MODULARITY IN COGNITION: THE CASE OF PHONETIC AND SEMANTIC INTERPRETATION OF EMPTY ELEMENTS ★

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ABSTRACT

In this paper, we offer an argu-
ment in favor of the modular character
of mind, based on a more detailed
proof of the modular character of
the linguistic capacity: in comparing
the properties of different components
of grammar in a specific area we
will draw general consequences about
the properties of the cognitive system.
More specifically, we analyze and com-
pare the properties, in logical form (LF)
and in phonology, of "empty elements"
- elements that are "visible" or "full"
at some level of representation, but
not at another level.

Our analysis shows that empty
elements are governed at LF by princi-
ples on variables, binding conditions,
and thematic principles, that relate
elements at a distance. In phonology,
on the other hand, empty elements, i.e.,
empty segments and empty properties,
can be obtained by deletion and are
governed by very different principles
(underspecification, principles relating to
recoverability of deletion effects), and
these principles relate elements under
strict adjacency. In addition, when
a principle seems to be operating in
a similar fashion in both components, as
in the case of the Projection Principle,
it involves lexical properties, which
are properties affecting all components.
We conclude, hence, that grammar
is a modular system, with different
components following different principles
but related of course, among other
things, by the properties of lexical
structure.

It follows from this analysis that
a theory that views language as part

of a homogeneous cognitive capacity
cannot be mantained: cognition cannot
be nonmodular in a strict sense, since
a subpart of it, the linguistic capacity
is modular itself. We conclude also
that the linguistic capacity being modu-
lar, we can only expect that, when
studied in more detail, other cognitive
capacities will be shown to differ in
their structure still more from the
language system.

INTRODUCTION

One of the outcomes of the work within framework of generative
grammar in the last thirty years is the modular character of the linguis-
tic capacity that characterizes the human species, and, more generally,
the modular character of mind. The type of argument that we will
develop here is language-internal: in comparing the properties of diffe-
rent components of grammar in a specific area we will draw general
consequences in the direction just mentioned. Specifically, we will analyze
and compare the properties of "empty elements" (or "empty categories")
in logical form (LF) and in phonology.

Empty elements are especially suites to fit the goals of the gene-
rative research program:

> "...there is an intrinsic fascination in the study of properties of
> empty elements. These properties can hardly be determined inducti-
> vely from observed overt phenomena, and therefore presumably
> reflect inner resources of the mind. If our goal is to discover
> the nature of the human language faculty, abstracting from the
> effects of experience. then these elements offer particularly valua-
> ble insights."(Chomsky, 1981, 55)

Departing somewhat from current practice, we will generalize
the notion "empty elements" from an element "that is 'visible' in PF
phonetic form , but 'full in LF logical form " (Bouchard, 1982, 2),[1]
to an element that is 'visible' or 'full' at some level of representation,
but has, at that same level no properties corresponding to another
level. Let's just see two examples for illustration.

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(1) a. [John] decided [e] to go.

      [Juan] decidió [e] ir.

  b. i) le hêtre [la [e]ɛtr]

      'the beech'

      les hêtres [le [e]ɛtr]

      (plural)

    ii) l'être [lɛtr]

      'the being'

      les êtres [lez ɛtr]

      (plural)

    iii) le maître [la mɛtr]

      'the master'

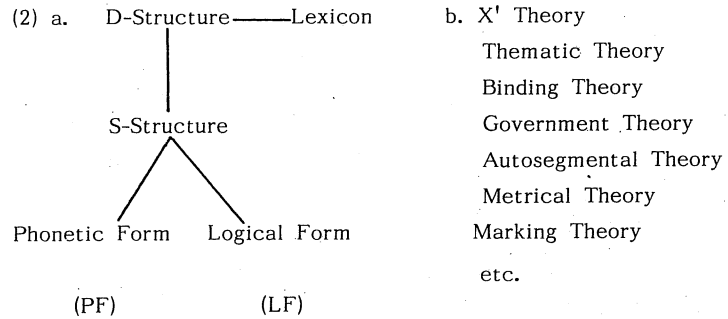   'el maestro'

      les maîtres [le mɛtr]

      (plural)

In (1a) the empty element e , in brackets, is necessary to deter-
mine, at the level of logical form, that the subject of the predicate
go is interpreted as John/Juan. e occupies the structural position
of subject and is related to John/Juan (controlled by John/Juan, to use
the technical term).

