ACategorialSyntaxforVerbsofPerception

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1.Introduction

“CategorialGrammar”isnotaparticulargrammaticalformalism,letaloneratheracovertermforafamilyofquitediverseapproachestetonaturallanguagesyntax.Thiscovertermisnonethelessuseful,sinceallthesetheoriesshareimportantcharacteristics.Besidesthecommon
foundationsinthe works of Ajdukiewicz 1935 and Bar-Hillel 1953 and the useofcomplexsyntacticcategoriesbuiltupfromatomswithslashes,theyare
basedontworelatedpremises that distinguishthemfromallothertheoriesof
grammar:

1. The locus of grammatical generalizations is the lexicon.

2. Constituent structure plays no role in grammatical theory.

The hypothesis that constituent structure is immaterial to grammatical descrip-
tions contrastssharplywiththeperspectivefoundinthegenerativetradi-
ton. Generative grammars are largely grounded on relations like c-command
and m-command that are based on tree geometry. Some the-
ories have defined grammatical relations like subject and object entirely in
termsof constituentstructure,forexample,thesubjectofacategory
is the
nominal which occurs in the Spec(x).

However,all Categorial Grammars assume that constituent structure
is immaterial. The hypothesis that constituent structure is immaterial to grammatical descrip-
tions means that Categorial Grammars do not distinguish between
Categorial Grammar (henceforth: CG) and generative grammar (henceforth: Gen).

The paper tries to counter this objection by demonstrating that the con-
figurational notion of “subject” in CG leads to analyses that are descrip-
tive in a way that the corresponding notion of “subject” in generative gram-
mar is not.

Introduction

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Categorial Grammar is not a particular grammatical formalism; it alone a the

A Categorial Syntax for Verbs of Perception
Several tests indicate that the accusative NP Oswald is the subject of the embedded VP shoot Kennedy. Under a configurational notion of "subject" this implies that the string Oswald shoot Kennedy forms a sentential constituent. On the other hand, there is firm evidence both from syntax and semantics that this string should not be considered a constituent. We will attempt to show that

\( \text{(1)} \) in a categorial setting, some of the subject properties of the accusative NP Oswald can be derived without recourse to constituent structure, and (2) that this frees the way to a fairly simple semantics of perception verbs that solves most puzzles from the literature in a straightforward way.

### 2. Subject properties and NI perception reports

Consider the following two sentences:

\( \text{(2a)} \) John saw that Bill left.

\( \text{(2b)} \) John saw Bill leave.

Examples (2a) and (2b) both involve John's perception of something, although the entailments are rather different. Example (2a) involves perception with some cogitation, while the naked infinitive complement, as in (2b), involves non-epistemic perception, that is, raw perception without any additional non-perceptual cogitation. The subject properties of the accusative NP Oswald can be derived without recourse to constituent structure, as in (1). The subject properties of the accusative NP Oswald can be derived without recourse to constituent structure, as in (1).
Thus, I can see John embezzle money without seeing that John is embezzling money simply because I can perceive events in the world without understanding their import.

These intuitions led to the semantic analysis of the sentence

(5) see $dX \wedge \text{run}$

There is a cover for a set of matrixes that take the immediate position. In the representation in (5) is

\[
\begin{array}{c}
[[[ \text{John} \quad \text{run} ]] \\
\wedge dX]
\end{array}
\]

Consider these examples (6a) and (6b), according to classical Government.

(6a) see $\text{John saw the blu the tem}$

(6b) see $\text{I've never seen there be so many complaints from students before.}$

Example (6a) shows that weather can occur in the postverbal position. In (6b), presentational phrases occur in this position in (6c), an idiom chunk (6c) presents the phrase in this position. In some cases, non-referential.

Let's consider the case where a sentence has a non-referential.

Suppose that $\text{run}$ is also a sentence. This is in (6a). A sentence must contain a sentence of a proposition. Suppose that $\text{run}$ is also a proposition. Since CPs propose propositions, whatever it is a cover for a set of matrixes that take the immediate position. In the representation in (5) is

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syntactic position that is both non-thematic and associated with a grammatical function is the structural subject position, and, therefore, non-referential elements are restricted to this position unless they are part of an idiom that includes the entire verb phrase as well. Turning to example (6c), we see that the postverbal NPreceives its idiosyncratic interpretation. Therefore, it is non-referential and cannot be asistertothemainverb. This again showsthat the postverbal NPin NI complement examples is a structural subject and not a direct object. The only way to satisfy this condition is if the postverbal NP forms a constituent with the naked infinitive.

