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Minimal Projection Heads & Optimality

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Minimal Projection, Heads, and Optimality

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0. Introduction

The goal of this paper is to show that inversion of the subject and auxiliary verb in English follows from the interaction of four principles, given the notion of Extended Projection proposed in Grimshaw (1991).

The principles are these:

Projection Principle (Proj-P)
Selected complements must be the same at d-structure and s-structure

Operators-in-Specifier (Op-Spec)
Syntactic operators must be in Specifier position

Obligatory Heads (Ob-Hd)
Heads must be filled at s-structure

Minimal Projection (Min-Proj)
A functional projection must be functionally interpreted

There is no theory of inversion per se, rather the patterns of inversion follow from the *interactions* among these principles. Moreover, because of the generality of the principles the theory extends automatically to the distribution of *do* and to the occasional obligatoriness of the *that* complementizer.

Proj-P is a generalized version of the principle proposed in Chomsky (1981), which constrains head movement as in Rizzi and Roberts (1989), and adjunction (McCloskey 1992). Proj-P prohibits these movements in a selected projection.

Op-Spec is based on the insight of Rizzi (1991) and related work, that there is a special relationship between the Specifier position and a certain kind of operator. I define a syntactic operator as a scope-bearing expression which takes its scope by virtue of its syntactic (as oppposed to LF) position. Op-Spec requires that such an expression be a Specifier.

Ob-Hd requires a head to be filled: it can be filled by lexical material, by a trace, or by phi-features, as in the English I.

Min-Proj requires that a functional projection make a contribution to the functional representation of the extended projection that it is part of; it is a relative of the principle of "Full Interpretaton". It is violated by empty projections, by projections which contain only functionally unspecified material and by projections which contain redundant functional information.

The nature and distribution of inversion follows from the interaction of these principles, which are related in a special way: they have the potential to conflict with each other. For example, Ob-Hd requires X-0 movement to fill the head of a projection, but Proj-P will prohibit such movement if the projection is selected. Such conflicts prove essential to explaining the empirical generalizations at issue, and can be straightforwardly understood under the assumptions of Optimality Theory, as developed by Prince and Smolensky (1993) (see Legendre et al (1993) for another instance of the application of Optimality Theory to syntactic representations). The core of Optimality is these three ideas:

Constraints can be violated
Constraints are ranked
The optimal form is grammatical

To preview a central case from the present work, a clause in which Ob-Hd is violated can be grammatical, but only where Ob-Hd conflicts with Proj-P, and where there is no other form available which satisfies both principles. In this situation, the form that violates Ob-Hd is optimal, hence grammatical. This is the key to the distribution of inversion.

Several of the principles have appeared in the literature, either in the form of concrete proposals incorporated into the theory here, or in the form of background assumptions which are recognised as partial truths and occasionally appealed to as part of an explanation. This is the case for Ob-Hd, for example. In order to recruit them in an explanation for inversion, however, we must take several theoretically important steps.

First, the principles are not "surface-true", i.e. it is easy to find examples of clauses that violate them. Thus one might be led to believe that they are not in fact correct. Under Optimality Theory, however, this is exactly what we expect: the only principle which will always be surface-true is one which never conflicts with any other principle, or which is victorious in any conflict because it is higher ranked than any principle that it conflicts with.

Second, the assumption that clauses are not structurally uniform (the result of Min-Proj) interacts in crucial ways with the rest of the system. This contradicts a background position which, though rarely stated, seems quite pervasive, and which leads to conclusions such as these: if any matrix clause must be a CP, then every matrix clause must be a CP; if a verb ever takes a CP complement then it always takes a CP complement; if a projection is ever possible it is always present. The background assumption of structural uniformity is explicitly denied by Min-Proj. This principle has an obvious affinity with recent proposals concerning economy and minimalism (Chomsky (1991, 1992)).

Finally, we will make essential use of the notion of extended projection (see Grimshaw 1991, Van Riemsdijk (1990), also Haider (1989) for a related proposal). The fundamental claim is that the functional projections erected over a lexical projection are projections not only of their own structural head but also of the head of the lexical projection. A CP is thus an extended projection of V (also in fact of I). A match in syntactic category is a prerequisite for an extended projection: C, I, and V are all verbal in category, P (or at least some Ps), D, and N are all nominal. The smallest verbal projection, then, is VP. IP is intermediate in size between VP and CP.

This plays a critical role in the argument of the present paper in two respects. First, the proper understanding of the Proj-P depends on the theory of selection, and it is crucial that extended projections be regulated by principles of projection and not of selection. Second, an essential component of OT concerns the definition of the set of competitors: the best form will be grammatical, but which forms must be considered in deciding which is best? The competition set is defined as the class of extended projections with identical lexical projections, and non-distinct LF representations. Competition is therefore between bigger and smaller extended projections with the same lexical projection at the base.

An inevitable outcome of the line of research developed here is a re-evaluation of the status of functional projections. I will argue that labels like "CP", "IP" etc. are merely notational conveniences. They play no role in the theory, which just requires that an extended projection be composed of a series of projections of matching category, its size and organization determined by a set of general well-formedness principles.

1. The Basics

First, consider an English matrix declarative sentence. Here, inversion is neither required nor allowed.

(1) a. They will read some books
b. *Will they read some books

Under Minimal Projection, these are IPs, not CPs. Well-formedness requirements require the V in a matrix declarative to be finite, hence the extended projection must be an IP rather than a VP for this reason at least, perhaps also for reasons having to do with the Extended Projection Principle (Chomsky 1981). Crucially, no well-formedness requirements motivate Spec of CP, or C. Hence a CP representation for these clauses violates Min-Proj, and the clauses must be represented as IPs. Thus the only heads are V and I, both of which are filled: V by lexical material and I by phi-features. There is no empty head and inversion is both unnecessary and impossible.

(2) $[_{IP}$ They will $[_{VP}$ read some books]]

The second basic example is that of English matrix wh questions. Wh questions are operator variable constructions and the wh phrase is subject to Op-Spec, hence it must be in Specifier position. Specifier of VP is filled by the underlying subject, specifier of IP by the surface subject, hence the operator must be in specifier of a higher projection. Matrix questions will have to be CPs in order not to violate Op-Spec. In questions introduced by *how come* there is no empty C because *how come* itself is a C (Collins 1991). But in other wh questions, the CP has an empty C head, which must be filled, otherwise Ob-Hd will be violated. C cannot be filled by the complementizer *that* because *that* is a subordinator, and cannot occur in main clauses. So the only way for C to be filled is by head movement. Thus in English wh questions, inversion is both possible and necessary, in order to satisfy Ob-Hd.

(3) a. Which books will they t read t?
b. *Which books they will read t?

(4) $[_{CP}$ Which books$_i$ will$_j$ $[_{IP}$ They e_j $[_{VP}$ read e_i]]]

In English matrix yes-no questions, inversion is again required.

(5) a. Will they read some books?
b. *They will read some books?

If matrix yes-no questions are CPs this effect will be explained. The C position will be empty, and Ob-Hd will induce inversion. Why is a CP consistent with Min-Proj here? Yes-no questions, like wh questions, involve an operator, which must be in Spec of CP, to satisfy Op-Spec. This is a crucial assumption (for interrogative complements at least) under Relativized

Minimality (Rizzi 1990a), since embedded yes-no questions induce minimality effects like those induced by overt wh interrogative operators. Moreover, polarity items can occur in yes-no questions, as illustrated by the polarity interpretation of any in (6), again motivating the presence of an operator to license them:

(6) Will they read any books?

So a matrix yes-no question is a CP with an empty C, hence inversion is predicted.

The fact that inversion is obligatory in yes-no questions is obscured by the existence of the use of declaratives with interrogative intonation to function as questions. Given the assumptions made here, these cannot be true interrogatives, since they are not CPs, and indeed we find that these sentences do not allow polarity items, so *any* in (7) has only the free choice reading:

(7) They will read any books?

Polarity items are licensed by an operator: the operator is present in (6) but not in (7); if it were present in (7) then CP would be motivated and inversion would have occurred.

This illustrates the idea. A clause is only as big as it needs to be. It is an IP unless it has to be a CP (a VP unless it has to be an IP, cf. Safir (1993)). A clause always has the minimal structure consistent with its well-formedness. There is no fixed structure for either matrix or subordinate clauses; no unique answer to the question of whether they are IPs or CPs. Sometimes they are one, sometimes the other, depending on what well-formedness conditions are relevant. However, every projection that is present has a head position which must be filled and inversion results when head movement applies to satisfy Ob-Hd. The head which moves is simply the one that is in the right structural position for movement (given ECP), and it moves just to fill a structural position.

Later we will develop the picture further by looking at a range of constructions in which inversion takes place: matrix yes-no questions, negative preposing contexts, conditionals, and verb second clauses. In each case we see the same basic paradigm: an "extra" projection is motivated by some well-formedness principle, and inversion fills an otherwise empty head.

2. Constraint Conflict: Obligatory Heads and the Projection Principle

As is well known, inversion in interrogatives is limited to main clauses in most varieties of English (see McCloskey (1992) for analysis of inversion in Hibernian English).

(8) I wonder when I will see such a sight again
*I wonder when will I see such a sight again

This simple fact turns out to provide key information about the system of principles involved in inversion, and explaining it will be a central result of the theory. Initially it is quite puzzling. Op-Spec will require that the wh phrase be in Specifier of CP in subordinate interrogatives, for just the same reason as in matrix interrogatives. Wh phrases show polarity licensing behavior in both.

(9) How many students have done any homework?
I wonder how many students have done any homework
They asked how many students had done any homework

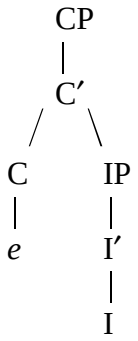
Thus we cannot reasonably assimilate subordinate interrogatives to the case of topicalization, which I will argue in Section 5 are adjunctions (although adjunction seems to be a possibility in French, see 5.2 and Déprez (1991)). The CP projection must be present, yet its head is apparently empty. Why then doesn't Ob-Hd require filling of the head position here as in matrix clauses?

This is where the ideas of constraint domination developed in Prince and Smolensky (1993) come into play. What I propose is that Ob-Hd is violated in subordinate interrogatives because it conflicts with a higher-ranked constraint in exactly this instance. This higher-ranked constraint is the Projection Principle. The constraints conflict because filling the head position would violate Proj-P. Since Proj-P is the dominant constraint, and since it is not possible to satisfy both Proj-P and Ob-Hd, the structure with the head position empty is well-formed. It is the optimal structure, hence it is the only one possible.

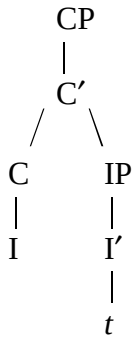
There are two crucial steps involved in recruiting Proj-P to interact with Ob-Hd in the right way. The first is to accept the idea proposed in Rizzi and Roberts (1989) that Proj-P rules out movement into the head of a selected phrase. The second is to incorporate into Proj-P the Extended Projection theory of selection: this will be postponed to 4.1.

Rizzi and Roberts' proposal is that the root nature of certain head movements (see Emonds 1975) follows from the Proj-P. Head movement which is direct substitution is disallowed in selected contexts. When (10b) is derived from (10a), for example, (their (39a,b), the s-structure head will be both a C and an I. A verb which selected this head would have a different complement after movement than it had before movement.

(10a)



(10b)



The Proj-P proposed here in fact generalizes even further, so that it excludes adjunction to arguments, which would have the result that the complement at d-structure is not the complement at s-structure. Selection will then prevent both inversion and adjunction. Thus we can derive the general finding that adjunction to arguments is impossible (Chomsky 1986, McCloskey 1992), and the observation made by Rochemont (1989) that topicalization adjoins to either CP or IP in a matrix, but only to IP in a subordinate clause.

