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From Cognition to Thematic Roles: The Projection Principle as an Acquisition Mechanism

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I. Introduction

     One virtue of core grammar is that it offers a concrete
version of language acquisition. It is concrete because there is
a direct link between specific data and the choice of a particular
grammar. It works like this: a finite number (perhaps small) of
grammars exists in the child's mind. Particular sentences trigger
the choice of parameters which--in one fell swoop--choose the
essence of a grammar.
     The analysis of "triggers" does not, as a rule, proceed
beyond those crucial sentences. In principle, the triggers could
be aspects of context, cognitive dispositions, neurological
events, or interesting combinations of these. Linguistic theory
is silent about the internal structure of acquisition triggers.
For instance, it is silent about how they might be embedded in a
larger theory of cognition.
     A cognitively construable language could be any symbolic
information that could be manipulated by any rule that any mental
faculty could devise. Therefore the set of possible cognitive
languages is much larger than the set of actual human languages.
Cognitively construable languages often result in possible
computer programs, but not in instantly understood vehicles for
human communication. That is, a language which, for example,
exhibited violations of the coordinate structure constraint would
be in principle understandable using problem solving ability. It
is a cognitively possible language, but not naturally occurring
language. Specifically, we will argue that there is no
straightforward mapping from linguistic constraints given by
Universal Grammar to general cognitive constraints, whatever they
may be. Linguistic theory (and the innate ability of the child)

selects in a subtle fashion among our cognitive powers. We shall try to provide specific examples of how that selection could work.

Thematic relations refer to notions which, of necessity, must be present in how we comprehend action in the world: agent, theme, location, goal. They are a natural point at which to seek a link between cognition and grammar. In Chomsky's terms, thematic relations have an "extra-linguistic dimension." Is the relation between cognitive roles and thematic roles simply one of inclusion? We shall argue that the connection between cognition and grammar is far more intricate. For instance, the notions of agent in the examples cook, cooker, (as in a good cooker of spaghetti) and the cooking of food by the French are all quite different. This leads to the view that thematic relations do not select a subset of cognitive relations, but rather duplicate a subset of cognitive relations. In other words, cognitive relations are realized as thematic relations in the syntax through a variety of mechanisms, and the mapping between cognitive relations and thematic relations is not one-to-one. These two kinds of relations co-exist and both affect definitions in the lexicon. Formal properties are needed (by adult and child) to know whether a given agent is cognitive or thematic. We will clarify these ideas as we proceed.

The goals of this essay are (1) explore the notion of implicit thematic roles, (2) define their role in the lexicon, and (3) show how a child relates cognitive and thematic information. Nominalizations and control phenomenon provide the crucial data.

2.0 The Projection Principle and Acquisition

The acquisition problem, classically, has had two dimensions (a) determination of primary linguistic data (PLD) and (b) the selection of a grammar consistent with that data. Each of the two dimensions is important because they can have interactive effects. The selection of a grammar is complicated whenever the analysis of PLD is not straightforward. If the PLD is ambiguous, then the set of mappings between data and possible grammars increases (geometrically). Therefore, a full explanation of language acquisition hinges upon how PLD is determined.

One very natural goal is to provide a way whereby a child can fix the meanings of words as a means to fixing the parameters of syntax. If words could not be independently triggered, then the acquisition process would be unbelievably complex. Every decision would depend on every other decision. The goal of a realistic acquisition device must surely be to avoid this degree of contingency. Some decisions must be based on limited, highly available data. Chomsky (1981) offers a means to do this: the projection principle (hereafter PrP).

The PrP states that every stage of a syntactic derivation must be consistent with the thematic relations specified by the lexicon for individual items. An informal version of the PrP is (Chomsky 1981:29):

1) Representations at each syntactic level (i.e. LF, D-, and S- structure) are projected from the lexicon, in that they observe the subcategorization properties of lexical items.

linguistic constraints which lends substance to the claim that language is innately specified. Therefore it constitutes more than just the interaction of cognitive abilities.

3.0 **The** Projection Principle and the Lexicon

Linguistic theory has no principle which predicts the following contrast:

  3) a. the ship sinks
      b. the ship was sunk

In (3b) there is an <u>implicit</u> <u>agent</u> in what has been called the agentless passive. In (3a) no agent is implied although knowledge of the world dictates that a cause must exist. The same contrast holds for other, clearly lexical, constructions:

  4) a. compound: boat-sinking
      b.   -able: the boat is sinkable

The meaning of (4a,b) can only be that someone or something can sink the boat, not that it might sink by itself. We cannot derive the meaning of these structures from the meaning of <u>sink</u> because <u>sink</u> has both a transitive and an intransitive form. Nor is context decisive since we have given no context for these utterances. The clear intuitive generalization is that compound, -able, and passive all derive from the <u>transitive</u> form of <u>sink</u>. The transitive form contains both an AGENT and a THEME. The thematic structure remains unaltered by lexical rules. We can extend the PrP to the lexicon to account for these facts:

  5) <u>Lexical Projection Principle</u>[2]
      The thematic roles linked to lexical entries are maintained throughout lexical derivations.

The lexical PrP directly predicts the possibility of agents in all of the constructions above:[3]

  6) a. the ship was sunk by the navy
      b. ship-sinking by the navy
      c. the ship is sinkable by the navy

These facts stand in contrast to the impossiblity of:

  7) *the ship sinks by the navy

Principle (5) accounts naturally for the evidence in (6). It does not address the fact that thematic relations can be present but <u>implicit</u> in (1b) and (2). Implicit relations can be accounted for formally by associating a <u>thematic grid</u> with lexical entries (see Stowell (1981)):

  8) a. <u>Verb</u>
          [NP]   sell   [NP]([PP])([PP])
                    AGENT

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The PrP clearly reduces the problem of grammar-selection by reducing the possible transformations that can apply in the course of a derivation. Transformations that alter thematic relations (i.e. add or delete) are disallowed.

2.1 Guiding Acquisition via the PrP

It is clear that the PrP contributes to the solution of the classic acquisition problem: Fewer grammars are projected under the instantaneous model, where all the data is present at once. Chomsky adds that it will assist in the analysis of primary data as well:

We want the primitives to be concepts that can plausibly be assumed to provide a preliminary, pre-linguistic, analysis of a reasonable selection of the presented data, that is, to provide the primary linguistic data that are mapped by the language faculty onto a grammar... It would be reasonable to suppose that such concepts as "agent of action" enter into the primitive basis if one believes, say, that the human conceptual system permits an analysis of events in these terms. Someone learning English must somehow discover the subcatgorization features of persuade, one aspect of learning its meaning. Given this knowledge, basic properties of the syntactic structures in which persuade appears are determined by the projection principle and need not be learned independently (1981:31).

One could formulate the notion "one aspect of learning its meaning" as follows:

2) a. Thematic relations are equivalent to a subset of inferences about a situation.
   b. Thematic relations are mapped into syntactic subcategorization relations.

The particular syntactic deployment of the arguments is determined by subcategorization. How does a child determine what arguments enter into subcategorization in the first place? In effect, Chomsky says that the inferences relevant to a given situation determine the thematic properties of a verb. In other words, if we infer who is agent in a situation, the role of agent must be attributed to the relevant verb. Other inferences may or may not be involved. For instance, if a person says "I want a coat" and we make the inference that he is cold, the inference is not a part of the thematic structure.