(1b) shows cases of French "h aspirée". Compare (i) and (ii). In
(ii) a vowel initial word determines the choice of the singular article 1
(we have vowel elision) and the plural article les (we get liaison);
in (iii) a consonant initial word prevents elision (we get la) and allows
consonant truncation (no liaison: le). If we turn now to (i), we see
that despite the fact that the word begins with a vowel, like in (ii),
it behaves exactly as if it were consonant initial, like in (iii): an empty
consonant e (the traditional "h aspirée") accounts for the lack of
elision and for the truncation in (i). (We used bold e to distinguish it
from the phonetic symbol e , as in le in our examples).

Let's proceed with some general outline of the theory of grammar
to make the following discussion more understandable.

Our framework with is Government and Binding theory and the parallel phonological theories which are consistent with it. Within this framework universal grammar is conceived of as a parameterized system. It contains a set of fundamental principles that *"sharply restrict the class of attainable grammars and narrowly constrain their form"*. (Chomsky, 1981, 4). The acquistion of the grammar of particular language consist of fixing the values of these parameters on the basis of experience.

Universal grammar consist of a related system of levels of representation, shown in (2a). The properties of these levels and their relationship to each other is determined by a set of subsystems of principles; some of them are given in (2b):

(2) a. D-Structure———Lexicon   b. X' Theory
                                          Thematic Theory
                                          Binding Theory
         S-Structure   Government Theory
                                          Autosegmental Theory
                                          Metrical Theory
  Phonetic Form   Logical Form   Marking Theory
                                          etc.

       (PF)   (LF)

The lexicon specifies the inherent properties of lexical items ("words"). D-Structure and S-Structure are syntactic levels related by transformational rules having the general form "move α" (where α is a phrase category). D-structure is obtained by projection of lexical categories following X' principles. S-structure is mapped onto Phonetic Form (PF), on the one hand, and onto Logical Form (LF), on the other. The level of Phonetic Form is derived from S-structure by the rules of phonology, *"at this level, sentences are represented in phonetic form with constituency marked"*. (Chomsky, 1986, 156).

We should point out that the properties of LF are a matter of empirical fact, so that LF may not coincide with what is called logical form in the philosophical tradition. The term LF, as used in Generative Grammar, is a technical term. LF is a partial representation of the meaning of a sentence: the scope of quantifiers, the interpretation of

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certain pronouns as bound variables; that is to say: the "structural" meaning" of sentences. LF does not represent word meaning, it does not define the truth conditions of a sentence, nor does it establish the conditions on the appropiate use of sentences. Nevertheless, given the LF generated by sentence grammar, the interaction with other cognitive system can be established in order to give fuller representations of meaning. The same questions can be raised in phonology where (grammatical) phonetic interpretation is then subject to phonetic "low level" processes of a very different character that account for the physical properties.

As Chomsky puts it (1986, 157): *"we may assume that the levels of PF and LF are the 'interface' between formal structure and other components of the mind/brain which interact with the language in thought, interpretation and expression".*

Phonetic form and logical form are submitted to a general principle of natural language, the Principle of Full Interpretation. This principle *"requires that very element of PF and LF, taken to be the interface of syntax (in broad sense) with system of language use, must receive an appropriate interpretation -must be licensed. (...) At the level of PF each phonetic element must be licensed by some physical interpretation".* (Chomsky, 1986,98). Similarly, LF doesn't permit, for instance, vacuous quantifiers: no element can be simply disregarded.

In the following two sections we will examine the linguistic properties of empty categories in semantic and in phonetic interpretation.In doing so, we will conclude that their licensing is governed by different formal principles. The obvious consequences of this modular character of different components of the grammar will be commented in the last section.

SEMANTIC INTERPRETATION

In this part, we will examine some aspects of the syntactic and semantic behavior of the empty category **pro** and strong pronouns. In so-called null-subject languages, the pronominal subject of a sentence (**he,** in English **he will speak**) is usually elliptical, i.e. not realized phonologically, as in (3b), which is usually represented with the empty category **pro**, as in (3b'). Its lexical correlate, the strong or overt pronouns (**ell** in (3a)) is also possible, but is different from the ordinary

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pronominal subject in languages like English. The empty category **pro**
allows for the phonetically not realized subject in so-called null-subject
languages, like Catalan, as opposed to English, for instance.