Proj-P will disallow head movement in complements to lexical heads, but it will allow head movement in matrix clauses and adjuncts. Ultimately we will see also (section 4.1) that it will allow movement in complements to functional heads, since they are not selected in the Extended Projection view of head-complement relations (Grimshaw 1991)). From this plus the Optimality Theory idea of constraint interaction, we derive the full pattern of inversion. Ob-Hd will be satisfied except where it conflicts with Proj-P.

3. The Optimality Theoretic Account

We can now lay out a precise version of the analysis in terms of optimality. In fact, even before investigating subordinate interrogatives we had already appealed implicitly to the notion that a constraint can be violated if the violation leads to satisfaction of another constraint. Min-Proj says that empty projections are not possible, because they have no functional content.. However, in order to satisfy Op-Spec we posited exactly such projections in the form of empty CPs, with Spec positions filled at s-structure by a wh operator. (Examples with negative operators will arise later). Thus it is clear that Min-Proj should be viewed as a violable constraint, which can conflict with Op-Spec, and lose. In other words it is ranked lower than Op-Spec.

The theory must specify the constraints and their ranking. So far, then, we have determined that Op-Spec outranks Min-Proj and that Proj-P outranks Ob-Hd. The correct ranking will ultimately prove to have Op-Spec higher ranked than Ob-Hd, as we will see below, so I will always represent them in this way, where the left to right arrangement reflects ranking:

Proj-P Op-Spec Ob-Hd Min-Proj

The theory will be successful if the grammatical sentences are those which are optimal. The optimal form is selected from among the class of competitors in the following way: the form which satisfies the highest-ranking constraint on which the competitors conflict, is optimal.

For example, consider a situation where constraint A outranks B and B outranks C. Suppose there are two competing forms, one which satisfies A, violates B, and satisfies C; and a second form which satisfies A and B and violates C. We can represent this as follows:

A *B C
A B *C

The optimal form is the second one, since the highest ranked constraint on which they differ is B, and the second form satisfies B. I refer the reader to Prince and Smolensky (1993) for further details.

An essential component of the theory is the set of principles by which the class of competitors, Prince and Smolensky's "candidate set", is chosen. In order to determine which form is optimal we need to know which forms to compare. As I mentioned in the Introduction, the class of competitors is the set of extended projections which shares a lexical projection and has a non-distinct logical form. (I will postpone a more precise treatment until Section 8.) In a matrix declarative such as (1), then, it is the set of extended projections which include will and have the same underlying VP.

We can now see how these principles and their ranking work out in the cases discussed so far. In order to simplify the presentation, I will assume that the possibility of a VP as a matrix

or complement clause is ruled out, so I will not consider VP as one of the possible structures to be evaluated by the principles. I adopt a notational convention for extended projections which can be illustrated in this way: a CP in which the C takes an IP complement in which the I takes a VP complement is written as: CP-IP-VP. A "$" indicates the optimal, i.e. grammatical version of the extended projection. I will present the constraints in accordance with their final ranking, and will point out the crucial evidence as we proceed. I will provide labelled bracketings, but to make them readable I will not show movement of the subject from inside VP to Specifier of IP.

3.1 Matrix Declaratives

$[_{IP}$DP I $[_{VP}$ V ..]]	Proj-P Op-Spec Ob-Hd Min-Proj	$
$[_{CP}$ e $[_{IP}$DP I $[_{VP}$ V ..]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj	
$[_{CP}$ I_i $[_{IP}$DP e_i $[_{VP}$ V ..]]]	Proj-P Op-Spec Ob-Hd *Min-Proj	

When the matrix is an IP, every principle is respected. (It follows from this that the corresponding sentence must be grammatical.) Ob-Hd is satisfied by phi features in I and by a lexical head in V. Min-Proj is respected since there is no empty projection, and Proj-P and Op-Spec are not relevant. When the matrix is a CP, Min-Proj will always be violated, since the CP is empty. In addition, if nothing inverts to C, Ob-Hd will be violated. Thus of the three competing possibilities, the best is the IP. It is crucial that IP and CP compete, otherwise the optimal CP variant would be grammatical and inverted declarative CPs would be grammatical, alongside declarative IPs. Matrix declaratives provide no grounds for ranking: the constraints never conflict hence any ranking will give the same result.

3.2 Matrix Interrogatives

$[_{IP}$DP I $[_{VP}$ V wh]]	Proj-P *Op-Spec Ob-Hd Min-Proj	
$[_{CP}$ e $[_{IP}$DP I $[_{VP}$ V wh]]]	Proj-P *Op-Spec *Ob-Hd *Min-Proj	
$[_{CP}$wh e $[_{IP}$DP I $[_{VP}$ V t]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj	
$[_{CP}$wh I_i $[_{IP}$DP e_i $[_{VP}$ V t]]]	Proj-P Op-Spec Ob-Hd *Min-Proj	$

If the matrix is an IP, Op-Spec will be violated, since the wh operator will not be in a Specifier position. (See 6.4 for the case where the Spec of IP is a wh operator). When the

matrix is a CP, Min-Proj is violated because the CP is empty at d-structure. If wh movement does not apply Op-Spec will be violated here too. Op-Spec can be satisfied by movement to Spec of CP, and Ob-Hd will be satisfied if I inverts to C, violated otherwise. Hence the optimal form is CP-IP-VP with inversion: it satisfies all constraints except Min-Proj.

Matrix interrogatives, as noted previously, provide crucial evidence that Op-Spec outranks Min-Proj.

3.3 Subordinate Interrogatives

The crucial point of contrast between a matrix interrogative and a subordinate interrogative lies in the fact that the matrix CP is unselected, so Proj-P is irrelevant. The subordinate interrogative is selected, however. Let us for now consider just the CP version of the complement.

$[_{CP}$wh e $[_{IP}$DP I $[_{VP}$ V t]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj $
$[_{CP}$ e $[_{IP}$DP I $[_{VP}$ V wh]]]	Proj-P *Op-Spec *Ob-Hd *Min-Proj
$[_{CP}$wh I_i $[_{IP}$DP e_i $[_{VP}$ V t]]]	*Proj-P Op-Spec Ob-Hd *Min-Proj
$[_{CP}$ I_i $[_{IP}$DP e_i $[_{VP}$ V wh]]]	*Proj-P *Op-Spec Ob-Hd *Min-Proj

The CP complement will violate Min-Proj. If wh preposing does not occur, Op-Spec will be violated. With respect to the other principles there are two possibilities: if inversion occurs Ob-Hd will be satisfied, but Proj-P will be violated, since this is a selected complement. If inversion does not occur Ob-Hd will be violated but Proj-P will be satisfied. The optimal form is one which satisfies Proj-P and Op-Spec but violates Ob-Hd, hence the clause with no inversion is grammatical, and the clause with inversion is not. Ranking Proj-P above Ob-Hd derives the absence of inversion in subordinate interrogatives, since the optimal form violates Ob-Hd. Thus here we have critical evidence that Proj-P outranks Ob-Hd.

The presence of an additional projection above CP would eliminate the Proj-P violation for subordinate interrogatives with inversion, so why is this not possible? The answer is that such an extra projection will always result in a situation which is less favored than the one with no inversion: the extra projection will violate both Min-Proj and Ob-Hd. For subordinate interrogatives with wh movement and no inversion the analysis is: Proj-P Op-Spec *Ob-Hd *Min-Proj. With the extra projection and inversion in CP the analysis is: Proj-P Op-Spec *Ob-Hd **Min-Proj. Hence the non-inverted structure is optimal.

So far we have examined only the CP form: if the clause is just an IP then Op-Spec will necessarily be violated: it turns out that by examining this case we determine that Op-Spec is crucially ranked higher than Ob-Hd. With this ranking we correctly predict that the best CP structure is better than IP, since Op-Spec is more important than Ob-Hd:

$[_{IP}$DP I $[_{VP}$ V wh]]	Proj-P *Op-Spec Ob-Hd Min-Proj
$[_{CP}$wh e $[_{IP}$DP I $[_{VP}$ V t]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj $

If Ob-Hd were ranked higher than Op-Spec the IP complement would be the optimal one, since it would now be better than the best CP, and we would predict no wh movement in complements at all:

$[_{IP}$DP I $[_{VP}$ V wh]]	Proj-P Ob-Hd *Op-Spec Min-Proj $
$[_{CP}$ e $[_{IP}$DP I $[_{VP}$ V wh]]]	Proj-P *Ob-Hd *Op-Spec *Min-Proj
$[_{CP}$wh e $[_{IP}$DP I $[_{VP}$ V t]]]	Proj-P *Ob-Hd Op-Spec *Min-Proj
$[_{CP}$wh I_i $[_{IPDP}$ e_i $[_{VP}$ V t]]]	*Proj-P Ob-Hd Op-Spec *Min-Proj

The IP complement violates Op-Spec only. The best CP complement, however, violates Ob-Hd, and no higher ranked principle. If, then, Ob-Hd is ranked higher than Op-Spec, the form which respects Ob-Hd will be optimal, giving us the indicated winner, with the result that there is no wh movement in complement clauses. Hence the ranking must have Op-Spec above Ob-Hd.

We can now see how the system works in subordinate yes-no questions, which will be CPs by the reasoning just applied in wh questions. The *if* version will respect all four principles: presumably *if* has a functional specification so its presence will satisfy Min-Proj, although this is not actually crucial here. Certainly *if* fills C so Ob-Hd is satisfied, Op-Spec is satisfied if the null operator is in Spec of CP, and Proj-P is satisfied since nothing has changed in the derivation.

$[_{CP}$Op if $[_{IP}$DP I $[_{VP}$ V ..]]]	Proj-P Op-Spec Ob-Hd Min-Proj

Under the proposal in Kayne (1991), *whether* is a Spec of CP, unlike *if*, so it occurs with an empty C. In order to fill C, movement would have to take place into the head of a selected complement. Here, as in the other kinds of subordinate interrogatives, Proj-P and Ob-Hd conflict, and Proj-P is dominant, so we find no inversion in *whether* clauses. (I have marked Min-Proj as violated here but nothing depends on this interpretation.)

$[_{CP}$whether e $[_{IP}$DP I $[_{VP}$ V t]]]	Proj-P *Ob-Hd Op-Spec *Min-Proj $
$[_{CP}$whether I_i $[_{IP}$DP e_i $[_{VP}$ V t]]]	*Proj-P Ob-Hd Op-Spec *Min-Proj

This case is informative for the principles which govern competition, to be taken up in Section 8. Assuming Kayne's proposal, the indirect question introduced by *if* and the indirect question introduced by *whether* must not compete. If they did compete then the *if* form would be the only grammatical one, since it violates no constraints while the best *whether* version violates Ob-Hd.

So far, then, we have evidence for the following pair rankings:

Proj-P > Ob-Hd; Op-Spec > Ob-Hd; Op-Spec > Min-Proj

Subsequently we will find evidence that Ob-Hd outranks Min-Proj. Evidence for ranking comes, of course, from the instances where there is a conflict between two principles. It is the resolution of the conflict that tells us which of the two constraints is dominant.

There is one more respect in which the pattern of subordinate interrogatives could be the result of constraint conflict. The maximally general formulation of Proj-P given in Section 1 is violated by wh movement in a subordinate clause, as well as by head movement. So we need either to take a more specific version of Proj-P, which will allow movement to Specifier, or to consider the possibility that Op-Spec is ranked above Proj-P. The result of the ranking would be that movement to Specifier is freely available in subordinate clauses, while the other movements are not. Adding Op-Spec into the constraint evaluation we would arrive at this analysis, which correctly predicts that wh preposing with no inversion is optimal, since it beats absence of wh preposing on Op-Spec, and preposing with inversion on Proj-P, the highest ranking, where inversion adds a second violation.