Thus, NI constructions which have the car

(6)

b. *John persuaded it to rain.

c. *John persuaded it to be obvious that Bill stole the car.

d. *John persuaded it to have been a riot in the park.

e. *John persuaded it to have hit the fan.

Becausetheir predicates are not verbal, small clause constructions do not show the

same range of non-thematic material in the following position. We take this to largely

determine our main point.

(7)

a. John believes Bill to have stolen the car.

b. *John believes it to have rained.

c. *John believes it to have been obvious that Bill stole the car.

d. *John believes it to have been a riot in the park.

e. *John believes it to have hit the fan.

The crucial point here is that the presence of "-thematic" material is diagnostic of the

embedded predicate. This, NI constructions seem to class within so-called "Exceptional Cases" (8)

(7a) John considers Bill a genius.

b. *John considers it to have rained.

c. *John considers it to have been obvious that Bill stole the car.

d. *John considers it to have been a riot in the park.

e. *John considers it to have hit the fan.
The contrast between the ECM constructions in (7) and the control constructions in (9) presents CG with an interesting problem. Generative grammar accounts for the contrast by associating subject properties with a particular piece of tree geometry, where, by subject property we mean things like:

10. a. The subject is allowed to be non-thematic;
    b. The subject is the "target" (or "landingsite") of raising operations;
    c. The subject is a "licensed" controller;
    d. The subject is a "trigger" for certain agreement relations;
    e. The presence of a subject defines local domains for binding.

Subjects are islands of extraction. The list in (10) can, of course, be expanded and clarified. Our point is that in classical generative accounts all of the properties in (10) are unified under a particular geometric approach to grammatical relations; thus, establishing one of the properties in (10) is sufficient to establish constituent structure and endow to element in question with the full array of subject properties. Grammatical subjects are traditionally treated as possible landing sites for raising processes like subject-to-subject raising (SSR) and passive. In constructions involving SSR and passive, grammatical subjects are traditionally treated as possible landing sites and endowed with the full array of subject properties. Furthermore, the post-verbal position in NC constructions admits only a few cases of SSR.

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11. a. John saw Bill be examined by a doctor.
    b. *John saw Bill be allowed to unlock the safe.

Constructions similar to passives but with non passive are more marked.

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Cases of SSR.

Furthermore the post-verbal position in NC constructions admits only a few cases of SSR.

12. a. John saw Bill appear to unlock the safe.
to a lesser extent, seems may involve semantic relations between the "raised" subject and the predicate that are unavailable in the true raising constructions associated with likely and tend. Similarly, get passives may be preferred over be passives in NIconstructions because of secondary semantic properties as-sociated with the former but unavailable in the latter. Compare, for example, the contrast between (13):

(a) Don't get killed.
(b) *Don't be killed.

differences in the aspectual properties associated with get and be. The contrast in (13) is probably attributable to differences in the aspectual properties associated with get and be.

Examples (14) show that anaphors like himself or each other must be bound within the domain defined by the postverbal NP; Mary in example (14a) is proximate to the anaphor herself and, so, is a legal antecedent for it; John in example (14b) is too distant to serve as a legal antecedent for himself. Similarly, examples (14c) and (14d) show that John can be a possible antecedent for the pronoun him, because Mary, despite the fact that the postverbal NP itself is in some sense a subject, functions as a trigger domain for binding due to the presence of a structural subject in the control domain. Putting aside formal details, let us suppose, following classical Government-Binding Theory, that subjects create a minimal domain for binding: that is, the presence of a structural subject on a constituent guarantees that a syntactic constituent where antecedents are available in the antecedent. The presence of a structural subject on a constituent guarantees that a syntactic constituent where antecedents are available is the domain defined by the postverbal NP.

The contrast in (13) is probably attributable to differences in the aspectual properties associated with get and be. These differences may also account for the contrast between (11a) and (11b). In particular, the presence of a structural subject on a constituent guarantees that a syntactic constituent where antecedents are available in the antecedent is the domain defined by the postverbal NP.

(14)a. John saw Mary touch herself.
b. *John saw Mary touch himself.
c. John saw Mary touch him.
d. *John saw Mary touch her.

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Neither can they be inserted into clefted positions:

(18) [\[whom we saw was Raquel\] which she took a bath]

3. Other syntactic tests for constituency

In the next section we will collect a series of syntactic arguments that challenge this conclusion. In those arguments, it is thus inevitable to consider the sentence (19) as a violation of the Islandhood of Subjects. Under the constraints that are minimally imposed on the structure of subjects, the wh-element is associated with a gap inside a subject, and a reduced clause in the wh-element is embedded in a preposition, a wh-external or an NPI.