This view of acquisition obviously provides general cognitive ability with a distinct role.[1] However, we shall argue that, upon a close look, the assertion in (2) is inadequate. Even the inference of agency itself is not sufficient to determine that a lexical item is marked with the thematic feature +AGENT. Formal criteria must also be satisfied. In a word, we argue that thief has agency as part of its meaning but only stealer (as in the stealer of those goods) is marked thematically as +AGENT. Evidence comes from the fact that we do not have *the thief of the books. It is the fact that inferences must satisfy additional

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                        THEME
                        GOAL
                        LOCATIVE

        b.  Nominal
             the selling ([of the car])([to Bill])([by John])
                              PP            PP          PP
                AGENT
                THEME
                GOAL
                LOCATIVE
```

The verb itself carries thematic relations which are mapped onto the syntactic structure. The syntactic structure is represented in the lexicon in the subcategorization frames. Our analysis makes the mapping between thematic structure and subcategorization frames optional (expressed by parentheses on PP's). The thematic relations are nevertheless present in the verb. In (8a) both AGENT and THEME are obligatorily expressed (as subject and object), while in (8b) only THEME is obligatory. There is a correlation here with the presence or absence of PP's. In effect, we are arguing that PP's are optional, but the thematic roles remain implicit, except for THEME. We will show that if the THEME PP is not expressed, then no thematic relations are present and a non-thematic lexical entry exists.

The formal account is simple to devise, but its consequences for a theory of language acquisition are important. The child must be able to project the fact that _the ship_ sinks has no obligatory agent, while _the ship was sunk_ must have an agent. The problem is fully comparable to the projection of empty categories in syntax. The system must be sufficiently deterministic so that the child can deduce the difference between (3a) and (3b) on a principled basis. In essence, the lexical PrP accomplishes precisely this goal.

However, unlike the syntax, the lexicon also contains rules that do not obey the PrP. Therefore the child must possess a system that discriminates among rules which do and do not obey the PrP. In particular, if the ergative form (the ship sinks) is derived from the transitive (someone sinks the ship) (see Keyser and Roeper (to appear)), then the _agent_ is deleted. A rough principle of discrimination (to be amended below) is the following (based on a similar claim by Fabb (1982)).

9) Lexical forms with affixes obey the lexical PrP.

Since compound (-ing), -able, and passive (-ed) all have affixes, the child would be able to know immediately that these forms carry thematic relations, while the ergative does not, since it has no affix. This account will be both supported and complicated by our discussion of nominalizations below.

4.0 control and the PrP

One predication that follows from our claim that thematic roles can be implicit is that they will function in the syntax in

the same way as explicit thematic roles. We find that implicit agents can control rationale clauses, sentential adverbs, and predicative adjectives, just as explicit agents typically do (See Jones (1982) for a discussion of rationale clauses, Nishigauchi forthcoming for a discussion of thematic control.):

10) a. the boat was sunk to win the war
    (compare: the boat was sunk by the enemy to win the war)
  b. the game was played wearing no shoes
  c. the game was played nude

In each of these constructions we can argue that a PRO must be controlled by an element in the higher clause. What we find is that it is implicit AGENT and not the derived subject which controls. In (10c) we are led to support the claim that a small clause contains a PRO which receives AGENT control: the game was played [PRO nude]s. (See Stowell (1981), Williams (1983) for discussion.) In contrast we see (11):

11) *the boat sinks to win the war

Where there is no agent, a rationale clause is excluded.[4]
    Implicit thematic roles are not limited to agents. The following differences can be analyzed in terms of a difference between + or - implicit goal:

12) a. it is possible for you
  b. it is possible for you to go
  c. it is possible to go

13) a. *it is probable for you
  b. *it is probable for you to go
  c. *it is probable to go

(12c) is possible, while (13c) is excluded because there is no implicit GOAL (for you) to control the PRO in the complement clause in the latter.[5]

5.0 Nominalization

    We turn now to a case study of the phenomena we have been discussing. Note that nominalizations also involve implicit agents and control:

14) the destroying of the city to prove a point

Where -ing is present a thematic object is necessary (for transitive verbs) and an agent is implied. Where nominalizations lack an affix, the object is eliminated:

15) the buying of clothes   16) *the buy of clothes
                                    (but: a good buy)
    the fooling of Bill   *the fool of Bill
    the cooking of stew   *the cook of stew
    the stealing of money   *the thief of money

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This is just what we would predict if affixes are correlated with thematic roles. There is a set of exceptions to this generalization which reveal its abstract character:

17)   **the** roll of the dice
      the make of car
      the love of God
      the review of the book

The contrast between (16) and (17) reveals that the PP with a bare nominalization is not a productive process. Furthermore the examples in (17) have an idiomatic character for the most part. Therefore, we believe that they are instances of PP attached to NP without any invocation of thematic roles. The view of the book is like the jacket of the book. It follows then that the PP's in (17) do not invoke thematic relations and therefore no implicit agent is present. If no implicit agent is present, then control is ruled out and we predict the ungrammaticality of the following examples:

18)   a.   *the roll of the dice to make money
      b.   *the make of the car to make money
      c.   *the love of God to save ourselves
      d.   *the review of the book to impress people

The -ing forms, once again, are perfectly grammatical: the reviewing of the book to impress people.
      In addition we find that with PP's in prenominal position the affixless nominalizations are free, while those with affixes must have a thematic relation:

19)   a.   Logan's crash
      b.   *Logan's crashing
      c.   the jet's crashing
      d.   the jet's crash

The bare nominalization allows a locative reading or a THEME (19d) while the -ing form requires THEME (19c) (or an AGENT for transitive verbs).
      The facts we have adduced show that thematic AGENTS and THEME are abstractions. The PP of the dice has the meaning of THEME only accidently because NP PP's are free in what they may mean. In addition we find that the agents which are contained in the meaning of words do no function as controllers:

20)   a.   *the cook (of stew) to win prizes
      b.   *the thief (of money) to get rich
      c.   *the ballerina (of Swan Lake) to win a prize

Our syntactic diagnostic reveals that cognitive agency and thematic agency are not the same, even when both are present in the lexicon. Cognitive agency may be present in the meaning of the word, but be unable to control. Thematic agency may be unexpressed, but implicit, and therefore able to control.

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Presence in a PP we have found to be an unreliable diagnostic for THEME. The following examples reveal that it is unreliable for agency as well:

21) a. *the symphony by Mozart to win a prize
    b. the symphony by Mozart
    c. an office by IBM
    d. *a pie by Mary
    e. *a hole by Doug
    f. *an idea by John

We see in the contrast between (21b,c) and (21d,e,f) that the agent-PP fails to generalize in the same manner that the Theme-PP fails to generalize.