$[_{CP}$wh e $[_{IP}$DP I $[_{VP}$ V t]]]	Op-Spec *Proj-P *Ob-Hd *Min-Proj $
$[_{CP}$ e $[_{IP}$DP I $[_{VP}$ V wh]]]	*Op-Spec Proj-P *Ob-Hd *Min-Proj
$[_{CP}$wh I_i $[_{IPDP}$ e_i $[_{VP}$ V t]]]	Op-Spec **Proj-P Ob-Hd *Min-Proj

I will leave open the question of whether this further generalization of Proj-P is correct, and continue to assume that Proj-P and Op-Spec are not crucially ranked. Nothing in this paper depends on this assumption.

Thus we have answered three questions: why there is no inversion in matrix declaratives, why there is inversion in matrix interrogatives and why matrix and subordinate interrogative clauses should show different inversion patterns. Heads are obligatory except where Proj-P makes them impossible. The fact that an empty head is possible is a side effect of the fact that movement is not. Since Proj-P does not affect matrix clauses or adjuncts, a head can be empty only in a selected complement.

The essential property of the solution is that each component principle is fully general: none of the principles is specific to interrogatives or to inversion, for example. In fact, there is no theory of inversion here, inversion is just the result of Ob-Hd, whose effects are seen whenever the effects of Proj-P do not obscure them.

3.4 Some Alternatives

Consider an alternative to the constraint conflict proposal for the absence of preposing in subordinate interrogatives, which might have some initial appeal, namely that there is a null C, or a C filled by +wh, in subordinate interrogatives. Now it is necessary to distinguish in a principled way between the empty head in this case, which by hypothesis would be filled by a null element, and other empty heads, such as the one in a matrix interrogative (and others to be analyzed in Section 4), which cannot be filled by a null complementizer.

In order to make this distinction, it is necessary to state that only selected heads can be null. What is revealing about this idea is that it builds into the principle governing empty heads exactly the effects of Proj-P. The situation is that heads can be empty in exactly the case where Proj-P will not allow them to be filled: this is a direct consequence of constraint conflict but not of an empty heads solution, where a condition reflecting the effects of conflict must be stipulated. The highly specific character of this kind of solution entails that it cannot extend over the range of cases which follow from the present proposal: this will be particularly clear in the case of obligatory complementizers (Section 7).

A particularly telling example is the following condition from Plunkett (1990):

> Specifier Licensing Condition (Plunkett 1990, 128)
> If a maximal projection is in a non-subcategorized position, its specifier may not be filled at s-structure unless its head position has also been filled by that time.

This is a description of an empirical situation, not the explanation for it. It is certainly not the principle governing inversion. Examining each part of the condition reveals that it is a statement concerning the effects of the interaction of the relevant principles in the particular case at hand.

A recent proposal for inversion has been developed by Rizzi (1991) Haegeman (1992). It uses the idea that a head with a certain feature has to raise in cases of inversion in order to get into a Specifier-head relationship with a Specifier with the same feature, to meet a well-formedness principle, called the "Wh Criterion" for the interrogative cases. The matrix-subordinate contrast results from the initial distribution of the feature: it is on I at d-structure in matrix clauses, hence it must raise to C, and it is on C already in subordinate clauses, hence inversion is not required to put it in the right relationship to Specifier of CP.

The insight that the relationship of Specifiers and heads lies behind inversion is incorporated into the present proposal. The central difference between the two proposals lies in the role of constraint conflict. What is the result of constraint interaction in the present paper is instead the

result of feature distribution in Rizzi-Haegeman approach. The d-structure position of the features is determined by selection: selected +wh goes in C, unselected in I. In this way the Wh Criterion builds into the account of feature distribution the effects of the independently existing Proj-P.

Maximally general principles will inevitably conflict. The alternative is to formulate more specific principles which are designed never to conflict, and the price is generality. In the remainder of this paper we will see the effect of the generality of Ob-Hd, in predicting the distribution of *do*, and of *that* as a obligatory element. Only by allowing constraints to conflict can we avoid building the effects of every principle into all of the others that it potentially conflicts with.

4. Inversion into Unselected Projections

Inversion into the head of a selected projection violates Proj-P. Matrix CPs are one kind of unselected projection, and there inversion does occur. The prediction is of course that other unselected projections will also admit inversion. In this section I investigate the other projections where inversion takes place, and show that this is indeed because Proj-P is not operative there.

4.1 Inversion in Complements to functional heads: *Negative Preposing*

If a negative operator is preposed inversion is required, as illustrated in (11) (Klima 1964, Liberman (1974)). In the absence of preposing, inversion is not allowed (see (12)).

(11) a. Never in her life will she work this hard again
b. *Never in her life she will work this hard again

(12) a. She will never (in her life) work this hard
b. *Will she never (in her life) work this hard

As expected, a moved negative takes scope over the entire IP:

(13) *Anyone will never work this hard again
Never will anyone work this hard again

This paradigm follows under the assumption that negative operators occur in specifier position, so a projection is present when preposing occurs, which is otherwise absent. The head of this projection is empty. Hence head movement must occur to fill the head, and inversion follows. (Several other operators prepose and induce inversion, just like the negatives, but I will not illustrate them here.)

What projection is involved? It cannot be CP since the negative element follows C in subordinate clauses, where the entire paradigm can be replicated, a point which I take up shortly.

(14) a. She said that never in her life would she work this hard again
b. *She said that never in her life she would work this hard again
c. She said that she would never (in her life) work this hard again
d. *She said that would she never (in her life) work this hard again

Nor can the projection be IP since the Specifier of IP is already filled by the subject. Thus the projection must be a further member of the verbal extended projection, which intervenes between IP and CP. I label it "XP" and postpone further discussion of its analysis until the final section of the paper.

(15) $[_{CP}$ C $[_{XP}$ X $[_{IP}$DP I $[_{VP}$ V Adv]]]

When negative preposing occurs in a matrix clause, the possibility of having a CP projection is ruled out in just the same way as for matrix declaratives; the CP projection will violate Min-Proj and Ob-Hd, and otherwise have the same constraint profile as the XP, so it can never be optimal. I will therefore demonstrate the operation of the principles only for XP and IP.

$[_{IP}$DP	I	$[_{VP}$	V	Adv]]]				Proj-P	*Op-Spec	Ob-Hd	Min-Proj
$[_{XP}$	e	$[_{IP}$	DP	I	$[_{VP}$	V	Adv]]]	Proj-P	*Op-Spec	*Ob-Hd	*Min-Proj
$[_{XP}$never	e	$[_{IP}$	DP	I	$[_{VP}$	V	t]]]	Proj-P	Op-Spec	*Ob-Hd	*Min-Proj
$[_{XP}$	I_i	$[_{IP}$	DP	e_i	$[_{VP}$	V	Adv]]]	Proj-P	*Op-Spec	Ob-Hd	*Min-Proj
$[_{XP}$never	I_i	$[_{IP}$	DP	e_i	$[_{VP}$	V	t]]]	Proj-P	Op-Spec	Ob-Hd	*Min-Proj $

If the matrix is an IP then there will be no possibility for preposing in the first place, so Op-Spec will be violated.[1] If the matrix is an XP, Min-Proj will always be violated because the XP will be empty. There are four possibilities for the XP: no inversion and no preposing will violate Ob-Hd and Op-Spec, preposing without inversion will violate Ob-Hd, inversion without preposing will violate Op-Spec, but preposing with inversion will violate nothing other than Min-Proj. Hence it is optimal, and grammatical. In this way the principles predict that preposing "induces" inversion, and inversion is impossible without preposing.

When we turn to negative preposing in subordinate clauses, we confront the revealing fact that inversion to X is not limited to main clauses. We have seen why inversion is not possible

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[1] I have simplified the discussion here by proceeding as if all negative phrase operators are subject *t*o Op-Spec. This is a translation into the present terms of the position taken in Rizzi (1991, class lectures LSA Linguistic Institute): a negative phrase cannot be a syntactic operator unless it is in Specifier position. This leaves open the analysis of negative expressions that are not moved to Spec of XP, such as never in (i): they are scope-taking even if they are not operators, so what well-formedness conditions are relevant for them?

(i) She has never read anything in my class

The position occupied by never here seems to be a phrasal rather than a head position: it can be occupied by expressions like quite often, almost always, although not by PPs like on Tuesdays. There are two likely analyses. The phrase is a Specifier, of a projection intermediate between VP and the projection of the auxiliary verb, the head position being unfilled because there is nothing available to fill it (or perhaps being filled by the main verb). Alternatively it is an adjunct, in which case it takes scope by virtue of its LF position, ie. it is not a syntactic operator. It is then necessary to explain why it cannot then adjoin to IP and take scope from there. If this were possible, there would be a well-formed structure without inversion, with the same structural analysis as topicalization (see Section 5). To exclude this possibility, we might hypothesize that LF operators, as opposed to syntactic operators, take scope only from their d-structure positions. It then follows that an operator either undergoes movement to Specifier and takes scope from there, or stays in place and takes scope only at LF.

in subordinate interrogatives, but why isn't the same true here? Why should inversion in interrogatives be sensitive to the main/subordinate distinction, but inversion with negative preposing not show a matrix-subordinate contrast?

Here it becomes important to accept the basic premise of Extended Projection (Grimshaw 1991), that the well-formedness of an extended projection is governed by projection, and not selection. In this view, functional heads do not select their complements, only lexical heads do. The principles which determine what complements functional heads take are principles of projection such as categorial consistency, and principles of functional composition. The XP projection motivated by operator movement is part of the verbal extended projection: more specifically it is a complement to C. But it is not selected by C, since C is a functional head. In fact, the behavior of XPs illustrates the argument developed in Grimshaw (1991) for the absence of selectional effects with functional heads. If C did select it would be necessary to complicate the description of C in order to allow it to take either an IP or an XP complement. Once we abandon the idea that selection regulates the relationship between C and the lower part of the extended projection, the optionality of XP is no longer a complication, it is simply the result of the fact that no principles require that XP always be present. (See the final section for an extended version of this argument.)

We now derive the consequence that Proj-P will be violated by head movement into the complement of a lexical head, but not by movement into the complement of a functional head; it follows from the fact that lexical heads are selectors and functional heads are not. The CP of a subordinate interrogative is a complement to a lexical head. The XP of preposed negatives is a complement to a C. XP is like a matrix clause in the critical respect: both are unselected, and therefore both allow inversion.

In demonstrating that the principles do give the right results here, I will simplify the presentation at this point, and consider only the case where the complement is a CP with *that* filling C. In Section 7 I will show that this is indeed the only possibility allowed, since all the other possibilities are less than optimal.

$[_{CP}$ that $[_{IP}$ DP	I	$[_{VP}$ V Adv]]]		Proj-P *Op-Spec Ob-Hd Min-Proj
$[_{CP}$ that $[_{XP}$	e	$[_{IP}$ DP I	$[_{VP}$ V Adv]]]	Proj-P *Op-Spec *Ob-Hd *Min-Proj
$[_{CP}$ that $[_{XP}$never	e	$[_{IP}$ DP I	$[_{VP}$ V t]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj
$[_{CP}$ that $[_{XP}$	I_i	$[_{IP}$ DP e_i	$[_{VP}$ V Adv]]]	Proj-P *Op-Spec Ob-Hd *Min-Proj
$[_{CP}$ that $[_{XP}$never	I_i	$[_{IP}$ DP e_i	$[_{VP}$ V t]]]	Proj-P Op-Spec Ob-Hd *Min-Proj $

If the CP dominates just IP, then Op-Spec will be violated. If XP is present Min-Proj is always violated, since XP is empty at d-structure. With no preposing and no inversion Op-Spec and Ob-Hd are violated; with negative preposing but no inversion Ob-Hd is violated; with inversion but no preposing Op-Spec is violated, and with both preposing and inversion nothing but Min-Proj is violated. Hence the version with preposing and inversion is the grammatical one.

As discussed above, Ob-Hd does not conflict with Proj-P here since the XP is not a selected complement, being the complement of a functional head, C, and not of a lexical head. This is why inversion with negative preposing is unaffected by the matrix/subordinate distinction.