The ungrammaticality of the example in (19) can be attributed to the fact that

(19) *What we saw was Raquel who took a bath.

The analysis of the post-verbal NP in NPI constructions as a one-constituent can be considered as a need for a sentence such as

(20) *Who did John see a friend of whom steal a car?

Which raises an issue for extraction:

(15) a. whom we saw was Raquel whom she took a bath

The post-verbal NP in NPI constructions is associated with a gap inside a subject, and a reduced clause in the wh-element is embedded in a preposition, a wh-external or an NPI.

The ungrammaticality of the example in (15) can be attributed to the fact that

(15) a. whom we saw was Raquel whom she took a bath

Finally, we note that subjects tend to be assigned to extraction:
It was Raquel Welch that we saw take a bath.

The evidence against the applicability of constituent analysis for English and German is

All three observations indicate that the appropriate sentence structure for

(24)

a. well der Polizist [jemanden gesehen haben]
   b. weil der Polizist [jemanden [gesehen haben]]

So the appropriate bracketing for (22) should be (24a) rather than (24b):

(23)

a. weil der Polizist [jemanden [gesehen haben]]
   b. weil der Polizist [jemanden [fliehen gesehen haben]]

Since the policeman saw somebody escape,

since the policeman saw somebody escape.

The topicalization test indicates that

(22)

a. weil der Polizist [jemanden [gesehen haben]]
   b. weil der Polizist [jemanden [fliehen gesehen haben]]

The simple test we have applied here is the topicalization test.

Finally, they cannot undergo alpha deletion.

We could hear, but we could not see, Raquel Welch take a bath.

They cannot be right, nor can we raise a 'no' raised.

If Raquel Welch take a bath, then we saw,

Additional evidence against a one constituent analysis comes from top-

(21)

a. Raquel Welch take a bath is a prelexical string to see
   b. Finally, they cannot undergo alpha deletion:

(20)

a. We could hear, but we could not see, Raquel Welch take a bath.
   b. They cannot be right, nor can we raise a 'no' raised.

(19)
John saw that Oswald assassinated Kennedy.

a. I saw John move the puppets.

(27)

Notice, in particular, that no privileged relationship holds between John and either Oswald or Kennedy in either (27a) and (27b). Compare this situation in (27) with the pair of sentences in (28), first observed by Vlach 1983:

(28)

a. John saw Oswald shoot Kennedy.

b. John saw Kennedy get shot by Oswald.

The invalidity of (28b) is demonstrated by (29).

z saw x y = [ z A x y ]  

(29)

The behavior of sentences in (28) is peculiar given the small clause structure in (27). To substantiate the claim in (29a) is valid, but the one in (29b) isn't.

In brief, it would seem that the subject of the perception verb and the postverbal NP stand in some special relationship in non-epistemic perceptual reports, a relationship that is wholly absent in epistemic perceptual reports. To explore this relationship, let us consider three putative counterexamples. Suppose that (28a) is valid for consider these putative counterexamples. Suppose that (28a) is valid, let us consider these putative counterexamples. Suppose that (28a) is valid.

a. John saw Kennedy get shot by Oswald.

(30)

b. I saw Oswald shoot Kennedy.

(31)

Observe by Vlach 1983:
It can be used just in case Mary is absolutely certain that no one else could be responsible for the movement of the puppets. In this case, seeing puppet movement is tantamount to direct perception of John.

Similarly, consider the case where Mary is separated from the forest by a large hill, so that she cannot see the forest (this example is due to Gee 1977). Observing a huge billow of smoke rising over the hill, can Mary later report her experience?

(31a) I saw the forest burn.

Again, the consensus of those we have asked is that (31a) is odd in the above context. We can sharpen the intuition by considering the following sentence:

(32a) I saw the forest burn, though I didn’t see the forest.

Again, the consensus of those we have asked is that (32a) is odd in the above context. We should be more certain than (31a) was, since we are more certain that the smoke was not the result of a forest fire.

VanderDoes (op.cit., p.245) discusses the following scenario: "Imagine Lucia, Henry, and Daniel sitting in separate rooms. There are four rooms in the house. The front room and Daniel’s room are connected by a phone. Lucia has a phone which enables her to speak to Henry, but only when she phones Henry. When Daniel sees the phone light up in the front room, he reports this by saying 

(33a) Daniel saw Lucia phone Henry.

VanderDoes claims that at least some of these sentences might be used. She argues that, for example, (33a) might be true if Daniel saw Lucia phone Henry and later reported that he had seen Daniel phone Henry. However, we disagree with this claim. We believe that (33a) is odd in the above context, even though Daniel might have seen Lucia phone Henry.