The import of these facts for an acquisition mechanism should not be underestimated. They show that there is no simple translation from a cognitive inference to a thematic relation. The child must possess joint awareness of an affix and of a thematic relation. We are forced to see the affix as crucial in the determination of whether thematic roles are present or absent. In what follows we shall show that the presence of the affix is also insufficient.

5.1 The -tion/-ing Contrast

The following contrast indicates that the presence of an affix is insufficient to guarantee the presence of thematic roles:

22) a. *the destroying was terrible
    b. *the allowing was terrible
    c. *the fracturing was terrible

23) a. the fracture was terrible
    b. the allowance was terrible
    c. the destruction was terrible

It appears that -tion does not invoke thematic relations. We correctly predict that the following sentence is ungrammatical:

24) *the destruction to prove a point

There is a natural generalization which appears to emerge here: those affixes that are non-neutral and affect the phonology of the stem do not carry thematic roles. In effect, they create a new stem. However, this generalization also proves to be inadequate because of the grammaticality of the following example:

25) the destruction of the city to prove a point

The generalization now must be:

26) A nominalization takes thematic roles if it has an affix and if a cognitive thematic role is present.

We find that (26) must also be amended, because it is only THEME which invokes AGENT, not the reverse:

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27) a. *the destruction by the enemy to prove a point
    b. the destruction by the enemy was incalculable

Therefore we must make the claim that:

28) An affix invokes thematic roles,
     if cognitive theme is present.

The ungrammaticality of *the destroying was terrible suggests that
languages (or at least English) have both a nominalization (ing)
which requires thematic roles and one in which thematic roles are
optional (tion). Note that we have not yet stated what "invoke"
means or how a child uses cognitive knowledge in this process.
     The claim in (26) is supported by the pattern of exceptions
to the pattern in (22). Note that we can say:

29) a. the killing was terrible
     b. the diving was unusual
     c. the painting was extraordinary

Each of the -ing nominalizations exists without a THEME and each
is grammatical. Note that each fails to have a -tion counterpart:
*killtion, *divetion, *paintion. It appears then that if the
language does not have two separate nominalizations, one that
takes thematic roles and one that does not, then a single
nominalization affix (-ing) can serve both roles. Predictably the
control facts follow suit. In (30a) no thematic roles are
present, while in (30b) they are invoked by the theme in the PP:[6]

30) a. *the killing to prove a point
     b.   the killing of Bill to prove a point
     c.   killing to prove a point

     Example (30c) appears to contradict the generalization that
THEME involves thematic relations. No THEME is present, but it
appears to be grammatical. The explanation lies in the fact that
(30c) can be read as a verb phrase with rational clause, which is
under an NP or an S node. It is no different from using an
infinitive in that context: to kill to prove a point would be
shameless. It is apparent from both the infinitive and the verb
phrase gerund that a verb can appear with neither THEME nor AGENT
in explicit form and nevertheless retain implicit thematic
relations which, in turn, are capable of control. The principle
that THEME must be present to invoke AGENT applies only to NP's.
     We are now in a position to generate a totally ambiguous
case:

31) a. the painting of Rembrandt
     b. the painting of Rembrandt to prove a point

In (31a) we have an ambiguity between -thematic painting where a
result is involved and a +thematic reading where an activity is
involved. Only the activity reading permits a rationale clause
because an agent is present. These examples show that no
generalizations about a particular affix, or an affix plus a

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THEME, suffice to identify a nominalization. The speaker must discriminate whether or not an action is involved.

The notion of "action" makes direct reference to cognition but, once again, it fails to work as a diagnostic:

32) the protection of children to guarantee continuity of our society is our prime responsibility

In (32) we find a grammatical sentence which, in cognitive terms, need not involve any particular action or event. A stone wall or innate moral awareness may serve as protectors of children, may guarantee continuity, and may be our responsibility.

Each new diagnostic fails. Is learning language therefore impossible? It is at points like this where an abstract combination of factors, united by principle, and modified by notions like markedness become necessary in linguistic theory. What specific demands are made upon the language-learner when confronted with this array of facts? How can we guarantee that a language-learner can wend his way through them?

Consider what the child cannot do: he cannot assume that -ing means thematic roles are present, he cannot assume that a THEME PP means that they are present, and he cannot assume that the presence of both means that they are present. He needs, in effect, to assume that if a word (like painting) has no -tion affix, can appear without THEME, then it can appear with a THEME and still be -thematic. This interaction can be stated as a sequence of individual decisions.

First a child hears:

33) a painting

and then:

34) a painting of Rembrandt

Having decided that a painting lacks thematic roles, then the content of (34) is recognizable as N + PP and not Verb + Affix + THEME. Using sequential exposure, the properties of non-thematic nominalizations are recognizable. We must refine our analysis before we can state how thematic nominalizations are recognized.

5.2. The Thematic Grid

Before we confront the acquisition of thematic nominalizations directly, our survey of relevant distinctions requires another step. Consider:

35) a. *the destroyer of the city by the navy
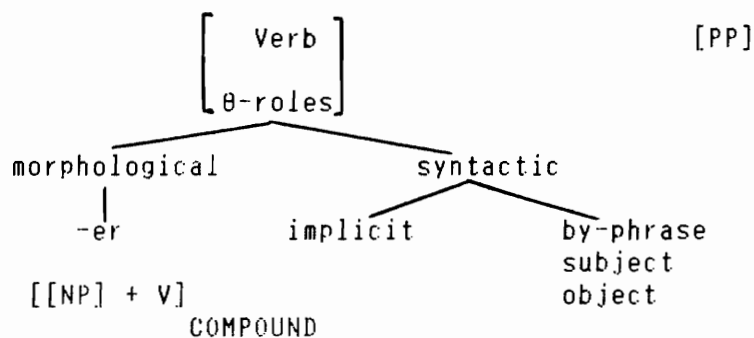   b. *the destroyer of the city to prove a point
    c. the destroyer of the city
    d. *John's destroyer of the city

These examples show that there are three positions for an agent: implicit, in a by-phrase, and in -er. The fact that the same AGENT is involved is shown by their incompatibility: -er cannot co-exist with a by phrase (30a) or an agentive genitive (35d).

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However, the -er is also unable to control a rationale clause (35b).

We are now able to see the syntactic characteristics of _implicit_ agents. They are represented in a fashion as if projected onto the word-external subcategorization frames, as if they were present on an invisible by-phrase. But the -_er_ agent is a part of the _morphology_ of the word and therefore does not have the _syntactic_ status needed to do control. We can summarize these facts in the following claim:

36) the PrP is satisfied on either of two dimensions of the thematic grid: internal or external.

a) Internal equals part of the word's morphology.
b) External equals mapped onto its subcategorization frames.
c) The external cases are optionally expressed.

$$\begin{bmatrix} \text{Verb} \\ \theta\text{-roles} \end{bmatrix} \qquad\qquad\qquad [PP]$$

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            morphological              syntactic
                 |                  ┌──────────┴──────────┐
                -er              implicit            by-phrase
                                                     subject
        [[NP] + V]                                   object
             COMPOUND
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We can see from the following compound words that word-internal agents cannot control:

37) a.   destroyed by the enemy to prove a point
    b.   *enemy-destroyed to prove a point
    c.   city-destroying to prove a point

In (37b) the agent has been incorporated into the word and therefore is ineligible for control. In (37c) the THEME has been incorporated and the AGENT, though implicit, remains mapped onto the external dimension of the Thematic Grid and therefore can control (or could appear: _city-destroyed_ _by_ _the_ _enemy_ _to_ _prove_ _a_ _point_).

5.3   Further Evidence of Non-equivalence of Thematic Relations and Cognitive Relations

