 1986's (20) INFL but not the subject NP is a sister of VP, which presumably assigns the external theta role:



Secondly, it captures the intuition (see also Fukui and Speas 1986) that the position of overt subjects in languages like the ones under consideration is a non-argument position. In particular, and in contrast to the treatment in Fukui and Speas 1986, it captures this intuition without requiring that case be assigned to such a non-argument subject under government rather than by coindexing, which is the way other non-arguments get case. Thirdly, our treatment explains why an epistemic modal can appear in a sentence like (17) even though it does not participate in theta role composition. Since the epistemic modal is the highest verb in the sentence (and so is dominated by INFL), the external theta role of its complement verb need not be composed with any theta role that the modal bears but rather can be assigned directly to the AGR element of the modal's inflectional affix.

Having defined external theta role assignment as assignment of the theta role to AGR plus coindexing of AGR with an A' subject, we can now see why passives are possible when the infinitival complement is a 'to' infinitive. In such a case the complement to the passive verb is an IP projection of an INFL that is lexically realized as 'to'. While it is ordinarily said that 'to' contains no agreement or tense features, we will say that the features AGR and TNS are realized on 'to' but that their values are unspecified. They receive their values by coindexing with a c-commanding INFL. The coindexing of the TNS feature yields the temporal reference of the infinitive clause, which is normally given by the tense of the matrix

clause; and the coindexing of the AGR feature yields the reference of the subject, which is given by the matrix clause AGR. Once we allow the infinitive marker 'to' to bear the AGR feature, we guarantee that the VP complement of 'to' will have a locus onto which to discharge its external theta role; namely, the AGR feature. Hence, the fact that theta role composition with the passive verb is not possible for the embedded VP will not rule the sentence out by blocking the external theta role assignment of the embedded VP. Furthermore, the overt subject of the matrix passive verb will receive its proper theta role (the external theta role of the embedded VP) via coindexing. The AGR and TNS features of the embedded IP must be coindexed with their matrix counterparts, or, being unbound, they will be uninterpretable. But once the infinitive AGR is so coindexed, the theta role assigned to it will characterize the entire chain of which it is the foot.

Coindexation with a c-commanding INFL is not the only way that an unspecified AGR feature can receive its value. This is clear from the existence of active sentences like (21).

(21) John believes [Mary to like pizza].

In such sentences, the unspecified AGR feature on 'to' receives its value by being coindexed with the complement subject rather than with a c-commanding INFL. Furthermore, in contrast to the passive sentences just discussed, coindexing the AGR feature on 'to' with that of the matrix verb must be ruled out in active sentences. This is shown by the ungrammaticality of sentences like (22).

(22) *John believes [pizza_i to like t_j]
intended reading: 'John believes himself to like pizza'

Given our discussion to this point, (22) might be expected to be grammatical since the AGR feature on 'to' would receive a value via coindexing and the external theta role of 'like' could be assigned to it, satisfying the theta criterion. The ungrammaticality of (22) shows that the value of AGR must be determined locally. In particular, we will say that AGR must be bound within the domain of the NP that minimally c-commands it. In contrast to (21), the satisfaction of this condition in (22) leads to a theta-criterion violation since the chain headed by 'pizza' would be associated with two theta roles: with the internal theta role of 'like' by virtue of the binding relation between 'pizza' and its trace, and with the external theta role of 'like' by virtue of the coindexing relation between 'pizza' and AGR. It is worth pointing out that the requirement that we impose on AGR is nearly equivalent to the requirement in standard transformational analyses that lexical anaphors and NP-trace be bound in the domain of a subject. Thus, the fact that the coindexing

domain for AGR is the matrix clause in the raising passive in (4) but the complement clause in the active sentence in (21) has a parallel in the facts in (23) and (24), and the contrast between (21) and (22) is analogous to the one between (24) and (25).

- (23) John_i likes [that picture of himself_i].
 (24) Mary likes [John's_i picture of himself_i].
 (25) *John_i likes [Mary's picture of himself_i].