Let’s consider the following sentence:

(34a) I saw the forest burn.

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We believe that, for example, (34a) might be true if Daniel saw Lucia phone Henry and later reported that he had seen Daniel phone Henry. However, we disagree with this claim. We believe that (34a) is odd in the above context, even though Daniel might have seen Lucia phone Henry.
According to him, the difference in meaning between (28a) and (28b) is due to the fact that the denotation of Kennedy shot by Oswald consists of events that include Kennedy's location, while Oswald shot Kennedy denotes a set of events that are locally connected to Oswald. Vlach doesn't give an explanation for this asymmetry, but apparently he assumes that the event descriptions that include a subject denote events that are located or around the location of the referent of the subject. To test this assumption, consider (34)

(34) Jackie saw Oswald's assassination of Kennedy.

Despite the fact that the subject of the event description is Oswald and the embedded accusative NP and the embedded VP are non-constituents, the traces of the event name are supported. The accusative NP and the embedded VP should be considered to be a separate unit.

whatabout the arguments in favor of a one-constituent analysis? There were two that didn't rely on grammatical functions, coordination and anaphora. In the next section, we will demonstrate that the former argument is not conclusive; non-constituents may be conjoined. Anaphoric reference is not a conclusive criterion.

As our starting point we take the semantics of verbs of perception as proposed by Higginbotham 1983. This decision is of little significance, other proposals
Barwise's or van der Does could be modified in a similar fashion. Higginbotham assumes that verbs that can occur in the complement of NPs perceiving the category with

\[ \mathcal{N}_1 \mathcal{A} / (S \setminus N) \]  

(40)

\[ \mathcal{L} \text{ (36a) } \]

(36)

\[ \text{John sees } \]

(36b)

The variable \( \eta \) ranges over event states here. The verb sees that occurs with

\[ \text{Jackie sees Oswald shoot Kennedy.} \]

(38)

\[ \text{(ShootO Oswald JFK } \]

The variable \( \xi \) ranges over events here. The verb see that occurs with

\[ \text{Jackie sees Oswald.} \]

(36)

\[ \text{Jackie saw Oswald shoot Kennedy.} \]

(40)

We leave internal morphosyntactic details open. In particular, we do not spell out the logical form of the noun phrase. The assumption is that a complex sentence can only be derived compositionally if the accusative NP "Oswald" is an argument of the matrix verb. This holds if the accusative NP "Oswald" is an argument of the matrix verb. This is compatible with the following syntactic structure of see:

\[ \text{((ShootO Oswald JFK } \]

This is compatible with the following syntactic category of see: the Categorial counterpart to structure given in (25a).

\[ \text{(SHOOTO JFK } \]

We leave irrelevant morphosyntactic details open. In particular, we do not spell out the internal structure of NPs but abbreviate its category with

\[ \text{N}_1 \text{A} / (S' \setminus \text{N}) \]

(40)

In the sequel we will show that the semantics of verbs of perception, paired with a categorial syntax, meet the main criteria that are discussed in the literature.
Verdicality

This is Barwise's name of the inferences scheme

\((41)\) John saw Mary leave

In an event-based semantics, the logical form of \(\text{Mary left}\) is

\(\text{LEAVE}

As under Higginbotham's original account, this follows from the premise by extensionality.

\((42)\) John saw Bill walk

Coordination behaves similarly, i.e., the following two equivalences hold

\(((43)\) a. John saw Mary swim and Bill walk

Coordination behaves similarly, i.e., the following two equivalences hold

\(\text{see} \quad \text{walk} \quad \text{John saw Mary swim and Bill walk} \equiv \text{John saw Mary swim} \land \text{Bill walk}

\(\text{see} \quad \text{walk} \quad \text{John saw Mary swim or Bill walk} \equiv \text{John saw Mary swim} \lor \text{John saw Bill walk}

Absence of scope ambiguities

Absence of scope ambiguities

\((44)\) John saw Bill walk

Verdicality

\((44)\) John saw Bill walk

This is Barwise's name of the inferences scheme.

Extensionality

Under Higginbotham's original account, this follows from the premise by extensionality.
and a is b c d e f g d e f h c e f.

So in the first sentence in (43a), the substrings *Mary* and *swim* must have their own separate Boolean categories because they are not joined together in the sentence.

Under any version of CG, the accusative NP and the NI phrase cannot be combined directly to yield a Boolean category. Thus as in the case of quantifier scope, the absence of an arrow scoping the *Mary* and *swim* into the same phrase is expected. We have to answer the question how the wide scope reading is to be derived through.