(3) a.　Ell parlarà
　　　　'He will speak'.

　b.　Parlarà　　=　　b' [pro] parlarà
　　　'He will speak'.

The possibilty of a null subject has to be related to a general
principle, the Projection Principle. One of its effects is that sentences
must have a subject. Consequently, if no lexical subject appears in
the sentence, then we must assume the existence of an empty pronomi-
nal subject. On the other hand, pronominal null subjects are possible
because of some properties of null-subjects languages (for instance, the
pronominal features of the Agreement node in Inflection, the functional
head of the sentence node).

We will concentrate on contexts in which strong pronouns alter-
nate with **pro** in the subject position of a tensed sentence, as in (3),
and also on contexts where a clitic-doubling structure, i.e. a structure
with both a strong pronoun and its corresponding accusative or dative
clitic, is possible. This is illustrated in (4), with accusative clitics.

(4) a.　La Maria el mira a ell.
　　　　'Mary sees him'

　b.　La Maria el mira [e]
　　　　'Mary sees him'.

Notice that the strong pronoun in (4a) is doubled by the clitic **el**.
Clitic-doubling structures are a polemic case of alternance between **pro**
and strong pronouns. Zubizarreta (1982), Otero (1986), and others assume
that the empty element in the argument position related to the identi-
fier clitic is **pro**. We won't enter into the controversy about the nature
of the empty element in (4b), because it doesn't specially affect our

analysis. In fact, what we are interested in is to get an answer to the following question: Is the presence of phonological content (**ell** in (3a)) the only difference between **pro** and strong pronouns? We will see that amomg pronominal the empty element **pro** and nonempty elements, namely clitic pronouns, act in a parallel way. In opposition to them, the also nonempty strong pronouns act differently in many cases. Hence there should be some lexical properties that distinguish them from both **pro** and clitics.

Consider now the cases exemplified in sentences (5), (6) and (7). All of them are constructions where strong pronouns are not allowed. In certain structural positions only **pro** and clitics (acting as so-called resumptive pronouns) can appear. Catalan, as other languages as well, can employ a productive alternative to the derivation by wh-movement: the resumptive pronoun strategy. This is the case of (5a) and (5c), where the element **pro** in (5a) and the clitic **li** in (5c), both related to the relative element, act at LF as a variable bound by the operator heading the relative clause. Strong pronouns like **ella**, as (5b) and (5d) show, cannot appear in this positions. Hence only **pro** and clitics may serve as a variable at LF.

(5) a. Aquesta és l'alumna [que no sabies [on era **pro**]]
   'This is the student [that (you) didn't know [where (she)
   was]]'

  b. *Aquesta és l'alumna [que no sabies [on era ella]]

  c. Aquesta és l'alumna [que diuen [que li han donat un
   premi]]
   'This is the student [that (they) say [that (they) have
   given her a prize]]'

  d. *Aquesta és l'alumna [que diuen [que li han donat un
   premi]]
   'This is the student [that (they) say [that (they) have
   have given her a prize]]'

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d. Aquesta és l'alumna [que diuen [que li han donat
un premi a ella]]

Let's see the second case. The structures in (6) show that only **pro**
and clitics may be associated to a topicalized constituent in Left Dislo-
cation constructions. In (6a) the clitic **li** is linked to the element in
Topic position. This linking allows the dislocated element to behave
with the sentence, in indirect object position. In (6c) a similar connec-
tion can be observed between the dislocated element and **pro**. However,
when the strong pronoun is present, the linking is not possible, as shown
by the fact that (6b) with **ella,** and (6d) with **ell** are not interpretable.

(6) a. $[[_{TOPIC}$ A la Maria $]_{,}[_S$ li han donat un premi]]
'To Mary, (they) her have given a prize'.

b. $[[_{TOPIC}$ A la Maria], $[_S$ li han donat un premi a
ella]]

c. $[[_{TOPIC}$ En Pere], $[_{TOPIC}$ de compliments], $[_S$ **pro** no
en fa]]
'Peter, compliments, (he) doesn't   pay.'

d. $[[_{TOPIC}$ En Pere], $[_{TOPIC}$ de compliments], $[_S$ ell no
en fa]]

Let's examine now the third case that shows the different beha-
vior between strong pronouns and empty or clitic pronouns. Only **pro**
and clitics may act as a variable bound by a quantified phrase (as
pointed out by Montalbetti (1984)):

(7) a.   Tothom sap que **pro** no viurà eternament.
'Everyone knows that (he) will not live forever'.

b.   Tothom sap que ell no viurà eternament.
'Everyone knows that he will not live forever'.