The only difference between our requirement and the one standardly imposed is that, for us, topicalized NP's in cases like (22) create binding domains just as subjects do. Since we are treating the position of lexical subject as an A' position, this extension is both natural and unavoidable. As far as we can tell, it leads to no undesirable consequences.

It might at first glance seem attractive to employ the concept of co-indexed AGR features in the analysis of control structures, using the co-indexation of the complement AGR with the matrix AGR to establish the controller of PRO, but the existence of object control verbs shows that this would be the wrong approach. We are assuming, in fact, the standard GB analysis of constructions involving PRO, although we consider that it may be preferable to consider PRO as a value of AGR, since there seems no reason to suppose that there should be a structural subject position in infinitive complements. If sentences like (26) are assigned a structure with PRO in the complement, their ungrammaticality is explained by the illegal occurrence of PRO in a governed position.

- (26) *John believes to be a genius.

If, instead, sentences like (26) are assigned a structure identical to the one we are proposing for raising verbs, the theta criterion will be violated, since the matrix subject will receive two theta roles – one from the matrix verb, and one from the complement verb, via the chain of co-indexation described above. This demonstrates that our account retains the capacity to distinguish syntactically among raising, control, and exceptional case-marking constructions.

Under the analysis we have given, the grammaticality of passives of perception verbs with 'to' infinitive complements is entirely unsurprising, as we will analyze sentences like those in (27) just as we have sentence (4):

- (27) a. John was seen to leave.
 b. Mary was heard to sneeze.
 c. Jane was made to confess.

It is clear that these cases are not related to their bare infinitive active counterparts by any syntactic rule because not all verbs that take bare infinitive complements have a corresponding passive with a 'to' infinitive. Thus, compare the sentences in (27) with those in (28):

- (28) a. *John was let to shout.
 b. *Mary was watched to swim.
 c. ?The ground was felt to give way.

Hence, the examples in (27) must be treated simply as independent lexical items, passives without a synchronic active source.⁴

There is one important fact that may appear to threaten our analysis; namely, that fact that the subject of a raising passive can be an expletive or an idiom chunk, as illustrated in (29) and (30) below:

- (29) There is believed to be a problem with this solution.
 (30) Tabs are believed to have been kept on Jane Fonda.

As has been known since the earliest work in generative grammar, these sentences show that the matrix subject of a raising passive must be associated syntactically, and not just semantically, with the lower clause since it is the structure and lexical content of the lower clause that requires and licenses the occurrence of the expletive or idiom chunk. Indeed, raising passives are syntactically identical in their behavior to morphologically simple raising verbs like 'seem' or raising adjectives like 'be likely' so that our claim that raising passives are lexical forces us to abandon the movement analysis of all raising predicates, at least within a grammatical notation in which basic syntactic structures are generated by a context-free grammar.⁵ Losing the movement analysis, however, does not have the serious consequences for the treatment of cases like (29) and (30) that it might appear to have. The coindexation algorithm we have given properly relates the matrix subject to the lower clause and the licensing of the expletive can be stated as a condition on the binding of the AGR element in the complement infinitive. Just such a treatment would be necessary in any case for simple sentences like (31) and (32) below:

- (31) There is a fly in the soup.

(32) Close tabs were kept on the election.

Under our treatment, even in these examples the relationship between the expletive or idiomatic subject and the verb of the sentence will have to be mediated by AGR. This suggests that AGR behaves with respect to binding just as NP trace does in a standard GB analysis; that is, it is not a bound variable but merely a syntactic place holder.

The extension of our analysis to the southern Romance languages is direct. In these languages (Italian, Spanish, and Portuguese⁶) the subjects of perception verb complements passivize freely, as illustrated in the following examples:

- (33) a. (Io) ho visto Gianni mangiare una mela. (Italian)
 b. Gianni è stato visto mangiare una mela.
 (34) a. (Yo) vi a Juan comer una manzana. (Spanish)
 b. Juan fue visto comer una manzana.
 (35) a. (Eu) vi João comer uma maçã. (Portuguese)
 b. João foi visto comer uma maçã.