It is quite evident that the agents of the rationale clauses in the examples (38a,b)

38) a.   the child's laughing to avoid embarrassment
    b.   the childish laughing to avoid embarrassment
    c.   the American destruction of Vietnam to maintain capitalism
    d.   Americca's destruction of Vietnam to maintain capitalism

In (38a), <u>child</u> is construed as the agent of laughing and it also controls the PRO of the rationale clause. In (38b), however, the adjective does not refer to the agent of laughing. Further, PRO is arb, not controlled by the adjective <u>childish</u> (if anything, there is the implication here that an adult is laughing to avoid embarrassment, although the context of utterance might dictate otherwise). The same kind of inference to an agent is involved in a more subtle fashion in (38c,d) both of which have similar meaning. One can infer here that American means "by America", although it could also mean "in a typically American manner." The agency of <u>American</u> is clearly inferred, while the agency of <u>America's</u> is a direct thematic relation. Therefore, the control relation between <u>America's</u> and PRO is only indirect (if this example is acceptable at all). Since (38c) has an implied agent (recall the earlier discussion of implicit agents), the listener can infer that this implied agent is identical to the agent which is inferred due to the presence of the adjective (although this is a circuitous and less natural way to establish control). The contrast illustrates the distinction between inferred agency and expressed thematic relations.

A second illustration of the idea that cognitive objects, which includes inferred objects, are not equivalent to thematic objects comes from Postal (1969). He observed that the following two sentences contrast with one another:

39)   a.   the orphans of the Rosenbergs miss them
      b.   *John is an orphan and he misses them

Coreference between <u>the Rosenbergs</u>, the overt THEME, and <u>them</u> is licensed in (39a). In (39b), however, even though the notion of parents is necessary to the meaning of <u>orphan</u>, a chain of inference terminating in "parents are dead" is clearly inadequate to allow coreference to be established between an inferred THEME and an overt pronoun. This latter cognitive theme is not equivalent to the thematic relation THEME.

Our third example involves the notion of "incorporated theme" (see Stowell (1981)). The following sentences contrast:

40)   a.   John whined
      b.   *John whined a big whine

The verb <u>whine</u> cannot take an object but seems to entail an object, i.e. it entails that something was uttered. However, the verb <u>utter</u> works the other way around:

41)   a.   *John uttered
      b.   John uttered a soft moan

In the cognitive domain the two verbs both involve a kind of object, but in the grammatical domain only <u>utter</u> has a true THEME.

It follows from these examples that a child cannot simply hear a verb in a certain context and decide that it has a particular set of thematic relations. He must find further

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evidence to decide if the relation is purely cognitive or both
cognitive and thematic.[7]

6.0 Further Problems with the Affix Diagnostic

    We have argued that affixation generally implies the
inheritance of thematic roles (see Randall (1982)). Thus we find
the following contrast:

    42) a.   the cooker of stew
         b.   *the cook of stew

And we found that in each of the lexical rules that retains
thematic relations there is an explicit affix involved. It is,
however, once again not the case that affixes will uniformly
involve the retention of thematic roles. It is clear that out-
adds a theme to intransitive verbs:

    43) a.   Bill outruns John
         b.   John overthrew second base
         c.   *Bill runs John
         d.   *John threw second base

And over- in this context involves conversion of the locative
marked by a preposition (to second base) into a THEME. On the
other hand, phrases like overreact to John/*overreact John indicate
that the prefix does not uniformly determine thematic relations by
itself. Here the verb (react to) dominates the prefix.
    How does a child deal with contradictory evidence? Some
preferential principle must exist. One natural principle is to
look for a match rather than a conflict in the thematic properties
of affixes and verbs. Therefore both of the following two cases
would illustrate conflict:

    44) a.   John over-indulged in sweets
                  THEME   LOC   (LOC dominates)

         b.   John out-ran Bill
                  THEME   (THEME is imposed on intransitives)

While in the following examples we have agreement between the
thematic property of the prefix and of the verb:

    45) a.   John over-indulged his son
                  THEME   THEME

         b.   John outfought Bill
                  THEME THEME

         c.   Fred outmanipulated John
                  THEME   THEME

         d.   Bill overestimated the rent
                  THEME   THEME

In all of these cases both the affix and the verb take THEME. We predict that (45) should occur first.[8]

6.1 A Principle of Thematic Uniformity

The notion of matching leads to a principle which can account for (or at least predict) preferences throughout our (somewhat bewildering) array of data. Let us begin from an elementary observation. It is not the case that a single hypothesis accounts for the thematic character of a nominalization. Verbs, Affixes, and prepositions are each subject to independent hypotheses about both meaning and associated thematic relations. A child must learn to associate at least the cognitive notion of agency with the preposition by in order to understand phrases like a symphony by Mozart. He cannot make the assumption that by is limited to the cognitive notion of agency, otherwise he would not be able to assume thematic agency in a phrase like the destruction of the city by the enemy. We can resolve this terminological dilemma by asserting that by carries a PP-AGENT. Such a PP-AGENT cannot invoke the verbal thematic system unless it is matched with a VERB-AGENT.[9]

The necessity for a system of matching becomes clear when we consider what happens in the general case when the thematic relations of Verb, Affix, and PP fail to match:

46) a. *outhappen
     b. *elapse to John
     c. *John gallopped Fred

If the affix could rearrange the meaning and thematic structure of a verb completely, then (46) should be possible, while if the PP could rearrange thematic relations and meaning, then (46) should be possible, and if the direct-object could control transitivity, then (46) should be possible.

Since there are exceptions to the generalization that verb's meaning is expressed in its thematic relations, and to the generalization that a PP caries thematic relation, and to the inheritance principle for affixes, it is clear that a straightforward interpretation of these relations is inappropriate.

The first hypothesis we might consider is atomic. The child attempts to learn which thematic role is associated with which PP, which relations are carried by a verb, and which relations are carried by an affix. Clearly this is impossible because there are no environments in which affixes, PP's, or verbs occur alone. Nevertheless it is true that there is independent productivity associated with each of them. We find for instance that children will make productive use of the benefactive ("peek to me"), and make obviously productive use of prefixes and suffixes. Therefore we must propose a system which has the dual consequence that the individual features are learnable separately and that they have reference to each other.

Consider the following principle:

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47) <u>Principle</u> <u>of</u> <u>Theta-Uniformity</u>: The characteristics of
PP's, affixes, and verbs are all compatible. Theta—roles
are present on verbs and affixes when explicit in argument
structure.

The principle can only represent the unmarked case because of the
exceptions we have been discussing. However, it has a desirable
consequence: a child associates thematic roles with a verb just
when they are explicit in the argument structure. Similarly
theta-roles are associated with affixes as they are with verbs.
The affix <u>out</u>- will not appear with a verb which has an
obligatory thematic role like locative:

48) *John output the ball on the shelf