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Pro in (7a) can be free or bound. If it is bound by **tothom** 'every-one' its LF is (8), where **pro** doesn't receive an independent value.

(8)   (Every x, x: a person (x knows that x will not live
        forever))

The presence of the strong pronoun **ell** in (7b) makes the bound reading impossible. Catalan strong pronouns cannot act as variable. They cannot be bound indirectly through a **pro**, as in (9), where the reading of **ell** is always free[2].

(9)   Tothom diu que **pro** sap que ell no viurà eternament.
        'Everyone says that (he) knows that he will not live
        forever'.

How should we explain the behavior of **pro** and clitics in contrast with the behavior of strong pronouns? How can we account for the resistance of strong pronouns to act as a variable? The answer may lie in the nature of strong pronouns, in their quantifier-like character (Rigau, 1986). Actually, our suggestion is that their quantifier nature frees them from becoming bound variables.

In fact, traditional grammarians have insisted on the so-called emphatic character of strong pronouns in context such as (3) and (7), repeated here as (10).

(10) a.   Ell parlarà. / **pro** parlarà.
          'He will speak'.

     b.   La Maria el mira a ell. / La Maria el mira [e].
          'Mary sees him'.

In these contexts, strong pronouns act as a **distinctive** pronoun (in the sense of Ronat, 1979).[3] The pronoun **ell** in (10a) can thus be compared to the French pronoun **lui** in colloquial sentences like (11a), but not to the same pronoun **lui** in (11b), where **lui** acts as a topic pronoun. Furthermore, since French is not a null-subject language, the Catalan **pro** in (10a) is comparable to the French clitic **il** in (11c)[4].

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(11) a.   Il parlera lui.

   b.   Il parlera, lui.

   c.   Il parlera.

Let's assume that the strong pronouns in contexts as (10) act as quantifiers. For the moment, let's consider the first sentence in (10b). Here the strong pronoun can be compared to the French quantifier **tous** in (12).

(12)   Marie a tous voulu les revoir $[_{NP}e$]
         Mary has all wanted them see-again.

According to Kayne (1984, chapter 4), in (12) **tous** binds the argumental position represented by the empty NP after **revoir**. Thus the chain formed by the clitic **les** and the empty NP is interpretable as a variable bound by **tous**. Then, in (10b), the strong pronoun **ell** can also be taken to bind quantifier the empty position related to the clitic **el**, this position being in the scope of **ell**. The pronoun **ell** would be generated in a peripheral, non-argument postition, maybe a position adjoined to de S node, as examples in (13) seem to show. In (13) the verbal form **vam acostumar** selects a direct object (DO) and a prepositional phrase (PP) headed by the (nondative) preposition **a**, as in (13a), where the DO is **el nen** 'the boy' and the PP is **a això** 'to it'.

(13) a.   Vam acostumar el nen a això.
         '(We) got used the boy to it'

   b.   El vam acostumar a ell a això.
         '(We) him got used to him to it'

   c.   El vam acostumar a això a ell.
         '(We) him got used to it to him'

   d.   El vam acostumar a ell, a això.
         '(We) him got used to him, to it'

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d.   L'hi vam acostumar a ell, a això.
    '(We) him+**clitic** got used to him, to it'

In these sentences the syntactic position of the strong pronoun **ell** cannot be the position of the empty element related to the clitic: the DO position, as shown in (13b), determines an ill-formed sentence if pronounced with non-dislocation intonation. Hence **ell** cannot be in the empty object position related to the clitic as the contrast between (13b) and (13c) shows. When placed close to the verb, the pronoun **ell** displaces the PP **a això** out of the verbal phrase to a right Topic position, as made visible by the presence of the resumptive clitic **hi** in (13e). Other constructions, like sentences with postposed subjects, that we will not examine here, also show that the position of strong pronouns in clitic-doubling structures cannot be in the argument position.

Assuming that our analysis is right, the strong pronoun **ell** in (10b) is in a non-argument position, then it locally binds the empty position related to the clitic with which the strong pronoun is coindexed, as shown in (14).

(14) $[_{\bar{S}} \ [_S$ La Maria *el* mira $[\ e_i]$ a *ell*$_i$ $]$

It follows, then, that in (10a) the pronoun **ell** will not be in the subject position at D-structure, but in a peripheral position, as in (15).

