

An Optimality Theoretic Approach to Subject-AUX Inversion and its Cross-linguistic Variation

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1. Introduction

The examples as in (1) demonstrate the phenomenon known as Subject-Auxiliary inversion (henceforth, SAI); the auxiliary element in these structures occurs to the left of the subject. When no auxiliary element is available, a form of the expletive *do* appears as in (2).

(1) What will you like to do?

(2) Why did you go there?

SAI does not apply when the questioned element is the subject as in (3a).

(3) a. Who saw the film?

b. *Who did see the film? (without a marked emphatic reading)

SAI is limited to matrix sentences; it does not apply in embedded contexts such as indirect questions and sentential subjects:

(4) I wonder why he went there.

(5) What he did is a mystery.

In the framework of the principles and parameters approach and the Minimalist Program, many proposals have been presented concerning SAI in matrix clauses and the embedded contexts where SAI does not apply. Rizzi (1996) provides an account of such construction-specific manifestations of I-to-C movement in a language like English

(“residual verb second”) by making use of an independently necessary principle viz. the *wh*-criterion. Under the Minimalist Program, on the other hand, one category bearing [+wh] feature in *wh*-interrogatives in English moves to CP-SPEC in overt syntax (Chomsky and Lasnik (1993), Chomsky (1993), Chomsky (1995a, 1995b), among others). It is assumed that complementizers bearing [+wh] feature are always strong. As strong features must be eliminated before PF because of its uninterpretability to the interface, the [+wh] feature of the complementizer must be discharged before PF (see Chomsky (1993)). A *wh*-movement must therefore be present in CP-SPEC at some point in the derivation before PF so that the strong features can be discharged by the feature checking between the complementizer and the *wh*-phrase.¹

Things are not as simple as that, however. Some varieties of English allow such a root phenomenon as SAI in both of an embedded question (whether it be a yes-no question or a *wh*-question) and sentential subject CPs, other varieties of English allow SAI not in the complement of semi-factive verbs but in the complement which matrix verbs take as genuine questions. The facts lead the analyses based on feature checking or the *wh*-criterion to be in quandary as to how to provide a unified account for those cross-linguistic variations.

This paper is devoted to providing a straightforward and unified account for SAI in interrogatives and its cross-linguistic variation in embedded contexts by making use of the following Optimality Theoretic constraints:

CLAUSE TYPE (CL-TYPE): Clause type must be manifested.

OPERATOR (OP): Syntactic operators must be in a c-commanding specifier position from which their scope is interpreted.

CASE: One member of the chain of an argument must be Case-marked.

ECONOMY OF REPRESENTATION (ECO-REP): There can be no irrelevant symbols in a representation.

NO-REDUNDANCY (*REDUN): Redundant feature specification is not allowed.

HEAD: A projection has an overt head.

*trace: Trace is not allowed.

The precise formulation of these constraints is presented at the appropriate points in this paper. We assume that the constraints assess representations in overt syntax (formally known as S-Structure). The Lexicon provides the particular underlying forms in the language particular inputs. Generator (GEN) generates all projections by making use of the set of lexical items provided by the lexicon and targets the semantic representation. GEN also creates chains through movement and deletes material. If projections are generated from the same numeration and target the same semantic representation, they belong to the same candidate set.² The entire set of candidates is compared with respect to conformity to the set of ranked violable constraints and the optimal one survives (see Prince and Smolensky (1993)). Put in a familiar way, an optimal candidate in a candidate set is grammatical, all non-optimal candidates are ungrammatical.

2. Optimality Theoretic Account of Interrogatives

This section provides a straightforward account of the nature of SAI by making use of the constraints presented above, focusing primarily on SAI in matrix yes-no questions. Before we proceed, some remarks on an abstract feature bearing on an interrogative force are in order, since the specification mechanism of such a feature provides some of the foundations of our argument of SAI in interrogatives.

2.1 [+Q] Specification

With respect to the specification of [+wh] feature in matrix questions, such a position may be the INFL. INFL can be divided into the two distinct elements: Tense and Agreement.³ Tense contains the independent tense specification of the whole sentence. Similarly, in a matrix question, the entire sentence must be specified as a question. We posit then that Tense may bear an interrogative feature. Although opinions vary on terminology of interrogative feature, we consolidate [+wh] feature of *wh*-questions and [+Q] feature of yes-no questions into [+Q] feature henceforth and thus Tense in questions may be specified as [+Q].