In other words, if a child hears <u>John</u> <u>sold</u> <u>a</u> <u>car</u> he will
assume that <u>sell</u> has a cognitive beneficiary. However, when he
hears <u>to</u> <u>Bill</u> he will realize that it is a thematic beneficiary.
The initial cognitive analysis is translated into a thematic
analysis when a PP is present. Likewise if a child hears <u>the</u> <u>car</u>
<u>was</u> <u>sold,</u> he will assume that the agent is cognitive, until or
unless he hears <u>the</u> <u>car</u> <u>was</u> <u>sold</u> <u>by</u> <u>Bill</u>.
      The relations we have been describing allow acquisition to
work both from an analysis of verb meaning to an interpretation of
PP's, but also the reverse. There will undoubtedly be verbs
whose meaning is somewhat obscure without the enlightening
presence of PP's. When a child first hears <u>I</u> <u>swear</u> <u>an</u> <u>oath</u> <u>upon</u>
<u>the</u> <u>Bible</u> <u>to</u> <u>you</u> the meaning may be rather obscure. It is
partially fixed in space by the comprehensible locative, agent,
object, and beneficiary.
      The principle of Theta-Uniformaity will provide the
centerpiece of our analysis. We shall expose the principle to
problematic data -- of just the sort a child might receive --
and see what further elaborations are necessary to achieve
acquisition.

7. Filters and Triggers

      We have established that theta-roles and the cognitive
apprehension of action are not identical. We have a cognitive
capacity, which is presumably much like animal cognition, to grasp
actions and events in terms of agents, objects, causes, and
locations. We shall call this form of mental ability Dog
Cognition (DogCog).
      We have argued specifically that DogCog agents (inferred) are
distinct from thematic agents and that DogCog Themes may be
distinct from thematic Themes. In effect all -thematic
nominalizations refer to DogCog concepts:

49) a. the symphony by Mozart
     b. the sale of the car

There are several consequences of this claim. First it appears
that all thematic relations are included in DogCog relations
although they may be distinct in the grammar. Second the child

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must have a capacity with which to distinguish those PP's
which carry true thematic relations from those which are
what we have called "pseudo" thematic roles and now
attribute to DogCog.
     Since there is a subset relation between thematic roles
and DogCog concepts, it is possible that an ontogenic
relation between them exists. A child derives thematic roles
from DogCog roles when certain conditions are met. In other
words, DogCog concepts are a prerequisite for the
realization of thematic relations. The child's LAD must be
looking for the fulfillment of thematic roles. Therefore it
will attempt to _filter_ the range of DogCog concepts in
pursuit of the crucial set of roles associable with lexical
items. The existence of implied and inferred thematic roles
means that the filter must be linked to a trigger in order
to prevent the wrong cognitive roles from being designated
thematic roles. The first feature of the trigger is presence
in a PP or in a sister relation to the V or VP:
     50) DogCog represents all inferrable relations
          a. LAD designates those relations as Thematic
             relations if all of 1,2,3, are true:
             1. They occur in syntactic positions
             2. They are sisters to +V affixation
             3. +V affixes = tense, -ing, other nominalizations
The provisions of (50) mean that neither (49a) nor (49b)
will trigger thematic relations. In (49b) there are no +V
affixes although the stem is a verb-derivative.
     The procedure in (50) can be looked upon as a
realization of the notion that thematic relations have an
"extralinguistic dimension" in Chomsky's terminology. What
is crucial in our formulation is that the extra-linguistic
dimension is not identical to thematic relations, but rather
a cognitive source. The thematic relations that are derived
from DogCog coexist with DogCog and do not replace it.
Therefore principles of discrimination are always necessary.
8.0 -Thematic Nominalizations
     Our exposition thus far suggests that -thematic
nominalizations are derived from +thematic nominalizations
by a child deleting thematic roles from a nominalization
when it occurs without PP's. Thus a child first realizes
destruction _of_ _the_ _city_ and then realizes _destruction_ as a
derivative form. In fact, however, our acquisition mechanism
is unbiased. It is possible for the child to comprehend the
word _destruction_ by itself, with inferred Agent and Theme,
just as the child can comprehend the word _chair_. It is also
possible that he will understand _the_ _destruction_ _of_ _the_ _city_
(with an implicit agent) as +thematic immediately upon
recognition of the PP and the -tion affix.
     Note that we are not necessarily assuming that the
child must understand the relation between _destroy_ and
destruction before thematic relations are attributed to
destruction. It is precisely the character of our device
that it will recognize the triple: meaning of word, presence
of affix -tion, and presence of PP.

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These three ingredients suffice without the child necessarily possessing the phonological knowledge which is requisite for the full lexical entry. We would in fact predict that the verb/noun connection is made fairly late.

Consider now the following contrast:

51) a. *the gift of a book to Mary weighs five pounds
    b. the gift to Mary weighs five pounds

Why is (b) better? The answer is that when the theme (a book) is present then the nominal <u>gift</u> refers to an action and not to an object. It is clear from this example, however, that the presence of a PP (to Mary) and an affix (-t) plus a verb-derived meaning are misleading in (51a). This shows that the formulation in (52) is necessary:

52) Thematic relations are triggered when +Theme is
    present in the PP structure

This restriction also proves inadequate when we consider intransitives:

53) a. *his cooking in hospitals tastes terrible
    b. his cooking tastes terrible

We find that the non-theme PP <u>in hospitals</u> is sufficient to induce a +Thematic reading when intransitives are involved. The difference between these examples cannot be reliably stated in terms of our criteria because genuine ambiguity exists:

54) a. the painting in the hospital was terrible
    b. his painting in the hospital was terrible

Both (54a) and (54b) are ambiguous, but it is interesting to note that (54b) has a preferential reading for action (he paints) while (54a) has a preferential reading for object (a beautiful painting).

The different readings can only be extracted by reference to a meaning criterion:

55) Concrete objects have -thematic structure.

This principle works and it also allows us to make some predictions about language acquisition.

What happens when a nominalization is non-concrete but has undergone semantic drift? It will lose its +thematic status but it may still have PP's which should trigger +thematic readings. In other words, we can make the prediction that children will initially misunderstand a nominalization of the form:

56) the killing of July (stayed in the public's consciousness
    throughout the fall)

In (56) all the criteria are met for a +thematic reading and in fact it is a strong temptation to adults to provide a +thematic reading despite a nonsensical result. Note that the killing is not a concrete object, there is an affix, and an of PP; hence the +thematic reading is invoked. It follows that a child must learn that such interpretations are lexically marked. A natural experiment would be possible but it has not yet been done.

In order for a child to correctly understand (56) he must learn that killing can exceptionally appear without a PP and therefore may be -thematic roles. Once this fact has been fixed in his lexicon, he can generate PP's freely with killing as with any ordinary NP (the chair in the kitchen) without any necessary thematic interpretation. This two-step process cannot be telescoped within a single learning experience by our hypothesis. Unless the child already possesses knowledge of killing, he will be forced to supply a +thematic reading.

8.1 The Extensions of Thematic Roles

Our discussion thus far has established that abstract principles are involved even when a child is learning apparently "concrete" aspects of the grammar: agent and theme relations.