Min-Proj requires that the XP intermediate verbal projection be omitted unless its presence leads to satisfaction of a higher ranked principle. As a consequence the structure of a subordinate clause with a preposed negative is different from that of one with no preposing. One has the extra XP and the other does not. This is crucial to inversion of course: when the XP is present inversion must occur, when the XP is absent inversion is not possible. In order to understand inversion in this way it is essential to view it as the result of an interaction between Op-Spec, Min-Proj and Ob-Hd. It is Ob-Hd which requires that a head be filled, but it is Op-Spec and Min-Proj that determine what head positions are present in the first place.

4.2 Inversion in Adjuncts and Lexically Filled Heads

Inversion should be possible in adjunct clauses since they too are unselected. This we can see in conditional adjuncts. We can also see another effect here. In the present proposal, the only reason the X-0 moves is to fill an empty head position. The properties of the X-0 itself are really quite irrelevant -- it merely happens to be in the right place at the right time. We expect, then, that if the language can fill the head lexically, Ob-Hd will be equally well satisfied. Moreover, there should be a complementary relationship between inversion and the lexical item, since only one head position will be available, given Min-Proj.

The pattern in conditionals, illustrated in (16)-(18) and (20), and similar paradigms, have been pointed out in Rizzi and Roberts (1989).

(16) a. Had I been on time I would have caught the train
b. Were he to be asked, he would probably say no.
c. Should it ever happen, you will be sorry.

(17) a. *I had been on time I would have caught the train
b. *He were to be asked, he would probably say no.
c. *It should ever happen, you will be sorry.

The analysis is that conditional adjuncts are operator constructions, and the conditional operator, like the others discussed, is subject to Op-Spec. The operator thus motivates a projection which has no head and X-0 movement fills the head position, resulting in inversion. However, *if* can fill the head instead.

(18) a. If I had been on time I would have caught the train
b. If he were to be asked, he would probably say no.
c. If it should ever happen, you will be sorry.

When the structure is an IP, Op-Spec will always be violated, as there is no Specifier position available for the conditional operator. I will set this possibility aside as it is easy to see that it will never lead to the optimal representation.

$[_{CP}$ Op e $[_{IP}$DP I $[_{VP}$ V ..]]]	Proj-P	Op-Spec	*Ob-Hd	Min-Proj
$[_{CP}$ Op I_i $[_{IP}$DP e_i $[_{VP}$ V ..]]]	Proj-P	Op-Spec	Ob-Hd	Min-Proj $
$[_{CP}$ Op if $[_{IP}$DP I $[_{VP}$ V ..]]]	Proj-P	Op-Spec	Ob-Hd	Min-Proj $

Provided we take the base-generated operator in Spec of CP to result in satisfaction of Min-Proj we will get the right result. Since the adjunct CP is not selected, no conflict between Proj-P and Ob-Hd and movement can occur. Both the candidate with inversion and the candidate with *if* respect all of the constraints, hence both are grammatical. Conditionals thus illustrate a further

point about the optimality theoretic account: in conditionals there are two variants, one with *if* and one with inversion. Both are possible because both satisfy the same constraints.[2] Alternative competing forms will be possible only if they have exactly the same status with respect to all the constraints (Prince and Smolensky 1993).

This pattern of alternation between a lexical head and inversion is never possible in complements to lexical heads, because of the effects of Proj-P, so only (19a) is possible (in standard English):

(19) a. I wonder if he will do it (Proj-P Op-Spec Ob-Hd Min-Proj)
b. *I wonder will he do it (*Proj-P Op-Spec Ob-Hd *Min-Proj)

Similarly, in declarative complements there is no alternation between *that* and inverted structures: Proj-P will be violated if the C is filled by inversion.

Inversion is not merely unnecessary but also impossible when *if* occurs:

(20) *If had I been on time I would have caught the train

$[_{CP}$Op if $[_{XP}$ I_i $[_{IP}$ DP e_i $[_{VP}$ V ..]]] Proj-P Op-Spec Ob-Hd *Min-Proj

$[_{CP}$ if $[_{XP}$Op I_i $[_{IP}$ DP e_i $[_{VP}$ V ..]]] Proj-P Op-Spec Ob-Hd *Min-Proj

One projection violates Min-Proj but obeys Op-Spec, providing the necessary specifier position. But in order to have both *if* and inversion as in (20), it is necessary to have two head positions and hence two projections. The second will violate Min-Proj with no compensating improvement on any higher ranked constraint, hence the configuration is not legitimate. This structure competes with those in (16) and (18), and loses.

[2] This does depend on the assumption that MP is not violated by the conditional with inversion, which is not obviously correct. Alternatively, the inversion and <u>if</u> conditional may not compete, in which case both will be grammatical. See Section 8 for relevant discussion of competitors. Another alternative is that MP should be reformulated so that it is never violated when a projection contains an operator or contentful head. I leave this open for now.

4.3 Verb Second: Inversion in matrix declaratives

Verb second languages show a paradigm in which inversion is found in matrix declaratives, as illustrated in (21), with examples from Weerman (1989).

(21) a. De man heeft een boek gezien
the man has a book seen
b. Een boek heeft de man gezien
a book has the man seen
c. Gistern heeft de man een boek gezien
yesterday has the man a book seen

While there are a number of different accounts of V2, they have in common that they view the typological property that distinguishes the V2 languages from the others as a property of the C position. Such accounts leave open, however, the question of why these languages are V2 and not V1: why do they have a filled Spec of CP position?

In the present terms we can look at V2 from another angle: suppose that the typological property of a V2 language is that it requires the topic to occur in Specifier for a matrix clause, i.e. it shows the effects of a "Topic in Specifier" constraint (Top-Spec), which outranks Min-Proj. (Or perhaps V2 languages treat topics as syntactic operators, subject to Op-Spec.) It will now follow that in a V2 language a matrix declarative must have an extra projection, and inversion will be required to fill the otherwise empty head position. Another characteristic difference between English and V2 languages is the ability of a main verb to move to C; this is addressed in 6.2.

$[_{IP}$DP	I	$[_{VP}$	V	..	]]	Proj-P	Op-Spec	*Top-Spec	Ob-Hd	Min-Proj
$[_{CP}$topic	e	$[_{IP}$DP	I	$[_{VP}$ V	t]]]	Proj-P	Op-Spec	Top-Spec	*Ob-Hd	*Min-Proj
$[_{CP}$topic	I_i	$[_{IPDP}$ e_i		$[_{VP}$ V	t]]]	Proj-P	Op-Spec	Top-Spec	Ob-Hd	*Min-Proj $
$[_{CP}$	e	$[_{IP}$DP	I	$[_{VP}$ V	..]]]	Proj-P	Op-Spec	*Top-Spec	*Ob-Hd	*Min-Proj

For the sake of convenience only I have designated the extra projection here as "CP"; see Section 9. Top-Spec is either absent in non V2 languages, or ranked below Min-Proj where it can have no effect (Prince and Smolensky (1993)).

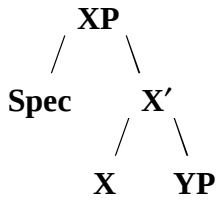
Matrix V2 structures fall in with the inversion pattern of negative preposing, inversion in adjuncts, and inversion in matrix interrogatives, as cases of inversion into an unselected projection. Since matrix clauses are unselected, here we see the effects of Ob-Hd without the obscuring effects of Proj-P.[3]

[3] The distribution of V2 in subordinate clauses is a complex issue. It will be governed by interactions among Proj-Prin, Top-Spec and Ob-Hd, and perhaps other well-formedness conditions. See McCloskey (1993) and Grimshaw (in prep.) for discussion of related questions concerning English inversion in subordinate clauses.

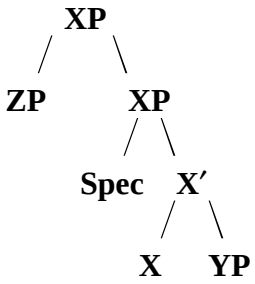
5. Adjunction

Not every case of preposing induces inversion: in terms of the present system of constraints inversion will not be induced when preposing does not motivate a projection by satisfying a constraint which is higher ranked than Min-Proj. This will be the situation when the preposing is an adjunction rather than a movement to Spec. Adjunction does not increase the number of projections present in the representation:

(22) a.



b.



The moved phrase simply adjoins to an existing projection, hence there are no more heads to be filled in an adjoined structure than in a structure with no adjunction at all. Ob-Hd will be satisfied in exactly the same way in the adjoined structure as it is in the structure involving no adjunction. Inversion will therefore never be necessary and never be possible.

5.1 Topicalization

I will argue that this is the analysis of topicalization.[4] What then distinguishes a topic, which merely adjoins, from a phrase which occurs in Specifier? The difference is that topics have a particular discourse status but not a special LF status. To put it another way, operators move for reasons of scope, topics move for discourse reasons. Topicalization is not an operator-variable structure, but a topic-predication structure; see Erteschik-Shir (1992, in prep.) for a recent theory of topic and focus. (Relative clauses seem to line up with topicalization in most respects, behaving as predicates rather than as operator-variable configurations. Presumably this lies behind the absence of inversion even in wh relatives, although I will not explore this here.)

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[4] (Lasnik and Saito (1992) also crucially take topicalization to be adjunction. Baltin (1982) argues that topicalization is adjunction to S (=IP), however his arguments are not helpful in the present context as they cannot distinguish between topicalization as adjunction to IP and topicalization as movement to Spec of a projection between IP and CP, a difference which is crucial here.

Several differences between topicalization and the operator-variable constructions fall into place under this hypothesis, including differences with respect to resumptive pronouns, weak crossover, and island effects.[5]

Topicalizations can involve a resumptive pronoun (in a "Left Dislocation" configuration), while true operator variable constructions, such as interrogatives, or the Negative Preposings cannot:

(23) a. That man, I can't stand.
b. That man, I can't stand him.

(24) a. Which man/who do you hate?
b. *Which man/who do you hate him?

(25) a. None of those men/no men can I stand
b. *None of those men/no men can I stand them/him

Lasnik and Stowell (1991) observe that weak crossover effects are absent in topicalizations. The point is illustrated by (26a), based on Lasnik and Stowell's (20c), and (27a). They contrast with (26b) and (27b) where the preposed phrase is a syntactic operator.

(26) a. ?This book$_i$, I would expect its$_i$ author to buy t
b. *Which book$_i$ would you expect its$_i$ author to buy t?

(27) a. ?John$_i$, only his$_i$ mother loves t
b. *Who$_i$ does (only, even) his$_i$ mother love t

Similar results obtain with other operators:

(28) a. *No book$_i$ would I expect its$_i$ author to buy t
b. *Only a very good book$_i$ would I expect its$_i$ author to autograph t publicly

This suggests that weak crossover constrains operator-variable constructions and that topic-trace constructions do not count as such.

Relativized Minimality (Rizzi 1990a) gives us further insight into this difference. Syntactic operators should all act as intervening A-bar operators/specifiers for relativized minimality. Topics, on the other hand, should not do so if they are not operators. There are two respects in which we can compare topics to operators. Is the relationship between a topic and its trace

[5] It is surely not an accident also that interrogative operators must be overt, while in topicalization no wh element can appear. Again this suggests that there is a fundamental difference between the two.

blocked by an intervening operator? Is the relationship between an operator and its trace blocked by an intervening topic? Although the data is complicated there seems to be a consistent pattern: the examples in which topics extract over operators, or in which operators extract over topics, are consistently better than those involving two operators.

For instance, extraction of a topic from a wh island is considerably better than extraction of a wh phrase: in (29) a topic PP or DP has been extracted from a wh island -- note the absence of inversion. In (30) the PP or DP is a wh operator -- note the inversion. The pair of examples in (30) is considerably worse than the pair in (29).

(29) a. ?With that kind of job, even the government must wonder who could be happy
b. ?That kind of job, even the government must wonder who could be happy with
(30) a. *With what kind of job must even the government wonder who could be happy
b. *What kind of job must even the government wonder who could be happy with?