(15) $[_{\bar{S}}$ Ell$_i$ $[_S$ **pro**$_i$ INFL parlarà $]$ $]$

The pronoun **ell** is coindexed with **pro** in subject position with which **ell** agrees in person, number and case. At LF the strong pronoun **ell** will locally bind **pro**, and consequently **pro** will be understood as a bound variable.

We take the distinctive character of strong pronouns in (10) as an indication of quantifierhood, and finally, we may consider that this quantifier property accounts in a straightforward way, with no further assumptions necessary, for the particular behavior of strong pronouns in (7) and (9), where the strong pronoun cannot be bound by a quanti-

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fied expression. Therefore, general principles of various subsystems of universal grammar (principles on variables, binding principles, thematic principles, etc.) determine the behavior of strong pronouns and empty pronouns in a null-subject language like Catalan.

PHONOLOGICAL INTERPRETATION

The phonological component interprets a syntactic S-structure yielding a surface phonological, or phonetic interpretation. Natural languages could possibly have no phonology, a possibility which is actually empirically false. If this were the case, the syntactic representation at S-structure would contain a string of lexical elements that would be identical to the phonetic string - let's say, simplifying matters considerably, the corresponding phonetic transcription. This is not the case for two reasons: first, there are a phonetic properties of lexical elements that are predictable, and not represented at lexical structure. Second, the phonetic representation is a function of two different elements: lexical phonological properties and syntactic S-structure properties (to give two examples, syntactic word order determines the contact between word-final and word-initial segments which is affected by phonological processes, and the different degrees of stress are dependent on constituent structure).

Phonological elements are furthermore sets of properties organized in a intricate way, which we will not discuss here. Empty elements can thus be either null elements in the string, like in the case (1bi) that we discussed at the begining, or null properties of an element of the string.

Let's consider a couple of examples, those in (16). Words are represented in standard ortography with the segments we are examining in transcription, enclosed in brackets. The English words **cane** and **gain** have to have their first consonant specified for voicing, the property which distinguished them lexically. (Voicing is implemented articulatorily mainly by vocal cord vibration). The same is true of the first consonant of the corresponding Spanish glosses **caña** and **ganas,** which are distinguished lexically by - among other things - the voicing properties of this first segment of the string. But the initial [k] in **cane**

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is aspirated; this property is not lexical, it can be predicted. In **scan**, under different phonological conditions, the [k] is not aspirated. Similary, in ¿qué ganas? the [g] is not a stop but a continuant [γ] (the airflow is not interrupted during the articulation as in the case of [g]). **Qué** has moved before S-structure from postverbal to preverbal position, which in this case implies postvocalic position also, thus creating the appropiate conditions for phonological rules to interpret the initial consonant as [γ].

(16)   [k^h]ane   [k]aña
          [g]ain   [g]anas

          s[k]an

                 ganas qué ───→ qué [γ]anas e

    Let's consider first a case of null elements corresponding to whole phonological segments. In Catalan in word final position, the clusters **nt, lt, mp, ŋk** are not possible, the cluster being simplified to its first element: **nt** becomes **n**, **lt** becomes **l**, etc. The lexical presence of the second element of the cluster is justified by alternations of the same morpheme in different environments.

(17)   ci[ŋe]   'five'   ci[ŋk]è   'fifth'

        a[l e]   'high'-masc.   a[lt]a   'high'-fem.

        fecu[n e]   'fertile'-masc. fecu[nd]a   'fertile'-fem.

        corro[m e] 's/he corrupts' corro[mp]ia   's/he corrupted'

    In (17), when the cluster is word-final (first column), the morpheme ends in [ŋ], [l], [n], [m] (e is the empty element left by deletion); when a suffix beginning in a vowel follows (second column), the cluster is mantained: we have [ŋk], [lt], etc. In classical analyses, a lexical form with the consonantal cluster is posited. A phonological rule of Cluster Simplification deletes the final consonant under the appropiate phonological conditions, e.g. word finally. In the cases in the second column of (17) the cluster is no longer word final and the phonological

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rule does not apply (Wheeler 1979, Mascaró 1978, among others).