We have avoided an issue that has been avoided within linguistic theory itself: how many thematic relations are there? It is clear that the set of relations must be finite because it would not be possible to have an infinite set of relations in a lexical entry. The set of cognitive relations might be infinite, depending upon the kinds of combinatorial character they have as a substructure.

However if thematic relations are finite, they must be internally recursive. It is clearly possible to have a locative continue ad infinitum:

57) We put the cat in the kitchen in the corner under
       the table near the wastebasket...

The child, therefore, in identifying thematic relations with the PP's, cannot make the assumption that an isomorphic relation exists. He must examine the content of each PP to determine if it is a subpart of a previous role or a new thematic role.

In addition it remains unclear what the inventory of thematic roles is and what their abstractness is. The issues are related. Are thematic roles limited to: Agent, Theme, Goal, Locative, Instrument? If they are, then how must we analyze a sentence of the form:

58) John spoke in a responsible manner.

It is clearly not an accident that (58) contains the preposition in and not from or with. Should we therefore designate the notion of location as an abstraction which subsumes whatever is associated with a locative preposition? (See Jackendoff in various papers for discussion of this issue.) We shall not seek to explore this question. We note simply that its resolution is obviously important for a theory of acquisition. The claims we

have made in this paper are not changed by the resolution of this
question.
    If (58) has no thematic interpretation for <u>in a responsible
manner</u>, then we must assume that DogCog functions to assign a
contextual interpretation to whatever the phrase contains. If so,
then the child must be able to interpret some PP's associated with
+thematic nominalizations as nonetheless -thematic.
    We conclude that the child must be able to analyze any PP as
+thematic or -thematic. If the Head of the phrase is identifiably
a nominal which has undergone semantic drift, or lacks an affix,
the PP will be -thematic no matter what its content. If there is
an affix, then the PP will be +thematic if it fits one of the
thematic roles. These conclusions remain although the precise
dimensions of thematic roles cannot be determined at the moment.

8.2 Summary

    We have argued that a transfer from cognitive roles to
thematic relations occurs only when a set of formal criteria are
met. The Theta-Uniformity Principle causes the transfer when the
meaning of the verb, the thematic structure of the affix, and
thematic meaning of the preposition are simultaneously satisfied.
That is, the set of cognitive relations

    59)   x, y, $\underline{X}$, $\underline{Q}$, $\underline{W}$, n, j

are associated with a verb. A subset is selected if compatible
with affix and P:

    60)   AF (-ing) <u>compatible with</u> Z, Q, W
          Prep (of) = THEME-marker

Then the verb will mark Z, Q, W as THEMATIC relations. These
thematic relations will be associated with the VP and enable the
VP to accept rationale clauses and satisfy the theta-criterion,
etc.
    Let us consider the kinds of cases that our system rules out.
We will use a simple descriptive vocabulary: V=verb, AF-affix,
P = Prep, CogTH = cognitive role of Theme, and THEME = thematic
role. None of the following forms is sufficient to satisfy the
theta-uniformity principle:

    61)   a.   V+ AF (destruction) ===> -thematic roles
          b.   V+ CogTH (whine) ===> -thematic roles
          c.   V+ AF + P (the gift to Mary) ===> - thematic roles
          d.   V+ + P +CogTH (the role of the dice) ===> -thematic

The only acceptable form is:

    62)   V + Af + P + CogTH (the destroying of the city) == +thematic

This form triggers thematic roles, but it is also subject to
ambiguity:

    63)   the painting of Rembrandt

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We argue that such cases produce the +thematic reading ambiguity
in all instances. The child must therefore have separate
information that <u>painting</u> can occur in isolation before he can see
that a -thematic reading is possible. Therefore he must make a
sequence of two decisions in order to arrive at the -thematic
reading.

There is another approach which would follow from the full
adherence to the instantaneous model in acquisition. A child
would decide on the thematic structure of these nominalizations in
terms of a rationale clause. It is only the +thematic reading
that is available in (64):

    64) the painting of Rembrandt to win a prize

We are arguing that the child's LAD should not let all decisions
about basic structure depend upon the analysis of such very
complex sentences. The trigger procedure should operate upon
smaller units, even if a certain amount of ambiguity is
unavoidable. This approach is in the spirit of Wexler and
Culicover's effort to make short sentences sufficient for phrase-
structure decisions in acquisition.

9.0 Overgeneralization

The deductive structure we have developed leads, as it
stands, to the prediction that a child will produce no
overgeneralizations. The child associates a set of cognitive
relations with a word. If syntactic positions are filled, those
cognitive relations are converted into thematic relations. If
they are empty, the cognitive relations remain cognitive
relations.

Where affixes are productive, thematic relations are always
possible and therefore an overgeneralization of thematic relations
is impossible. It is impossible to incorrectly associate thematic
relations with -<u>ing</u> because it is always possible to have thematic
relations with -<u>ing</u> (the killing of John).

Where no affix is present, the lexicon is unproductive, and
therefore a child should not use a word unless he has heard it.
Consider the following contrast in that light:

    65) a.   the handing out of awards
         b.   *the handout of awards

In (65b) we have ungrammaticality because <u>handout</u> can mean either
a pittance or a sheet of information but it no longer refers to
the act of handing out. If a child knows that non-affixed forms
are non-productive, then he will make no overgeneralization of
(65a) to (65b). In fact, there is no literature on such
overgeneralizations. If they occur, as they might, they are rare
and probably produced analogically. Therefore, we can conclude
that our theory correctly predicts the absence of
overgeneralizations in this domain.

Nevertheless the overgeneralization of thematic relations
does occur. M. Bowerman (1982) has collected these examples:

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66) a. "feel your hand to that"
      b. "I'm going to cover a screen over me"
      c. "She's gonna pinch it on my foot" (= pinch my foot)
      d. "Pinch on the balloon"
      e. "Eva is touching gently on the plant"
      f. "I'm gonna fill some salt into the bear"
         (shaped salt-shaker)
      g. "Touch to me"

These examples all involve a GOAL or a LOCATIVE that is customarily treated as a direct object in the adult language (e.g. touch me). It is of interest that none of them are nominalizations, but nonetheless it is worth a digression to discuss them.

In principle such examples should not arise in our deductive system. However there is no deductive explanation for the existence of the classic lexical overgeneralization either. That is, if the language contains _come_ and _came_, then why should a child ever say "comed". The answer must be that at times a child learns _partial_ lexical entries. That is, he learns _come_ and projects the past tense by a regular rule, thereby producing _comed_.

The critical question then arises, how does he eliminate _comed_? Here we can apply the _uniqueness principle_ (see Wexler (1979), Roeper (1982b), Pinker and Lebeaux (to appear)):

67) Uniqueness Principle: one surface form is associated with
                        one deep structure form.

This principle must be translated to state that one surface form exists for each lexical feature, where feature may include tense marking or thematic roles. When the child hears _came_, following the uniqueness principle, it will eliminate _comed_.