Contrasts of this type have been mentioned in the literature: Rizzi (1990a, 105-6) notes that PP Preposing from a wh island is possible in Italian if the PP is [-wh], but not if the PP is [+wh]. In the present terms, this would suggest that the [+wh] PP is an operator, but the [-wh] PP is simply a topic, essentially as proposed by Cinque (1990). Then the presence of the operator in Spec of CP of the interrogative complement does not affect the relationship between the topic and its trace.

The second relevant configuration is extraction of an operator over a topic, versus extraction of an operator over an operator. Does topicalization create an island for operator movement?[6] Comparison of adjunct extraction over a topic and adjunct extraction over an operator shows a significant difference:

(31) a. ??Under which/what circumstances did you say [that children they would give those books t to t]?
b. *<u>Under which/what circumstances</u> did you ask [which children they would give those books to t]?

(32) a. ??Under which/what circumstances did you say [that those books they would give t to children t]?
b. *Under which/what circumstances did you ask [which books they would give t to children t]?

---

[6] Rochemont (1989) claims that topic constructions are islands to further extraction: citing examples like (i). However such examples involve crossing dependencies and probably processing difficulties, so the fact that they do indeed seem ungrammatical is probably not very informative:

(i) *What does John think that Bill, Mary gave t to t

While I have not presented a complete paradigm and analysis, I hope this is sufficient to show that extraction patterns of topics are quite unlike those of operator-variable constructions. This conclusion coheres in an interesting way with observations concerning relativization: both in Swedish (Engdahl 1980) and in Italian (Rizzi 1982), it is possible to relativize into a wh island, however in both languages there appears to be a significant difference between relativization into a wh island and operator movement from a wh island, which is probably properly treated as ungrammatical. Again, this suggests that relativization and topicalization do not involve operator-variable binding, but are predication structures.

Despite the important similarities in extraction patterns among all of these different cases, there are fundamental differences in the way in which the long-distance relationship is represented, which leads to the conclusion that while they all exemplify the same movement process they are otherwise not uniform. Differences may be due to the nature of the gap, and or to differences in the nature of the antecedent for the gap: see Cinque (1990) Lasnik and Stowell (1991), Postal (1992) , Dwivedi (1993) for recent discussion. The evidence from inversion strongly supports the view that there is indeed an important difference in the analysis of the antecedent: topics are adjoined, operators move to Specifier.

In the system of principles developed here, then, we predict that a group of effects will cluster together: movement to specifier will cluster with inversion, weak crossover effects, polarity item licensing when the operator is of the right kind, and operator-based relativized minimality effects. Topicalization shows none of these, because it is not operator movement, hence it is adjunction, not movement to specifier.

Why does the topic adjoin to IP? Under the assumptions about phrase structure which are emerging here, and which will be elaborated in Section 9, it is impossible to stipulate that IP is the adjunction site. Indeed, it would also be incorrect. Rochemont (1989) argues that topicalization can adjoin to CP in matrix, but not subordinate, clauses, on the basis of examples like (32):

(32) a. Tom, why would anyone want to meet?
b. *I wonder Tom, why would anyone want to meet?

We must conclude from this that topicalization can in principle adjoin to any projection, and that any restrictions on its appearance must be independently explicable; of course the matrix/subordinate asymmetry observed by Rochemont is expected under the present system of principles, since adjunction to a subordinate CP violates Proj-P.

Of the other possible adjunction sites, it appears that topicalization can adjoin to XP, although adjunction to the IP inside XP is ungrammatical:

(33) a. (He said that) Beans, never in his life had he been able to stand
b. *(He said that) Never in his life had beans, he been able to stand

Note that the ungrammaticality of (33b) again shows that it is not correct to analyze topicalization as adjunction to IP: here the topic adjoins to IP but the result is ungrammatical.

VP adjunction for topics, and adjunction to the projection headed by *do* (see Section 6), both seem impossible, although either is possible for an adverb like usually.

(34) a. *(He said that) he beans, couldn't stand
b. *He said that be couldn't beans, stand
c. He said that he (usually) couldn't (usually) stand beans

It seems that the topic has to be the subject of a predication relation and that in the ill-formed sentences the topic is adjoined to a sub-part of the predicate rather than to the predicate itself. Thus the VP-adjoined position is a possible position for a VP adjunct but not for a topic, since part of the predicate is not included in the VP. Similarly IP adjunction is possible for a topic, but not if it is included in an XP, since then again part of the predicate is outside IP. The topic can adjoin only to a phrase which corresponds to the predicate of the topic-predicate relation.

If this is correct, then topicalization can adjoin to any verbal projection in principle. Phrase structure labels such as "IP" play no role in the theory of topics. This provides one piece of evidence that they are notational conveniences but not theoretical entities, a point to be further taken up in Section 9.

5.2 A Mixed Specifier and Adjunction System

French shows a mixture of a system respecting Op-Spec, like English, and one using adjunction, like English topicalization. Observationally, wh movement is optional, but inversion occurs only with wh movement (Rizzi 1991). The optionality of movement indicates, in the present terms, that French wh phrases are ambiguous between quantifiers (see Kim (1990) on Korean) and true wh operators. On their quantifier analysis, they are not subject to Op-Spec. The presence of a CP projection with the inverted form will violate Min-Proj with no compensating satisfaction of Op-Spec, hence the uninverted version will be optimal:

(35) a. Elle a rencontré qui?
She has met who
b. *A-t-elle t rencontré qui?
Has she met who

$[_{CP}$ I_i $[_{IPDP}$ e_i $[_{VP}$ V qui]]]	Proj-P Op-Spec Ob-Hd *Min-Proj	
$[_{IP}$DP I $[_{VP}$ V qui]]	Proj-P Op-Spec Ob-Hd Min-Proj	$

In their operator incarnation, however, the wh phrases are subject to Op-Spec and move to Spec of CP, inducing inversion in the usual way:

(36) Qui a-t-elle t rencontré t?
Who has she met

$[_{CP}$qui I_i $[_{IP}$DP e_i $[_{VP}$ V t]]] Proj-P Op-Spec Ob-Hd *Min-Proj $

$[_{CP}$qui e $[_{IP}$DP I $[_{VP}$ V t]]] Proj-P Op-Spec *Ob-Hd *Min-Proj

The final piece of the paradigm, (37), is explained if the wh phrase, though clause initial, is not a wh operator, but is adjoined (cf Déprez 1991).

(37) Qui elle a rencontré t?
Who she has met

$[_{IP}$qui $[_{IP}$DP I $[_{VP}$ V t]]] Proj-P Op-Spec Ob-Hd Min-Proj $

Under this analysis, (37) violates no constraints, so it is inevitably grammatical. The adjoined wh phrase should be distinguishable from the operator wh phrase, however. It should not license an unmoved wh element, as pointed out by R. Zanuttini (p.c.). Nor should it license polarity items, or induce weak crossover.

According to this analysis, the difference between French and English is in the nature of the wh phrases, (not in the presence or absence of dynamic agreement as in Rizzi (1991), Haegeman (1992)). French interrogative phrases are not always syntactic operators, while the English counterparts are.

6. *Do*-Support

The generalization governing *do* in English is simple to state but has proved challenging to formalize: that *do* is possible only when it is necessary (Chomsky 1957, 1991).

The theory developed so far formalizes exactly this conceptualization of *do*, given two assumptions. First, *do* is a semantically and functionally empty verbal head: this seems to be the minimal specification we can give to *do*. As a result a projection headed by *do* violates Min-Proj. Second, Ob-Hd outranks Min-Proj, i.e. an empty (Min-Proj-violating) functional projection is possible when it results in satisfaction of Ob-Hd. From these two assumptions, plus the constraints proposed here, the distribution of *do* follows.

6.1 The Occurrence of *do*

I will first show how the analysis works out for the contrast between matrix declaratives and matrix interrogatives, starting with declaratives. I will not show the VP and CP options since it is clear that they could never be optimal. I will assume throughout this section that the first auxiliary verb in a clause always raises to I, although I will not discuss the motivation for this movement, see Grimshaw (in prep.).

(38) a. She said that
b. *She did say that

$[_{IP}$DP I	$[_{XP}$ e $[_{VP}$ V ..]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj	
$[_{IP}$DP do_i	$[_{XP}$ e_i $[_{VP}$ V ..]]]	Proj-P Op-Spec Ob-Hd *Min-Proj	
$[_{IP}$DP I	$[_{VP}$ V ..]]	Proj-P Op-Spec Ob-Hd Min-Proj	$

Here then, the IP form of the clause, with no auxiliary verb projection, is the optimal one, since it involves no violations, while the alternative with *do* involves violation of Min-Proj, and the alternative which has an extra projection but no *do*, indicated by "YP", violates both Ob-Hd and Min-Proj. Thus auxiliary *do* cannot occur in a declarative.

Other auxiliaries can, however. They differ from *do* in having semantic content, hence the structure with the auxiliary will not compete with the structure without the auxiliary. See Section 9.

In interrogatives the result is different. I simplify by considering only those forms which do not violate Op-Spec, i.e. where wh movement has occurred, and by not treating the case of an extra projection (XP) with an empty head, which we have already seen in the previous case.

(39) a. What did she say?
b. *What she said?
c. *What she did say?

$[_{CP}$wh do$_i$ $[_{IP}$DP e$_i$ $[_{XP}$ e$_i$ $[_{VP}$ V t]]]	Proj-P Op-Spec Ob-Hd **Min-Proj $
$[_{CP}$wh e $[_{IP}$DP I $[_{VP}$ V t]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj
$[_{CP}$wh e $[_{IP}$DP do$_i$ $[_{XP}$ e$_i$ $[_{VP}$ V t]]]	Proj-P Op-Spec *Ob-Hd **Min-Proj

Since the CP has no functional interpretation, there is a Min-Proj violation. The alternatives with *do* involve a second Min-Proj violation. If *do* does not invert, Ob-Hd is violated in addition. The optimal form is the one in which *do* occurs and inverts to C: this one violates only Min-Proj.

Thus we obtain the desired result: *do* is possible only where it is necessary, and it is necessary when its presence makes a clause obey a constraint that has a higher ranking than Min-Proj: in this case Ob-Hd.

Finally, we predict correctly that *do* is not possible in subordinate interrogatives. (Again, for simplicity I consider only those cases where Op-Spec is satisfied by movement to Spec of CP).

$[_{CP}$wh do$_i$ $[_{IP}$DP e$_i$ $[_{XP}$ e$_i$ $[_{VP}$ V t]]]	*Proj-P Op-Spec Ob-Hd **Min-Proj
$[_{CP}$wh e $[_{IP}$DP I $[_{VP}$ V t]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj $
$[_{CP}$wh e $[_{IP}$DP do$_i$ $[_{XP}$ e$_i$ $[_{VP}$ V t]]]	Proj-P Op-Spec *Ob-Hd **Min-Proj

As we have already seen, when no auxiliary verb is present and there is no inversion, a subordinate interrogative violates Min-Proj (because of the empty CP) and Ob-Hd because C is empty. But it satisfies Proj-P and Op-Spec. Including a *do* adds an Min-Proj violation, and if it inverts, a Proj-P violation. So the presence of a *do* can only add violations in this situation, it can never reduce them, hence it is never possible. In effect, since Ob-Hd is violated in subordinate interrogatives anyway, by the empty C, there is no advantage to the presence of *do*.

6.2 Main Verbs

Of course the reason *do* gets a chance to appear at all is that English, unlike the V2 languages, does not allow main verbs to invert:

(40) *Said she that?