Imagine that contrary our conclusions, we try to push the seman-
tic-phonological paralellism. Let's try to pose the question in a 'some-
what' "syntactic" fashion. What licenses, we might ask, the empty seg-
ment **e.** In the classical analysis it is the existence of a very specific
language particular rule, clearly an unsatisfactory answer, since it places
too high a burden of the language learner. In fact there is more than,
just language particular parametrical setting in the process: the clusters
nt, lt, mp, ŋk are homorganic, i.e. they share a phonological property
namely place of articulation. We can thus describe this "deletion" as
case of deletion under (partial) identity (or, rather non-distinctness);
in a sense, then the deleted element is partially recoverable. We can
have a very general rule, with few parametric options, say "Delete C",
at operation, and general conditions on representations licensing the
resulting structures. Consider the words **corromp** 's/he corrompts' and
circ 'circus' with deletion aplying freely:

(18)

a.   b.   c.   d.
·corro[m e]   corro[mp]   *ci[r e]   ci[rk]

e.   f.
[PLACE LABIAL]   [PLACE ALVEOLAR] [PLACE VELAR]
      /\ | |
    m   e   r   e
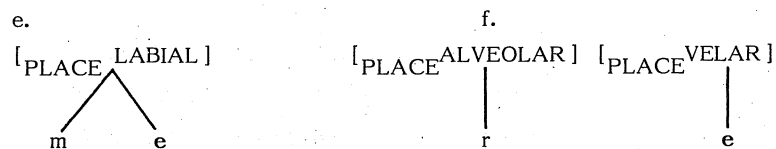
If the rule "Delete C" is optional all the structures in (18a-d)
will arise. Let's say that there are two reasons to license (18a). The
structure of (18a) is (18e), where the lower row represents timing units
of a phoneme, and the upper row represents properties assigned to
them (the relation of properties to timing units being indicated by
association lines). First, we assume some version of the so-called Pro-
jection Principle applying in phonology. The Projection Principle basica-
lly states that lexical properties are preserved at every stage of the

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derivation; this, in a certain sense ensures the right "recoverability of deletion" effects mentioned above. Second, we assume that, in some cases, the principle should be appropiately relaxed under positive evidence, in the sense, e.g., that timing units can be deleted but not their other segmental properties. Under these assumptions, the e in (18e) is licensed by the preceding (labial) [m] which shares place of articulation in the lexical property which should be preserved at all stages. In (18c), on the other hand, [r] cannot license its e, since its place properties are different from the ones of the lexical [k]: the Projection Principle is violated. In (18f), if only the timing unit is deleted, leaving e, then the velar place property, not being associated to any timing unit, is not interpreted, in violation of Full Interpretation.

Even if the analysis should be right, the situation is still very different from the situation in syntax and logical form. We do not have empty elements in situ, which are then licensed by general principles. Imagine we would posite them. **Cinc** 'five', would have the lexical structure in (19a).

(19)   a. ci[ŋ e]   b. ti[ŋ e]   'I have'
           c. ci[ŋ e] è   d. ti[ŋ e] em 'We have'
           f. ci[ŋk]è   g. ti[ŋg]em, ti[ŋk]em 'We have'-
                                            subjunctive.

Now consider the form in (19b). The last consonant is the same as the last consonant in (19a), [ŋ]. When a suffix follows, and hence no "deletion" takes place, we would expect the same result in both cases. Any single one of them is not problematic; (19c) for istance could be analyzed by some kind of insertion mechanism: the empty element e would be interpreted phonetically as a unit of timing having the properties of its controller, namely velar place of articulation, and the more "neutral" or unmarked, in the technical sense, consonantal properties. This would correctly give ci[ŋk]è as the phonetically interpreted form. But in (19b) we also would predict [k], hence ti[ŋk]em, the wrong form, instead of the correct ti[ŋg]em . Clearly enough, there is a lexical voicing contrast between the second element of the cluster in these two cases, and many parallel ones could be adduced. This

entails that in the lexical representation no completely empty element can be mantained, and a deletion analysis is unavoidable.

We will consider now a case of an empty element that corresponds, not to a whole phonological segment, but to a phonological property. We discuss briefly, with Catalan examples, the phenomenon usually called Final Devoicing, attested in many languages (Dutch, Russian, German, Turkish, etc.). This phenomenon affects all obstruent consonants; here we will illustrate it with an example involving the consonant **s**. The verbal roots of the Catalan verbs **tossir** and **cosir** end in a voiceless **s** and in voiced **z** consonant, respectively, as the contrast in (20a) shows; the same happens in (20b) with the nominals **grassos** and **gasos.**

(20) a.   tu[s] o   cu[z] o
          'I cough'   'I sew'

     b.   gras[s] os   ga[z] os
          'fat'-pl.   'gas'-pl.