Up to the present point, we remained neutral as to which version of CG is suitable. A certain degree of associativity is needed to deal with this instance of non-constituent coordination. So the question can be handled in any version of Combinatory Categorial Grammar (CCG, cf. Ades and Steedman 1982) that contains the operation of function composition.

As shown in Fig. 5

The Combinatory branch of CG uses a formalism to combine categories and the associativity of CCG uses a Lambda derivation.

Some both combinators are theorems of the Lambek calculus, this is shown in (39).
Figure 1: Derivation of John saw Mary swim and Bil walk
Failure of logical equivalence

Although the complements of perception verbs can be combined by the conjunctions "and" and "or" in classical propositional logic, it is not always possible to exchange these complements in a way that maintains logical equivalence. For instance, (44b) does not have a reading that is equivalent to (44a).

(44a) Hegel saw Schelling's sneeze.
(44b) Hegel saw (Schelling's sneeze and Hölderlin ate) or (Schelling's sneeze and Hölderlin did not eat).

To handle this problem, it has to be remarked that even though the use of logical connectives in the "complement" of perception verbs leads to logically valid inferences, the resulting statements may not be semantically equivalent to the original perception reports.

The puzzle of Russell's schoolchildren

Barwise gives a further desideratum for an adequate semantics of perception reports which is illustrated by the following inferences scheme.

(46a) Russell sees each boy touch at least one girl.
(46b) Russell sees each boy touch at least one girl.
(46c) Russell does not see any girl being touched by more than one boy.
(46d) Russell does not see any girl being touched by more than one boy.

By simple propositional reasoning we can derive that each girl is touched by exactly one boy. This does not follow from (44a), so (44a) and (44b) cannot be equivalent.

Hölderlin and what is seen by Hölderlin's acts is seen by Hölderlin. Hölderlin's acts is seen by Hölderlin.

A girl who is not touched by a boy is not touched at all. Russell sees each boy touch at least one girl. Russell does not see any girl being touched by more than one boy. Russell does not see any girl being touched by more than one boy. Russell sees each boy touch at least one girl. Russell sees each boy touch at least one girl. Russell does not see any girl being touched by more than one boy. Russell does not see any girl being touched by more than one boy. Russell sees each boy touch at least one girl. Russell sees each boy touch at least one girl. Russell does not see any girl being touched by more than one boy. Russell sees each boy touch at least one girl.
Happens that each girl receives exactly two phone calls. So each girl picks up two receivers simultaneously and holds them to her ears (one receiver per ear). The TV audience can see all 15 participants, but they can only see the left side of the girls. Russell was watching this silly show on TV. In this situation a) and b) are true, but c) isn’t:

a) Russell saw each boy calling at least one girl.
b) Russell didn’t see any girl being called by more than one boy.
c) There are at least as many girls as boys.

This is problematic for the theories of Barwise, Higginbotham, and van der Does, since they uniformly predict that if Russell sees Ô calling Ô, he also sees Ô getting a call by Ô. So if Russell sees two boys calling the same girl, he would see this girl getting calls from two boys. This makes the argument valid. Since we don’t claim that Russell sees a girl called if he sees a boy call her, no such prediction is made.

To sum up this section, we tried to demonstrate that a fairly innocent modification of Higginbotham’s proposal is sufficient to accommodate Vlach’s puzzle while preserving its general advantages. Likely a similar adjustment could be made with other theories of the semantic of perceptual reports. We have argued that the semantic puzzles posed by perceptual reports need a treatment that accounts for all the problems to which they give rise. In this paper, we have presented some arguments for a modified analysis of perceptual reports.

6. Conclusion

In this paper, we have presented some arguments for a modified analysis of non-finite complement verbs of perception. We have argued that the semantic analysis that takes the non-finite complement as a constituent denoting a scene or situation fails to provide a satisfactory account of certain counterintuitive facts. If we insist on compositional interpretation, the information-exchange a one-sentence model may be made with other theories of the semantics of perceptual reports, which predict the presence of a semantic value. The dualist’s proposal is sufficient to accommodate these facts. To sum up, this section, we need to demonstrate that a fairly innocent modification of Higginbotham’s proposal is made.

Russell didn’t see any girl being called by more than one boy.

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There are at least as many girls as boys.

Russell didn’t see any girl being called by more than one boy.

Russell saw each boy calling at least one girl.

However, however, this is not the case, because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics. We believe, however, that the standard account, the subject properties of the NP follow because these properties are considered with the semantics.
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are not included in the provided list.

As we conclude this article, it is important to note that the problem of the
subject properties of the local clause is not yet fully understood. Further
evidence is needed to fully resolve this issue. However, the tentative hypo-
hesoses presented here provide a framework for future research in this
area.
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