The same logic works for the elimination of the erroneous overgeneralizations in (66). When the child hears _touch me_, he first learns a partial lexical entry: the meaning of _touch_ has a thematic grid with _goal_ on it. He does not, apparently, register the fact that the GOAL is not represented prepositionally in the subcategorization of the verb. Therefore he can produce "touch to me" under a further assumption:

67) The unmarked form for thematic relations is expression
        through prepositional phrases.

When the child then registers on the fact that _touch me_ has the GOAL in the accusative form, then he revises his lexicon accordingly. This is what the Theta-Uniformity Principle as an unmarked principle would dictate.

In essence, the existence of overgeneralizations is understandable within our system but not predicted by it. The thematic filter operates on existing words, and does not produce novel PP's on a productive basis. Without productivity, no overgeneralization should occur.

Perhaps the most important fact is that there are no

widespread overgeneralizations in the domain of affixless
nominalizations, which are unproductive. We are unaware of
evidence that children say things like "the thief of the book".
This is predictable if the child knows that these nominalizations
have no thematic grid, are not productive, and that therefore all
PP's with affixless nominalizations are either idiosyncratic or
subject to cognitive inference.[10]

9. The Derivation of Acquisition

In lieu of a summary let us walk through the acquisition
process. We shall suppose a sequence of exposure for a series of
words, with data and a child's conclusions.

68) Data Conclusion

a. John creates statues	create ==> Thematic (AG,TH)
	Cognitive: GO
b. John creates statues for Bill	Cognitive GO ==> Thematic GO
c. the creation	creation ==> -thematic
	Cognitive: concrete object
d. the creation for Bill	creation ==> -thematic (no THEME)
	Cognitive: concrete object
e. the creation of statues for Bill	creation ==> +thematic: TH,GO
	Implicit: AG
f. John sells cars	sell ==> thematic: AG,TH (unmarked)
	Cognitive: GOAL
g. John sells cars to young boys	sell ==> thematic: AG,TH,GO
h. cars were sold	sell ==> THEME: TH
	Implicit: AG,GO
i. the selling	selling ==> -thematic
j. the selling of cars	selling ==> +thematic
	Implicit: AG,GO
k. the selling to young boys	selling ==> -thematic
	Cognitive: AG,TH
l. the sale	sale ==> -thematic (no affix)
	Cognitive: AG,TH,GO
m. the sale of cars	sale ==> -thematic (no affix)
	Cognitive: AG,TH,GO

In essence the child must assign every inferred notion to one of
three categories: Cognitive, Thematic, thematic implicit. The
crucial diagnostics are affixation, prepositional phrases, and
subject/object positions.

What happens if the order of presentation is not what is
given above? It does not matter. If the child hears +thematic
cases first, he will then make +thematic decisions. If he hears
-thematic cases (the creation), -thematic decisions follow. If he
hears a passive sentence before an active, then he ought to be
able to project an implicit agent immediately under the assumption
that _Theme_ implies _Agent_.

Although the deductive system provides for this possiblity,
it is quite possible that performance factors intervene. One can
imagine that a child would seek explicit agents and explicit verbs
before either passive or nominalizations are acquired. However,

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from a deductive perspective, a child could deduce an underlying verb from a nominalization (with THEME) as easily as the reverse. In this respect the acquisition of lexical entries is overdetermined. Acquisition succeeds in principle via a number of routes. It is important to discover the actual route of acquisition -- and not just the set of possible routes -- because the actual route will enable us to see how a child's language ability is embedded in other mental abilities and their process of maturation.

10. Implicit Evidence

The claims we have been making about the use of lexical items and their thematic properties as a mechanism for acquisition are empirical. There should therefore be relevant evidence. We have begun experimentation to determine the presence or absence of implicit thematic roles in children's grammars.

Consider first the alternatives. If a child used only DogCog, then he would assign to each lexical collocation a meaning that was appropriate to context. The expression stick-breaking could just as easily mean a stick breaking or someone breaking a stick. It means the latter if the compound derives from the transitive form and not the intransitive. Likewise boat-sinking has two natural meanings as a combination of words, but requires an implicit agent if the compound is recognized. Once again, where no affix is present, either interpretation is possible. Thus bus-stop may refer to where the bus stops, or a sign, or a button to stop a bus. However, bus-stopping refers to the action of someone or something stopping a bus.

Under the DogCog assumption, without thematic relations, we would predict no particular sensitivity to these thematic distinctions. If, however, thematic roles are designated at an early stage of acquisition and then used as stepping stones to other derivational processes, we would expect awareness of implicit relations to emerge early.

In an informal, but rather persuasive, experiment we asked children to illustrate a baby sitting and baby-sitting, a stick breaking and stick-breaking, a watching bird and a watched bird, and half a dozen other similar pairs. Six year-old children, who have the facility to draw the animals, showed consistent graphic distinctions.[11] In baby-sitting an adult appears, while in a baby-sitting there is none. In bird-watching, an adult appears, while in a watching bird a worm appears. The awareness of implict relations is incontrovertible (see illustration).

11. Conclusion.

In conclusion, we are able to see from a number of perspectives that thematic roles are crucial in the process of acquisition and crucial in the syntax of English. However, once again, just as the notion of "question" is seen to require a formal dimension (a movement transformation), the notion of agent requires a triumvirate of formal factors (affixation, PP, and the category underlying verb), in order to be represented in the human mind. We have argued that the PrP must be extended to include

morphological rules. The effect of this extension is, once more, to constrain the domain of possible grammars, thereby simplifying the acquisiton problem from a deductive perspective. We have tried to state how the PrP functions in a realistic model of acquisition. That is, we interpreted what one aspect of "learning the meaning of a lexical item" can and cannot mean.

It is self-evident that thematic roles possess some relation to a human theory of action. Human beings analyze events in terms of agents, objects, goals, beneficiaries, causes, and results. These terms also serve to describe grammatical constituents. What kind of transfer is possible? We have sharply defined notions of imminent or potential events, of fears, hopes, and indirect consequences which can be much more important than beneficiaries, etc. Not only is the theory of action broader and different from the theory of grammatical thematic relations, but it probably has a different set of emphases. Thematic relations, though related, seem orthogonal to action.

Universal grammar can be equipped with the capacity to look for a particular subset of action relations as thematic relations instantiated in the speech stream. One might expect there to be a convenient isomorphic mapping between thematic relations and grammatical features. We have shown that this is not the case. Principles of grammar beyond extra-linguistic connections must be available before acquisition is possible.

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FOOTNOTES

[1] There is a large literature on the connections between cognition and language. The common assumption is that cognitive notions like agent can appear in language as thematic relations. We argue that there is a derivative relation between cognitive notions and thematic relations. The result of this derivation is that cognitive and thematic notions are distinct and both are necessary. A cognitive notion can enter into the definitions of a word without becoming a part of the thematic grid associated with that word. This perspective on the connection between cognition and language is not, as far as we know, a part of the voluminous discussion on the topic.