When no suffix like **-o** or **-os** appears after the root, the consonant is word final and, if voiced, devoices, i.e. [z] becomes [s].This is the case in the 3rd sg. and the masc. sg., respectively, of the examples in (20), which appear in (21):

(21) a.   tu[s]   cu[s]

     b.   gra[s]   ga[s]

Any phonological segment can be viewed as a set of properties. [z] is a consonant, it is obstruent, it is noncontinuant , it is alveolar, it is voiced, etc. Since we are concentrating here on one of these properties, namely voicing, we will represent these consonants with the voicing property, a feature with two values [$_{\text{VOICE}}$ +], and [$_{\text{VOICE}}$ -], and we will represent the rest of the properties, including the timing unit, by "S". So the set {S, [$_{\text{VOICE}}$ +]} is represented as in (22), with the two elements linked by a vertical association line. Given the fact that there is a voicing contrast in
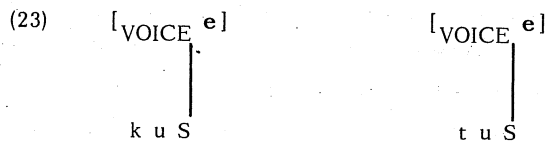
the examples in (20), the last consonant of **cus** and of **tus** will be represented, lexically, as in (22).

(22) $[_{VOICE} +]$ $[_{VOICE} +]$
        | |
        k u S   t u S
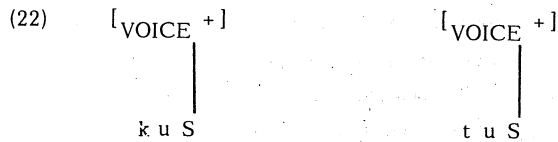
Final Devoicing, according to recent analyses (Mascaró, 1985), consists of the loss of voicing property, which becomes empty. (23) is derived from (22) by this process.

(23) $[_{VOICE} e]$ $[_{VOICE} e]$
        | |
        k u S   t u S

Again, representations like those in (23) must be given a (phonetic) full interpretation. According to marking theory (or more recent variants like underspecification theory) empty, i.e. unmarked or unspecified elements are given by "default" the unmarked value, which in the case of obstruents and voicing in minus ($[_{VOICE} -]$). In other words, since obstruents are voiceless in the unmarked case, marking theory interprets (23) in the form shown in (21a), their actual phonetic form.

This second example of empty phonological element is a case of licensing not by a local related element which is adjacent, like in the first phonological example, but a case of licensing by simultaneous properties.

Notice that the particular conditions of linking are quite different from those that apply in semantic interpretation. If in phonology the situation were parallel to the one we encounter in syntax, then situations of long distance linking would be expected (like in our previous examples of semantic interpretation). Neither movement nor long distance licensing is a possible phonological situation. To see that, let's image two of those (according to our theory) impossible languages. We will

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call them Penglish and Senglish, for English with an aberrant phonological rule, and English with an aberrant semantic rule, respectively. Empirically, neither of them is a possible language, according to the by now considerable information we have about the nature of semantic and phonological processes. Penglish is just like English, but it has a phonological rule with a typically semantic format: it moves final consonants to the front of any word beginning by a vowel.

(24) **English**: Ask him any question about us at ten.

Penglish: Mask hi nany questio sabout tu na te.

The phonetically interpreted sentence in (24) is not only unattested in any English dialect, but would be considered linguistically inimaginable by any experienced phonologist.

Senglish, shown in (25), is just the same as English, but it has a semantic rule with a phonological format, that deletes a variable immediately before the modal element **must.**

(25) **English**: Everyone must know that he is mortal.

LF: (Every x, x: a person (x must know x is mortal))

Senglish: Everyone must know that he is mortal.

LF: (Every x, x: a person (e must know x is mortal))

The deletion rule of Senglish applying at LF under tipically phonological conditions, would entail that presence of the modal auxiliar verb **must** determines that the formal variable left by quantifier **everyone** is deleted, and then given an arbitrary interpretation, the equivalent of the interpretation of the "real English" sentence **It is know that everyone is mortal.** If the modal auxiliary verb were not present, no deletion would apply and hence the interpretation of the Senglish sentence would be the same as the "real English" one: **Everyone knows that he is mortal.** Again we do not know of anyone getting the Senglish

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interpretations, nor is it imaginable to sound linguists, we think, that a natural language could show that situation.