This suggests the existence of another well-formedness principle which rules out the placement of a lexical head in a functional position: "Lex-Funct" for Lexical-in-Functional. This constraint is ranked above Min-Proj in English, therefore English will violate Min-Proj (introducing *do*) in order to avoid violating Lex-Funct. The constraint evaluation of inversion of *do* versus inversion of a main verb is this:

$[_{CP}$wh V_i $[_{IP}$DP e_i $[_{VP}$ e_i t]]]	Proj-P	Op-Spec	Ob-Hd	*Lex-Funct	*Min-Proj	
$[_{CP}$wh do_i $[_{IP}$DP e_i $[_{XP}$ e_i $[_{VP}$ V t]]]	Proj-P	Op-Spec	Ob-Hd	Lex-Funct	**Min-Proj	$

The English system thus depends on two elements: the first is the effects of Lex-Funct and the second the existence of a verb like *do*, which can satisfy Ob-Hd but is semantically empty. What of the languages that allow main verbs to move to C, such as the V2 languages? Suppose Lex-Funct is ranked below Ob-Hd, which is consistent with English. If the language has no empty auxiliary like *do*, adding an extra projection will always violate Ob-Hd, so the English route to optimality will not be available. The optimal form will be one in which Lex-Funct alone is violated:

$[_{CP}$wh V_i $[_{IP}$DP e_i $[_{VP}$ e_i t]]]	Proj-P	Op-Spec	Ob-Hd	*Lex-Funct	*Min-Proj	$
$[_{CP}$wh e $[_{IP}$DP I $[_{XP}$ e $[_{VP}$ V t]]]	Proj-P	Op-Spec	**Ob-Hd	Lex-Funct	**Min-Proj	

The best resolution of the problem of satisfying Ob-Hd is to move a main verb, then, if the language has no empty auxiliary. Note that in this analysis both kinds of language have Lex-Funct: the difference in observed patterns follows from the interaction between Lex-Funct and Min-Proj, mediated by the presence or absence of an empty auxiliary in the language.

6.3 Co-occurrences

This analysis automatically explains why *do* never co-occurs with another auxiliary verb, or with another token of *do*. Consider, for example, a matrix declarative clause in which *do* and *have* co-occur.

$[_{IP}$DP do$_i$ $[_{XP}$ e$_i$ $[_{XP}$ have $[_{VP}$ V ..]]]	Proj-P Op-Spec Ob-Hd *Min-Proj
$[_{IP}$DP have$_i$ $[_{XP}$ e$_i$ $[_{XP}$ do $[_{VP}$ V ..]]]	Proj-P Op-Spec Ob-Hd *Min-Proj
$[_{IP}$DP have$_i$ $[_{XP}$ e$_i$ $[_{VP}$ V ..]]	Proj-P Op-Spec Ob-Hd Min-Proj $

Since the clause with *have* violates nothing, there is no advantage to including *do* and its projection, hence only the *have* version is possible.

The same will obtain in matrix interrogatives:

$[_{CP}$wh have$_i$ $[_{IP}$DP e$_i$ $[_{XP}$ e$_i$ $[_{VP}$ V t]]]	Proj-P Op-Spec Ob-Hd *Min-Proj $
$[_{CP}$wh have$_i$ $[_{IP}$DP e$_i$ $[_{XP}$ e$_i$ $[_{XP}$ do $[_{VP}$ V t]]]	Proj-P Op-Spec Ob-Hd **Min-Proj
$[_{CP}$wh do$_i$ $[_{IP}$DP e$_i$ $[_{XP}$ e$_i$ $[_{XP}$ have $[_{VP}$ V t]]]	Proj-P Op-Spec Ob-Hd **Min-Proj

Since *have* can move to C to satisfy Ob-Hd, again there is no advantage to including a *do*. The clause with just *have* and inversion has the competitive edge because it satisfies Ob-Hd without an extra Min-Proj violation.

We also predict that *do* will not occur with main *be*. Since *be* has the capacity to move to C, to satisfy Ob-Hd, the form with *do* will have no competitive advantage over the one without, and the *do*-less form will be optimal.

Obviously, auxiliary *do* will also not repeat. Clauses containing *do* will be in competition with all otherwise equivalent clauses containing more and fewer occurrences of *do*. Each occurrence of *do* yields a violation of Min-Proj, and no occurrence of *do* after the first one can ever improve the sentence. Hence a clause with more than one instance of *do* can never be optimal. I illustrate this with respect to a matrix question with no semantic auxiliary, where one *do* is possible:

$[_{CP}$wh do$_i$ $[_{IP}$DP e_i $[_{XP}$ e_i $[_{VP}$ V t]]] Proj-P Op-Spec Ob-Hd **Min-Proj $

$[_{CP}$wh do$_i$ $[_{IP}$DP e_i $[_{XP}$ e_i $[_{XP}$ do $[_{VP}$ V t]]] Proj-P Op-Spec Ob-Hd ***Min-Proj

$[_{CP}$wh do$_i$ $[_{IP}$DP e_i $[_{XP}$ e_i $[_{XP}$ do $[_{XP}$ do $[_{VP}$ V t]]] Proj-P Op-Spec Ob-Hd ****Min-Proj

6.4 *Wh* Subjects

The fact that *do* cannot occur with a subject wh phrase necessitates analyzing the wh subject as in Spec of IP rather than Spec of CP.

(41) Who arrived?
*Who did arrive?

If the wh phrase were in Specifier of CP the optimal configuration would be one in which *do* fills C:

$[_{CP}$wh e $[_{IP}$t I $[_{VP}$ V ..]]] Proj-P *Ob-Hd Op-Spec *Min-Proj

$[_{CP}$wh do$_i$ $[_{IP}$t e_i $[_{XP}$ e_i $[_{VP}$ V ..]]] Proj-P Ob-Hd Op-Spec *Min-Proj $

If, on the other hand, the wh phrase is in Specifier of IP, the optimal configuration is one without *do*:

$[_{IP}$wh I $[_{VP}$ V ..]]] Proj-P Ob-Hd Op-Spec Min-Proj $

$[_{IP}$wh do$_i$ $[_{XP}$ e_i $[_{VP}$ V ..]]] Proj-P Ob-Hd Op-Spec *Min-Proj

Thus we conclude that subject wh phrases do not move, but remain in Specifier of IP. This idea has been frequently entertained (see Gazdar (1981), Chung and Mccloskey (1983), Haider (1989) for example, also Travis 1991 and Vikner and Schwartz 1991 for discussion of a similar analysis in V2 systems). From the present perspective it is important because it provides key information about the correct way to understand how interrogatives work, and ultimately, how extended projections work.

There is an apparently overwhelming argument against the idea that wh questions with subject wh phrases are just IPs: this is based on selection. The very same predicates select questions with wh subjects as those with other wh phrases. Yet the former are IPs and the latter are CPs, so how is it possible to explain why they are selected by the same predicates? This problem does not arise under the "Type-Category" theory of selection (Grimshaw 1991): any verbal projection with a [+wh] Spec is equivalent to any other verbal projection with the same property, as far as selection is concerned. See Sections 7 and 9.

Clearly, then, Op-Spec does not require that a wh operator occur in Specifier of CP, just that it occur in a Specifier position. An interrogative clause is therefore not required to be a CP, but just a verbal projection with a wh specifier. When a wh phrase is a non-subject it will always have to move to a Spec position. The candidate positions are basically VP, IP, and CP. Both of the first two are filled, so non-subject wh phrases move to Spec of a higher projection, which we label CP. This positioning of the wh operator also meets the requirement that type-affecting elements be outermost in clause structure, and take scope over the entire proposition (Section 9). Specifier of VP is not a possible position for a wh operator, then, both because it is (usually) filled and because it does not give the wh operator the right scope.

The one case where the requirements of an interrogative are met without any movement is when a wh-phrase is a subject. It is already in Specifier position, moreover it is in Specifier of the highest phrase in the verbal extended projection. Thus an IP will be a perfectly good interrogative, provided it has a wh phrase as subject. It follows that although CP can be present for a non-subject-wh, it cannot be present for a subject-wh, since Op-Spec holds in this case already. When we compare a CP structure and an IP structure for, for example, interrogatives like Who will leave?, we see that this is so: the presence of CP violates Min-Proj but leads to no improvement on any higher ranked principle. This is so regardless of the surface position of the wh phrase and the auxiliary.

$[_{IP}$wh will $[_{VP}$ V ..]]]	Proj-P Op-Spec Ob-Hd Min-Proj	$
$[_{CP}$wh will$_i$ $[_{IP}$t e_i $[_{VP}$ V ..]]]	Proj-P Op-Spec Ob-Hd *Min-Proj	
$[_{CP}$ will$_i$ $[_{IP}$who e_i $[_{VP}$ V ..]]]	Proj-P Op-Spec Ob-Hd *Min-Proj	
$[_{CP}$ e $[_{IP}$who will $[_{VP}$ V ..]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj	

Thus, in this analysis absence of *do* with subject wh phrases is due to a violation of Min-Proj.

Interrogatives with wh subjects show that Op-Spec does not specify which specifier must house the wh phrase, and neither does the well-formedness condition which says that interrogatives must have scope over the entire proposition. This result, along with the proposal that topicalization can adjoin to any projection, indicates a general line of reasoning in which reference cannot be made to such information, in which notions like "CP", "IP" really have no status. I return to this kind of theory in Section 9.

6.4 *do* with negation

Finally, I will sketch the analysis of *do* with negation, the basic outlines of which are obvious at this point. The presence of *not* induces a projection which is not otherwise present: let us assume that this is because *not* is subject to Op-Spec, and hence a projection is required to house it. (xxxrefs) The projection has an empty head which is filled by *do*. For concreteness I will assume that *do* is introduced as the head of a projection, and that not24 is introduced as the

specifier of a different projection, although it is perfectly possible that they occupy the head and specifier position of the same projection, and we get the same result in either case. The structure, then, is IP-NegP-doP-VP. (I use the label "NegP" here merely for comprehensibility: the projection may or may not correspond to NegP projections in the literature Laka (1990), Zanuttini (1991) Haegeman (1992)).

What we want to predict, then, is that the optimal structure with *not* also has *do*, while the optimal structure without *not* does not also have *do*.

Without *not*, the optimal structure is simply IP-VP, since the presence of NegP will violate Min-Proj, and may also violate Ob-Hd if *do* is not present or does not raise to head of NegP. The structure without NegP will be the optimal one, since it violates nothing.

$[_{IP}$DP I $[_{VP}$ V ..]]	Proj-P Op-Spec Ob-Hd Min-Proj	$
$[_{IP}$DP I $[_{NegP}$ e $[_{VP}$ V ..]]	Proj-P Op-Spec *Ob-Hd *Min-Proj	
$[_{IP}$DP I $[_{NegP}$ e $[_{XP}$ do $[_{VP}$ V ..]]	Proj-P Op-Spec *Ob-Hd **Min-Proj	
$[_{IP}$DP do_i $[_{NegP}$ e_i $[_{XP}$ e_i $[_{VP}$ V ..]]	Proj-P Op-Spec Ob-Hd **Min-Proj	

With *not*, the optimal structure is IP-NegP-doP-VP, with *do* raising through the head of NegP. If the projection of *do* is not present, Min-Proj is not violated, but Ob-Hd is, since nothing will fill the head of NegP. If the projection of *do* is present, Min-Proj is violated, but Ob-Hd is not, if *do* raises:

$[_{IP}$DP I $[_{NegP}$not e $[_{VP}$ V ..]]	Proj-P Op-Spec *Ob-Hd Min-Proj	
$[_{IP}$DP do_i $[_{NegP}$ e_i $[_{XP}$ e_i $[_{VP}$ V ..]]	Proj-P Op-Spec Ob-Hd *Min-Proj	$

Once again, then, the fact that Ob-Hd outranks Min-Proj explains why *do* appears when it does.

I will not discuss emphatic *do* here; the outlines of an analysis are presumably clear enough. The general line of explanation will support the proposal of Laka (1990) that emphasis induces a projection. However, the entire solution here rests on the crucial claim that such a projection is not always present. The same holds for the projection induced by *not*, among others. If these projections were always present, *do* would always appear. The hypothesis that clause structure is not uniform is central to the proposal.