There have been some theoretically informed discussions. For instance, work by Jackendoff, Pinker, Grimshaw, Roeper, and Wexler and Culicover provide some background on the topic.

[2] Finer and Roeper (1983) provide a formal account of a lexical projection principle which includes implicit thematic relations. The account involves the claim that implicit thematic roles divide into lexically implicit and syntactically implicit. The syntactically implicit role of AGENT is associated with subject position at D-structure. Therefore it is possible to define a consistent approach to control in terms of c-command and D-structure subject position. The revised projection principle, consequently, maintains the syntactic isomorphism of the theta-criterion.

The lexical projection principle is then used to explain various differences between the middle construction, Lexical and syntactic passives, and nominalizations. See Finer and Roeper (1983) f.or extensive disucssion of both the oretical and empirical details.

[3] Some speakers object to (6c), but many comparable examples can be found in the linguistics literature: "governable by the verb", "discoverable by the layman", etc.

[4] See Finer and Roeper (1983), Zubizaretta (1982) for a discussion of secondary agents which sometimes make such constructions acceptable: Joan of Arc died to save France. (Die is ergative under most analyses.) The fact that such exceptions exist in a systematical way indicates that it is not the illocutionary force of ergatives that leads to the exclusion of rationale clauses.

[5] These facts, by the way, indicate that it is unsatisfactory to account for the grammaticality of (11c) in terms of PRO$_{arb}$. (See Bouchard (1982), Lebeaux (1983)).

[6] We have illustrated above that the ion form can either be associated with a thematic grid or not. When there is no ion form, then the normally thematic ing nominalization can take on the properties of the [-thematic] ion form; i.e. it can appear as the head of NP with no arguments. Where there exists an ion form, then the ing version is thematic. There is thus a suppletion-

blocking relation between the two affixes of the following sort: a [-thematic] _ing_ nominalization exists if and only if there is no _ion_ nominalization.

[7] There are other examples, however that indicate that in certain contexts PP's must carry thematic relations:

        (i)   Germany's invasion by Poland
        (ii)   *the German invasion by Poland

There can be no (ii) because an agent cannot exist in a nominalization without a theme. The theme is not part of the thematic relations but rather, once again, inferred from the adjective.

       On the other hand, there is evidence to indicate that _invade_ admits an intransitive interpretation more easily than _destroy_. Compare _Poland invaded_ with _?Poland destroyed_. This contrast carries over to the nominalized forms intact -- note the ambiguity of _Poland's invasion_ and the univocality of _Poland's destruction_.

       There are thus three thematic possibilities for _invasion_ diagrammed below):

    (iii)   _invasion_

                θ_1 θ_2 θ_3

                $\emptyset$ THEME   AGENT   AGENT

       The presence of the _by_ phrase in (ii) will invoke either branch θ_2 or θ_3. There is no NP in (ii) to which THEME can be assigned, so θ_2 is not a possibility. Regarding branch θ_3, perhaps _German_ in (ii) can be associated with a cognitive theme, but there appears to be a matching requirement such that all expressed thematic roles be of one sort, thematic or cognitive. They must all be thematic or all cognitive, but not partially one or the other. This claim may also be too strong. It is perhaps the case that thematic AGENTS must co-occur with explicit THEME, though not the reverse given the grammaticality of _the American invasion of Vietnam_ (but see discussion surrounding (27)).

[8] Randall (1982) argues that a child begins with a notion of simple inheritance. In other words, the verb always dominates. This could be true, or it could be true at some stage of acquisition, but not be true at a later stage. It is an empirical question. She provides a variety of experiments showing that children do overgeneralize inheritance.

[9] Rather than claiming that the preposition _by_ is ambiguous between assigning a cognitive or thematic agent, we propose instead that _by_ does assign _agent_ (thematic) in each case. Where the head of NP or VP has no θ-grid associated with it, where the θ-grid is not invoked, the agent role assigned by _by_ is associated by the free semantic relation between a noun and the PP's surrounding it. Where the θ-grid is invoked (by the presence of affix and theme), then the _by_-phrase is mapped into the AGENT slot

of the θ-grid.

Thus, in <u>symphony</u> <u>by</u> <u>Mozart</u>, <u>symphony</u> has no θ-grid
associated with it, and pragmatic conditions allow <u>Mozart</u> to
receive, albeit loosely, an agentive interpretation. In <u>the</u>
<u>destruction</u> <u>of</u> <u>the</u> <u>city</u> <u>by</u> <u>the</u> <u>enemy</u>, on the other hand, we have
suggested that the θ-grid is invoked here by the presence of AF +
Prep + THEME; the reflex of this situation is that the NP of the
<u>by</u>-phrase is associated with the <u>agent</u> slot of the θ-grid, the
grid is suppressed in what we have termed the [-thematic]
nominalization by the absence of the triggering factors in
<u>destruction</u>. This being the case, <u>the</u> <u>destruction</u> <u>by</u> <u>the</u> <u>enemy</u> is
still [-thematic] and <u>enemy</u> receives an agentive interpretation by
means of <u>by</u> in the same sense as <u>Mozart</u> does in the earlier
example.

The analysis outlined above is, strictly speaking, an
acquisitional heuristic, not a part of grammar. It is
straightforward, however, to grammaticize the procedure in the
following way. Given that the LAD postulates both a [+thematic]
and [-thematic] entry for <u>painting</u>, <u>painting</u> is either one or the
other in each case above. This yields four possibilities:

    a)   painting by Rembrandt
         -th

    b)   painting by Rembrandt
         +th

    c)   painting of Aristotle by Rembrandt
         -th

    d)   painting of Aristotle by Rembrandt
         +th

(a) and (d) are grammatical possibilities, but (b) is not and may
be viewed as a violation of the θ-criterion; THEME is unassigned.
(c), on the other hand, need not be a θ-criterion violation under
the assumption that prepositions assign their own θ-roles in the
absence of a matching assignment by the head of NP or ⟨.VP. In
this case, then, both <u>Aristotle</u> and <u>Rembrandt</u> may receive θ-roles
from their respective prepositions, but these θ-roles cannot be
associated by the grammar with <u>painting</u> (it has no θ-grid). At
this point, formal grammar throws up its hands and pragmatic
factors associate the NP's with the cognitive (non-grammatical) θ-
roles which are determine by the context of utterance. What this
amounts to is an echo of the variable R relation proposed for
genitive specifier position in, e.g. <u>John's</u> <u>cat</u>, where the
relation between <u>John</u> and <u>cat</u> can vary across many dimensions.
(Here, of course, the variation is constrained by the range of
relations determine by the prepositions (loosely speaking <u>by</u> =
AGENT, <u>to</u> = GOAL, <u>of</u> = THEME, etc.).

[10] The notion of non-productivity is of course itself
problematic. We must still explain why a non-productive class has
any entries. Why should there be a word <u>handout</u> at all, if bare
nominalizations are unproductive. The term unproductive means,

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in effect, not systematically productive. This means that some
feature of particular meaning is associated with particular
instances. This, in turn, is equivalent to saying that the
elements must undergo semantic drift.

[11] We would expect implicit thematic relations to appear much
earlier, though , if they comprise a building block of
acquisition. We have therefore undertaken experiments to show that
substantially younger children also distinguish between the
watching bird and the watched bird.

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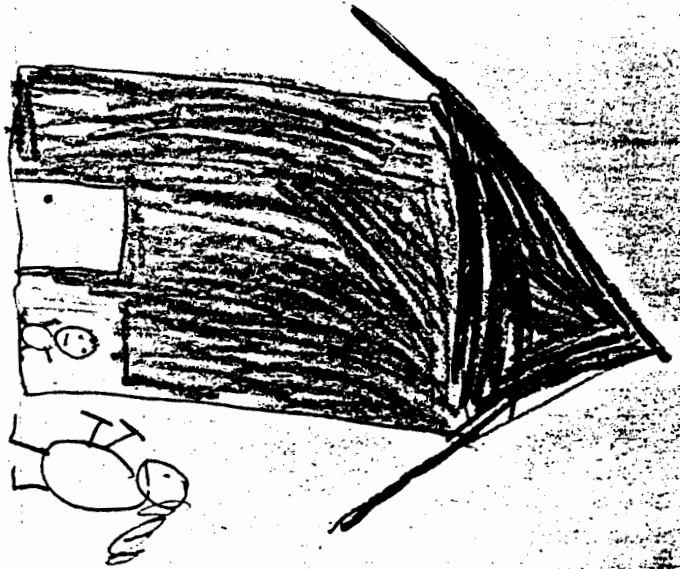Williams, E.S. 1983. "Against Small Clauses", _Linguistic Inquiry_ 14.2.

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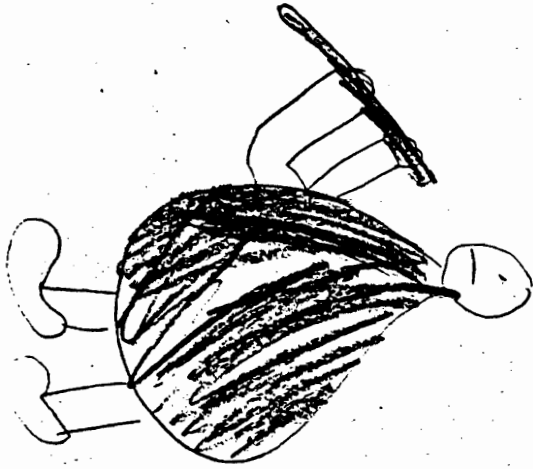
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