Notice also that there is an explanation for the fact that there seem to be nonetheless parallelism between the form of phonetic and semantic interpretation rules. In both cases lexical structure is involved, and is to be expected that the same lexical structure and principles affect phonetic and semantic interpretation.

CONCLUSION

It seems that very different principles are at stake in the semantic and in the phonetic interpretation of S-structures. In the preeceding discussion, we have tried to look for parallel situations: on the one hand, the case of empty elements in phonology, that might be comparable to the more familiar syntactic and semantic empty categories; on the other hand, a quantifier-variable structure that does not involve movement at logical form, movement rules being bizarre in phonology. Even in such cases, where parallelisms might be expected, it appears that the principles governing them (such as the ones shown in (2b)) are of a very different nature. In our case, we have seen deletion operating in phonetic interpretation and not at logical form, long distance relations at logical form, not for phonetic form. On the other hand, when a principle seems to be operating in a similar fashion in both components, as might be the case for the Projection Principle, we see that it involves lexical properties, which affect all components. We conclude hence, that grammar is a modular system, with different components following different principles, but related of course, among other things, by the properties of lexical structure.

It follows that a theory that views language as a part a homogeneous cognitive capacity is difficult to mantain: cognition cannot be nonmodular in a strict sense, since a subpart of it, the linguistic capacity, is modular itself[5].

The proponents of a nonmodular approach to cognition might still entertain the idea that modularity is a matter of degree, a adopt a "mild" nonmodular approach, holding that cognitive capacities follow the same general principles, with very minor properties or local princi-

ples being particular to some of them. Since the modularity we have found in language (and which could be supported with many other cases that we haven't presented here) is already considerable, the "mild" nonmodularists would not be able to expand it much further, if the term "nonmodular" is to keep some content at all. Hence, they should come to the curious conclusion that the principles of some other cognitive capacity, let's say visual interpretation, are identical to the principles of semantic interpretation, and different from the principles of phonetic interpretation, or conversely. Certainly, a surprising result.

The right conclusion, we think, is that the linguistic capacity is modular, and that we can only expect that, when studied in more detail, other cognitive capacities will be shown to differ in their structure still more from the language system.

NOTES

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[1] It should say rather "phonological form". Phonological rules deriving phonetic form may delete whole short lexical elements which are then invisible phonetically, but quite different from syntactic empty categories.
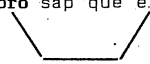
[2] A sentence like (9) is ambiguous, depending on the possible linkings between the nominals:

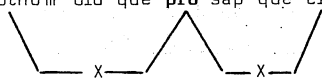(i) Tothom diu que **pro** sap que ell no viurà eternament.

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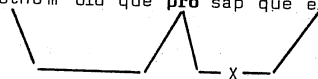
(ii) Tothom diu que **pro** sap que ell no viurà eternament.

(iii) Tothom diu que **pro** sap que ell no viurà eternament.

In (i) the fact that the quantifier **tothom** is linked to **pro** makes the link between **pro** and the strong pronoun **ell** impossible. When the quantifier is not linked to **pro, pro** and **ell** can be linked, as in (ii). Finally, the reading with no link, i.e. when the reference of the three nominals is disjunct, as in (iii), is also possible.

[3] According to Ronat (1979, 121), a sentence like *"elle viendra avec Marie n'implique pas que quelqu'un d'autre ne viendra pas, mais plutôt que quelqu'un d'autre fera autre chose, qui a un lien avec "elle" supposé établi par le discourse précédent. Ainsi le contraste pure peut se simboliser sous la forme P(x)—→ -P(-x). La formule du "distincfif" serait P(x)—→P'(y), où {x,y}, c'est-à-dire: une proposition concernant X implique une autre proposition concernant Y, à condition que X et Y soient compris comme appartenant à une même ensemble (constitué par exemple, par un prédicat commun)".*

[4] (11a) and (11b) are phonetically distinct. In **Il parlera lui** the sentence has the ordinary intonation, like in **Il parlera ici** 'he will speak here', whereas in **Il parlera, lui** there is an intonational break before **lui,** with a rising intonation at the end of **parlera.**

[5] For a more detailed discussion on the modularity of mind, see Fodor (1983) and references cited there.

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