7. The Obligatoriness of *that*

As I have emphasized throughout, in this approach there is no theory of inversion. Inversion is simply what happens when a head is empty, violating Ob-Hd, and is not prevented from being filled by the Proj-P. Thus if it is correct, the theory holds of all heads. In particular, then, it should hold also of elements such as the complementizer *that*. I will show here that the obligatory appearance of *that* in subordinate clauses with topicalization or operator movement to Specifier follows from the principles already laid out.

In order to do this I preview an analysis developed in Grimshaw (in. prep.), in which sentential complements can in principle be either IPs or CPs (or indeed XPs). When a complement is a CP, it must have its head filled, because of Ob-Hd. Thus verbs like think allow two complement structures, as in (42):

(42) a. I think [$_{CP}$ that it will rain]
b. I think [$_{IP}$ it will rain]

The objection to this analysis is that we now have to say that *think* and every verb like it takes both an IP and a CP complement. This not only complicates the lexical representation for all of these verbs, it makes it impossible to explain why there isn't a verb of approximately the same semantics as *think*, that takes just a CP, or just an IP, since such a verb would be exploiting the simplest possible selection option available.

The same issue arose in connection with the claim that interrogatives with wh subjects are IPs, in Section 6, and the same answer holds here. Type-Category selection (Grimshaw 1991) gives the right results. Recall that in extended projection functional heads do not select at all. Lexical heads do select, in the following way: they c-select the syntactic category and s-select the semantic type of their complements.

The crucial factor is that in extended projection, all members of the verbal projection (C, I, V and whatever other heads participate) are all of the same syntactic category (verbal). They differ in their functional analysis, not in their syntactic category. It follows that a lexical head can never c-select CP versus IP.

What about s-selection? Suppose finite IP and CP are good realizations of the same semantic type: let us call it "proposition". Then it will follow that all verbs which take propositional arguments take both realizations (IP and CP) of their arguments. (Those verbs which appear to take just CP, such as factives and manner-of-speaking verbs have different selectional specifications, evidently.)

Now we correctly predict free variation between IP and CP for complements of a proposition selecting verb: no verb can make a selectional distinction between them. Thus the argument for positing CP in all cases has no force in this theory.

Given that the complement can therefore be structurally either a CP or an IP, what do the well-formedness principles predict? When the complement is an IP no principles are violated. When the complement is a CP with *that* as head, no principles are violated either. The CP is functionally interpreted, so Min-Proj is respected, and the C is filled, so Ob-Hd is respected. Neither Proj-P nor Op-Spec is relevant. What is not possible is a CP with an empty C, since this violates both Ob-Hd and Min-Proj.

$[_{IP}$DP I $[_{VP}$ V ..]]	Proj-P Op-Spec Ob-Hd Min-Proj	$
$[_{CP}$ e $[_{IP}$DP I $[_{VP}$ V ..]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj	
$[_{CP}$ that $[_{IP}$DP I $[_{VP}$ V ..]]]	Proj-P Op-Spec Ob-Hd Min-Proj	$

Thus an IP complement and a CP complement headed by *that* have equivalent standing with respect to the constraints, and both are grammatical.

For completeness we should note that an XP complement is also possible in principle, since it will also satisfy the selectional requirements of the V: however it will never be the optimal complement so in fact it is an option that will never be realized.

$[_{XP}$ e $[_{IP}$DP I $[_{VP}$ V ..]]	Proj-P Op-Spec *Ob-Hd *Min-Proj
$[_{XP}$ I_i $[_{IP}$DP e_i $[_{VP}$ V ..]]	*Proj-P Op-Spec Ob-Hd *Min-Proj

Without inversion the structure will violate Ob-Hd since X will be empty, but with inversion the structure will violate Proj-P. Since the XP competes with IP and CP structures which violate no principles, even the best XP variant is non-optimal.

Min-Proj will guarantee that only one CP headed by *that* can occur in each clause: more generally it will rule out arbitrary numbers of projections with the same functional head. If we assume that only one instance of a functional head can be functionally interpreted, then any additional occurrence of the head will always be uninterpreted and violate Min-Proj. (Alternatively we could rephrase Min-Proj to require that functional projections be functionally distinct from each other.) Thus no additional stipulation is required to exclude multiple appearances of the complementizer.

$[_{CP}$ that $[_{IP}$DP I $[_{VP}$ V ..]]]	Proj-P Ob-Hd Op-Spec Min-Proj $
$[_{CP}$ that $[_{CP}$ that $[_{IP}$DP I $[_{VP}$ V ..]]]	Proj-P Ob-Hd Op-Spec *Min-Proj
$[_{CP}$ that $[_{CP}$ that $[_{CP}$ that $[_{IP}$DP I $[_{VP}$ V ..]]]	Proj-P Ob-Hd Op-Spec **Min-Proj

In general, then, IP and CP alternate in complement position. Nonetheless, there are certain circumstances in which the complementizer occurs obligatorily. In the terms of the current proposal, the interpretation for such a situation is that the complement has to be a CP, rather than an IP. I focus here on one such situation. When topicalization occurs in a subordinate clause, the *that* complementizer is obligatory. We can see this below: (43), with no topicalization, is equally good with and without the complementizer, while (44), with topicalization, becomes very seriously degraded if the complementizer is omitted:

(43) a. She swore/insisted/thought that no-one would ever accept this solution
b. She swore/insisted/thought no-one would ever accept this solution

(44) a. She swore/insisted/thought that this solution, no-one would ever accept
b. *She swore/insisted/thought this solution, no-one would ever accept

The basic argument I will make builds on a suggestion by Eric Hoekstra (p.c.) concerning topicalization. His suggestion is this: if the complement is a CP then the IP is not an argument, hence adjunction to the IP is possible. If the complement is an IP then adjunction to IP will be ruled out. Hence, only when there is a CP projection over the IP projection will the IP projection be a possible adjunction site. In this configuration Ob-Hd will require that the C be filled, hence *that* will have to be present.

The *that* complementizer is equally obligatory with negative preposing:

(45) a. She swore/insisted/thought that never in her life would she accept this solution
b. *She swore/insisted/thought never in her life would she accept this solution

I will demonstrate that the system of principles developed here automatically predicts the obligatoriness of *that* both with topicalization and with negative preposing. In both cases, the optimal structure contains a CP when one of these processes occurs, hence C has to be present to satisfy Ob-Hd.

There are three possible structures for the complements in (44) and (45). They could be IPs, XPs, or CPs. Let us consider first of all the situation for topicalization. If the complement is an IP, Proj-P will be violated. If the complement is an XP, Min-Proj will be violated, as will Ob-Hd unless inversion takes place. If inversion takes place Proj-P will be violated. Finally, if the complement is a CP-IP headed by *that*, Min-Proj and Ob-Hd will both be respected. (If the complement were CP-XP-IP Min-Proj would be violated; I will not show this case). Without *that*, both Min-Proj and Ob-Hd will be violated. Hence the optimal configuration is a CP with a filled head, hence this is the only grammatical configuration. (It is not possible to fill the C position by inversion, since inversion would violate Proj-P.)

$[_{IP}$topic $[_{IP}$DP I $[_{VP}$ V t]]	*Proj-P Op-Spec Ob-Hd Min-Proj
$[_{XP}$ e $[_{IP}$topic $[_{IP}$DP I $[_{VP}$ V t]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj
$[_{XP}$ I_i $[_{IP}$topic $[_{IP}$DP e_i $[_{VP}$ V t]]]	*Proj-P Op-Spec Ob-Hd *Min-Proj
$[_{CP}$ e $[_{IP}$ topic $[_{IP}$DP I $[_{VP}$ V t]]	Proj-P Op-Spec *Ob-Hd *Min-Proj
$[_{CP}$ that $[_{IP}$ topic $[_{IP}$DP I $[_{VP}$ V t]]	Proj-P Op-Spec Ob-Hd Min-Proj $

The reasoning for preposing to Specifier is essentially the same. If the complement is just an IP Op-Spec will be violated. If the complement is an XP, Min-Proj will be violated, and in addition either Proj-P or Ob-Hd must be violated: Proj-P if inversion to X occurs, and Ob-Hd if inversion to X does not occur. When the complement is CP-XP-IP headed by *that*, neither Min-Proj nor Ob-Hd is violated for CP, although XP violates Min-Proj. Inversion to X is not prohibited by Proj-P, and satisfies Ob-Hd for X. Thus there is a structure which violates only Min-Proj: this is the optimal structure, and it includes *that*.

$[_{IP}$DP I $[_{VP}$ V ..]]]	Proj-P *Op-Spec Ob-Hd Min-Proj
$[_{XP}$never I_i $[_{IP}$DP e_i $[_{VP}$ V t]]]	*Proj-P Op-Spec Ob-Hd *Min-Proj
$[_{XP}$never e $[_{IP}$DP I $[_{VP}$ V t]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj
$[_{CP}$ e $[_{XP}$never I_i $[_{IP}$DP e_i $[_{VP}$ V t]]]]	Proj-P Op-Spec *Ob-Hd *Min-Proj
$[_{CP}$ that $[_{XP}$never I_i $[_{IP}$DP e_i $[_{VP}$ V t]]]]	Proj-P Op-Spec Ob-Hd *Min-Proj $

Following along this reasoning, then, the CP is indeed present to protect the projection below it from being an argument: if the IP or XP is an argument it cannot be adjoined to, and its head cannot be filled by movement, because of Proj-P. There is a revealing contrast here between main and subordinate clauses: in subordinate clauses topicalization and negative preposing can happen only in CPs, whereas in main clauses they can happen in IPs. This is because Proj-P is not relevant in matrix clauses.

An important aspect of this result is what it tells us about the class of competing structures: it must be the set of extended projections that are compatible with the lexical selectional properties of V. The IP, XP, and CP complements all compete, and the CP is optimal. The optimal complement is a CP with a filled C, hence the obligatoriness effect.[7]

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[7] There is another set of cases where the complementizer is obligatory, analyzed in Stowell (1981). The empirical observation is that that is obligatory in all positions except when the CP is a complement to the verb, where it is optional. Stowell argues that this distribution follows from ECP. The empty C position must be properly governed, and it is only in complement position that this requirement

The explanation for the obligatoriness of *that* illustrates a property of OT which is of fundamental importance. In the case of subordinate interrogatives, inversion simply fails, since Proj-P and Ob-Hd conflict and Proj-P outranks Ob-Hd. Why then is it not possible for inversion to fail here too, when negative preposing occurs in the XP complement to V? If we get a grammatical sentence by failing to invert in a subordinate interrogative, why don't we get a grammatical sentence by failing to invert in an XP complement to a V? The two sentences have the same constraint profile: Proj-P Op-Spec *Ob-Hd *Min-Proj, and certainly look identical:

(46) a. He wondered when <u>she would</u> arrive
b. *He said never <u>he had</u> arrived so late

The solution uses a crucial feature of optimality theory. In the XP case there is another structure possible, namely the one that includes the CP. This structure, as we have seen, satisfies both Ob-Hd and Proj-P, so it is the optimal one.

In contrast, for an interrogative complement, there is no way to enlarge the extended projection to protect the CP, making inversion possible. The reason is that any additional projection will add both an Ob-Hd violation and an Min-Proj violation, because there is no functionally interpretable material that can occur on top of CP.

$[_{CP}$wh e $[_{IP}$DP I $[_{VP}$ V t]]] Proj-P Op-Spec *Ob-Hd *Min-Proj $

$[_{XP}$ e $[_{CP}$wh e $[_{IP}$DP I $[_{VP}$ V t]]] Proj-P Op-Spec **Ob-Hd **Min-Proj

So the uninverted form of the interrogative is optimal, but the inverted form of the negative is optimal. The very same pattern of constraint satisfaction and violation can yield a grammatical sentence or an ungrammatical sentence, depending on the competition.