If our analysis of the English case is correct, then the facts in (33) - (35) must mean that AGR is present in what are apparently bare infinitive complements; and, in fact, there is evidence in these languages to show that AGR is present in apparently bare infinitive constructions. This evidence is particularly strong for Portuguese, which optionally allows person inflection on infinitives, including the infinitive complements to perception verbs, as illustrated in (36) and (37) below:

- (36) Eu vi os cavalos correrem.
 'I saw the horses run+3rd pl.'
 (37) Para eles ganharem muito, devem trabalhar muito.
 'In order for them to make+3rd pl. a lot, (they) have to work a lot.'

When the Portuguese infinitive is inflected, it takes a nominative case lexical subject, showing that the AGR element licenses nominative case assignment for infinitives in just the same way that it does for tensed verbs (Chomsky 1981, Perini 1977). The simplest way of treating person inflection in general is to say that the inflection fixes the value of the AGR feature in INFL. If we want this treatment to apply to Portuguese, we must say that the Portuguese bare infinitive incorporates the AGR feature, either through raising of the infinitive into the INFL position or through some process by which INFL is morphologically rather than syntactically associated with matrix verbs in all clauses. Then, when the person inflection is added to the infinitive, the AGR feature will be specified in the standard way. In

any case, such a treatment of the inflected infinitive implies that the apparent bare infinitive complements of perception verbs in Portuguese actually include an AGR element, as our analysis requires.

Further evidence that apparently bare infinitives actually include some representation of INFL, here general to the southern Romance languages, appears in sentences like the following:

- (38) a. It is necessary PRO *(to) speak with Mary.
 b. Il est nécessaire *(de) PRO parler avec Marie.
 c. Es ist nötig, PRO mit Maria *(zu) sprechen.
 (39) a. Era necesario *(di) PRO parlare con Maria. (It.)
 b. Era preciso *(de) PRO hablar con Maria. (Sp.)
 c. Era preciso *(de) PRO falar com Maria. (Port.)

The sentences of (38), from the northern European languages English, French, and German, all contain overt morphological marks to indicate that the clausal complement to the adjective is a full S' and not a bare infinitive. In English and German, the mark is the INFL element 'to'/'zu' while in French it is the complementizer 'de'. In all of these cases, removal of the mark leads to ungrammaticality, an expected result since the resulting bare infinitive small clause would not block the illicit government of PRO by the matrix adjective. In the sentences of (39), which are from the southern European languages, the complementizer 'de'/'di' cannot occur, although it does introduce other infinitive clauses. Why this should be, we cannot, at present, say; but the fact that no complementizer is needed shows that seeming bare infinitives are not small clauses in these languages. Since the interpretation of the sentences of (39) is identical to that of the sentences in (38), the infinitival complement clauses in the former must contain PRO just as those in the latter do; and since PRO must be ungoverned, the embedded infinitives in (39) must be full S' complements. Since S' complements are always full clauses with INFL, the apparent bare infinitives in (39) must contain it.

NOTES

1. The apparently suppletive 'to' infinitive that gives a variant of (2) that is grammatical is actually a 'believe'-type passive. Cf. *infra*.
2. As we will see below, no passing of theta roles is actually necessary to account for sentences like (15), at least in English; and this fact will be important in

allowing us to account for the distribution of epistemic modals.

3. Apparently epistemic readings of embedded modals are not completely ruled out, as illustrated in (i):

- (i) ?Um die Stelle zu bekommen, mußt du nicht unbedingt gut schwimmen können. Du mußt nur gut schwimmen sollen.
'To get the job, you don't necessarily have to be able to swim well. You only have to be said to swim well.'

The very marginal acceptability of such sentences is consistent with the analysis proposed in the text since modals in these contexts are interpreted in a quasi-root sense rather than as true sentential operators. In the example in (i), for instance, 'sollen' expresses the property of enjoying a certain reputation.

4. Historically, these passives all did have active sources; but the actives gradually fell out of use.

5. Within the Tree Adjoining Grammar formalism that we have using as our grammatical notation in a number of recent papers, the equivalent of a movement analysis remains compatible with the empirical analysis we are presenting here. Time and space prevent us from discussing this point now; but we intend to pursue it in other work.

6. Apparently Catalan also belongs to this group (Enric Vallduvi, personal communication).

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