In sum, the question of why the complementizer is obligatory with topicalization or preposing to Specifier already has an answer in terms of the principles laid out here. The question of why *that* is obligatory reduces to the question of why a CP projection is obligatory, and this follows from the Projection Principle. An XP and an adjunction-site IP can occur only as a matrix, or inside a CP. The same principle, Ob-Hd, is responsible for the inversion patterns analyzed in earlier sections and for the obligatory appearance of the complementizer here.

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is met. In the theory developed here, there is a completely different way to look at the empirical generalization governing missing complementizers: complements can be IPs but in all other positions sentential arguments must be CPs. It follows from the system we have been exploring that, if there is a reason for the argument to be realized as a CP, <u>that</u> will be obligatory. The form which includes it will respect OH while the one which omits it will violate OH. The fact that IP extended projections are limited to complement position is part of a more general distributional pattern explored in Grimshaw (in prep.)]

8. Competition

Here we return to the question of how the set of competing forms is properly characterised: what is the set of structures from which the optimal one is selected? Thus far we can draw these conclusions:

(i) For the sub-system we have been examining, the competitors consist of single extended projections.

(ii) The theory compares only extended projections with the same lexical projection. Otherwise clauses with unrelated meanings would be competing for grammaticality. Thus Mary saw someone does not compete with Susan saw someone, Mary met someone, or Mary saw no-one.

(iii) Unlike lexical projections, the functional projections need not be the same for two structures to compete. If they did have to be the same, IP and CP could not compete, and if they did not compete, the best IP and the best CP would both be grammatical. This would give exactly the wrong result in matrix and subordinate interrogatives and in the obligatory *that* clauses.

(iv) The same functional heads do not have to appear in the competitors. This can be seen already from the obligatory *that* cases just mentioned. Similarly, if an extended projection with two instances of *that* did not compete with smaller versions, there would be no way to explain why multiple occurrences of *that* are not possible. The same holds for *do*, which must compete with *do do* structures, *do do do* structures, and so forth. Thus we conclude that functional projections need not be constant across all competitors.

(v) Nevertheless, structures including the semantically meaningful auxiliary verbs do not enter into competition with structures without the auxiliary, nor do they compete with structures containing different auxiliaries. Each competes just with the structure which includes both the auxiliary verb and *do*.

Perhaps, then, competing extended projections must have the same LF, or rather LFs that are non-distinct in some crucial respects. It would then follow that the lexical projections and contentful auxiliaries of competitors must be the same. In order to make the right prediction for functional heads in general, we will need to define the relevant notion of non-distinctness, so that an IP and a CP with a filled C count as having non-distinct LFs, presumably because the presence or absence of a complementizer does not alter the semantic type of the complement, as we have already seen in examining selection. Similarly, multiple occurrences of the same item will have to count as non-distinct from single occurrences, because they are informationally non-distinct.

This suggestion accords with the observation that a projection including *that* does not compete with one including *if*, even when they have the same lexical projection. The difference between *if* and *that* is semantic and thus counts for LF distinctness.

The final case we must check concerns *if* and *whether*. Even though the two kinds of interrogative mean the same, at least crudely, they do not compete, as pointed out in 3.3. If they were to compete, the *whether* version would lose because it violates Ob-Hd, while the *if* extended projection violates no constraints. Given that they have different structural representations under Kayne's hypothesis (and of course the problem only arises if we accept his proposal), the LFs will be structurally distinct, hence no competition will be possible, and we obtain the desired result.

To sum up, the set of competing structures consists of those extended projections which have identical lexical projections and non-distinct logical forms. This provides at least a first approximation of the principles determining what syntactic representations compete with each other.

Sentences, however, are made up of multiple extended projections, so what happens when they are combined? The constraints that have been the focus of this paper hold internally to extended projections; they do not govern the relationship between extended projections. Other constraints hold between extended projections, such as specifier-head agreement, theta marking, case marking, binding, and subjacency. In advance of an investigation, we cannot know how these principles interact with the constraints that are internal to extended projections, so I will not speculate about the question.

However, for the constraints proposed in this paper the situation is clear: the evaluation of each extended projection is independent of the evaluation of each other extended projection. For example, suppose that a sentence is composed of two extended projections, a nominal in Specifier of IP and the IP itself. Now suppose that there is one constraint which is relevant for each extended projection. How is the optimal form selected? Which is better, the sentence in which the constraint relevant for the nominal is violated and the other one satisfied, or the sentence in which the constraint relevant for the verbal is violated and the other one satisfied?

The issue just doesn't arise: the best form is the one that violates neither, and there will always be such a form because the well-formedness of one extended projection is independent of the well-formedness of every other. This is because the constraints are internal to extended projections.

With respect to constraints that hold within extended projections, then, the best sentence is constructed by putting together the best extended projections. This will hold no matter how big the sentences are that we are comparing. For sentences of arbitrary complexity which meet the requirements for being competitors the assessment of optimality just involves finding the optimal version of each extended projection. The optimal sentence is composed of the optimal extended projections.

9. Conclusion

The constraints studied here represent just a fragment of those that govern grammatical systems, of course. Many extensions seem perfectly plausible, however. For example, the constraints proposed here assign no cost to movement, but it seems very likely that there is such a cost. In fact, interesting consequences of the kind associated with economy of derivation (Chomsky 19xx) can be derived from a constraint which prohibits movement (or traces if the constraint governs s-structure), and which therefore conflicts in certain circumstances with other principles like Ob-Hd and Op-Spec. Although I have not illustrated the operation of this system of constraints here, it clearly predicts that movement is possible only when it is necessary, the core idea of economy.

Second, a note on computability: how easy is it to determine whether a given extended projection is optimal? As will shortly be emphasized, we have been led to a position in which there is no fixed limit on the number of projections that can be included in an extended projection. Thus the number of competitors also has no fixed limit. However, the system allows a simple way to eliminate all but a very few candidates; I will not attempt to prove this result, but will outline it. The basic idea rests on the fact that adding projections eventually and reliably leads to worsening status on the constraints. It is never the case that after adding, say two projections with worsening results, the addition of another projection will yield improvement.

Thus it seems that a procedure such as the following will always work: enumerate and evaluate competing extended projections, starting with an extended projection composed of just one projection, proceeding to the set of functionally well-formed extended projections composed of two projections, then to the set of functionally well-formed extended projections composed of three projections, and so forth. When adding an extra projection does not yield improvement on any constraint, cease enumeration. The optimal form is among those already enumerated.

Finally, I return to the core idea which underlies the enterprise of this paper: that every projection is optional, and only present if it is needed. The size of an extended projection, then, depends on various grammatical factors, and is not fixed. Interrogatives are (usually) CPs, imperatives and (naked) infinitives could be just VPs, and so forth. As I have pointed out earlier, this idea is really inconsistent with the hypothesis that what constructs phrase markers is either phrase structure rules or selectional statements. Optional projections are difficult to make sense of in such systems, because they always involve complicating the PS rules or selection statements.

If, however, it is principles of projection that govern the well formedness of extended projections, then optionality does not necessarily lead to complication. The projection relationship itself guarantees that the members of the extended projection must all be the same categorially, and that they are consistently specified. For example, *that* cannot combine with *to* because one is negatively and one positively specified for the property of being an infinitive, and as argued in Grimshaw (1991), morpho-syntactic features project through the entire extended projection. An improper combination of functional heads will thus violate a consistency requirement.

It follows from this and from Min-Proj that only one occurrence of each functional head will be able to occur in a given extended projection. If there were two or more identical occurrences, the structure would be sub-optimal due to the effects of Min-Proj (see section 7, for example.). If there were multiple distinct occurrences they will be ruled out by the consistency requirement just discussed.

Thus far, then, we have derived the following generalizations concerning well-formed extended projections: all heads are of the same category, heads must be morpho-syntactically consistent, and only one instance of each functional head type can be included. Evidently there is no need to appeal to phrase structure or selection to explain these restrictions.

The one issue that is so far unaddressed is that of relative position: why does C go outside I and not inside it? Here again it seems there is no need for stipulation, rather there are very general principles of semantic and functional well-formedness which determine the relationship among projections. The pattern shows a lexical core inside propositional structure, which is in turn inside type and subordination information. Those functional heads that pertain to propositional structure thus necessarily occur inside those functional heads that pertain to type and subordination.

More specifically, we can analyze lexical projections as denoting states or events. I is then a function from states or events to propositions, and C is a function from propositions to subordinate clauses with type specifications, such as interrogative or declarative. (The two are combined in English, although not in every language, see Kim (1990), and Bhatt and Yoon (1991). It is impossible, then, for a C to occur inside I: C cannot compose with a VP denotation, and I cannot compose with a CP. This is why *that* cannot fill just any empty head position in a verbal extended projection: its functional specification allows it to go only on the very edge.

In this kind of system, optional heads are easy to understand: they are just level-maintaining functions. Sentential negation, for example, is a function from a proposition to a proposition. Unlike adding, say, a C to an IP, adding a negation does not change the nature of the IP in any way that affects its combinatorial properties. Hence a clause with a negation will combine with higher level functional categories in just the same way as a clause without negation. This is why negation is optional.

These same principles determine where operators appear, i.e. which specifier position they occur in. Wh movement is type changing, so the wh operator must be outside everything pertaining to the propositional structure. Negative preposing on the other hand, is a kind of sentential negation, hence the operator appears outside the I information, but inside the C specification.

The conclusion, then, is that a strong enough characterization of functional well-formedness makes it possible to explain why extended projections are constructed as they are, without appeal to either phrase structure rules or selection mechanisms (or indeed to the "F values" of Grimshaw

(1991)). Once we make this shift, the existence of optional heads and projections is virtually inevitable, and certainly has no cost. In fact, every projection is an optional projection. Ackema et al. ref.

At this point, however, we can take a more radical step: there is no reason any more to label the projections which make up extended projections. Every projection is just that, a projection, which has a grammatical category, may have a lexically realized head, may have acquired a head by movement, or may lack one completely. An extended projection is just the result of free combination of heads of the same syntactic category, verbal in the cases we have studied in this paper. Any finite number of such projections can in principle make up an extended projection, but the actual number, combinations and hierarchical organization of the extended projection are subject to the well-formedness considerations outlined above. A thread of reasoning along these lines has been running through a number of recent proposals, especially Haider (1989), Ackema et al. (1992), and Heycock and Kroch (1993).

In this paper, I posited "XP" for negative preposing and for *do*. What then is XP? Evidently, this is not the right question to ask. XP is nothing but a verbal projection which takes its place in the system by virtue of the properties of its specifier or its head. But this is no different from any other projection, which also takes its place in the system by virtue of the properties of its specifier and or head. The label "CP" is just what we call an XP which happens to have a head of a particular functional status, but this is merely a convenience to the researcher, not a matter of grammatical representation.

From this perspective, there is, of course, no such thing as "CP recursion" (Rizzi and Roberts (1989) Vikner and Schwartz (1991) McCloskey (1993)). The "extra" projections that have sometimes been given this analysis are really no different from all other projections: just part of the indefinitely expandible verbal extended projection, which is regulated by the constraints examined in this paper, among others.

Evidence for the conclusion that projections are unlabeled comes from the argument that no grammatical principle can refer to "CP", or to "IP". We have seen good evidence that selection does not refer to the labels, since verbs which select interrogatives and verbs which select declaratives freely admit both the IP and the CP versions of their complements. Topicalization was found not to adjoin to IP, but rather to the projection that is predicated of the topic. Characterizing the configuration as one of adjunction to IP proved empirically incorrect. Similarly, there is no principle requiring that wh movement move phrases to Specifier of CP, there is just a constraint which requires that wh operators are in a specifier position from which they take scope over the whole clause. Whether this position is Specifier of IP or Specifier of CP is quite immaterial.

Thus extended projections are properly viewed as structures of flexible size and content. The precise form of an extended projection in any given instance depends on the effects of constraints which determine the optimal and hence grammatical representation through the theory of constraint interaction.

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