That a verbal inflection can carry [+Q] feature is highlighted by empirical fact that in some natural languages INFLs manifest a special morphology in interrogatives. Cases in point are Kikuyu (the language of an agricultural Negroid people in the largest Bantu-speaking group in Kenya), Palauan (the language of the islands of Palau in the Western Caroline Islands), Hausa (the language of a widespread Negroid people of the Sudan and Nigeria, of the Bantu family with some Hamitic mixture), and Moore (a Gur language spoken in Burkina Faso). According to Haik (1990), in these languages, clauses from which a *wh*-phrase has been extracted can trigger irrealis morphology in INFL, and the irrealis morphology is exhibited only in the domain between its S-structure position and the variable it binds. These observations of Kikuyu, Palauan, Hausa, and Moore suggest that there is some kind of connection between irrealis form and a reflex of interrogative force viz. [+Q] feature. Since irrealis form hinges on tense specification, it is legitimate to expect that in these languages Tense may bear [+Q] feature (cf. Chomsky and Lasnik (1977), Chomsky (1995b, 1998), etc.).

2.2 [+Q] feature in English

The close connection between Tense and [+Q] feature is found in English as well, which is clarified by investigating data involving the syntactic and semantic difference between infinite clauses and gerunds in the language. It is well-known that finite clauses and infinitival clauses share some analogous properties. Finite clauses contain a clause internal-COMP, and infinitival clauses can do as well. Since finite clauses and infinitival clauses can contain a complementizer position, they permit *wh*-movement.

- (6) a. I remembered [_{CP} where [_{IP} John had visited]].
b. I wonder [_{CP} where [_{IP} PRO to go]].

Finite clauses have the morphological feature, that is, [\pm past], whereas it is assumed that infinitival clauses lack the morphological feature [\pm past]. But this does not always mean that they have no Tense. Rather, the lack of the tense feature, as Stowell (1981, 1982) suggests, has the effect of specifying that the time-frame of the clause is unrealized with respect to the tense of the matrix which takes the infinitival clauses.⁴ Put in another way, the tense of the infinitival clauses is roughly that of *possible future*. It may be then that infinitival clauses have an internally determined tense as finite clauses do. As expected, control predicates have an internally determined tense as in *John tried to leave*. Gerunds, on the other hand, differ from finite and infinite clauses in some respects. One important difference concerns *wh*-movements. Gerunds lack *wh*-movements entirely, as compared to finite clauses and infinitival clauses, as shown in (7).

- (7) a. *I don't remember who (our) visiting.
b. *I wonder where (my) going.

Furthermore, tense of gerunds depends on matrix clauses. Consider the following paradigms:

- (8) a. John tried to climb the mountain.
 b. John tried climbing the mountain.

In (8a), the tense of the infinitival clause is thought to be unrealized with respect to the matrix. That is, the tense is *possible future*. In (8b), on the other hand, the tense of the gerund is ambiguous between present and *possible future* with respect to the tense of the matrix. This contrast suggests that the understood tense of the gerunds is controlled by the semantics of the matrix verbs. Therefore, it seems plausible that [+Q] feature is associated with Tense.

Given that [+Q] feature is specified in Tense of INFL, if a clause has an auxiliary in the I head as in (9), it obtains [+Q] feature from the Tense and undergoes I-to-C movement.

- (9) [_{CP} who_j [_C [_C has_i-C] [_{IP} Mary [_{INFL} [_T t_i-T]] [_{VP} seen t_j]]]]]

Having laid out the system of [+Q] specification, in the subsections that follow we discuss SAI in yes-no questions and present an empirically necessary constraint constraining SAI, which will lay a cornerstone in developing an account for its cross-linguistic variation in embedded questions.

2.3 Typology of Complementizers

Although the inversion demonstrated in yes-no questions parallels the inverted word order of *wh*-questions, yes-no questions exhibit the marked absence of a *wh*-word. Some light can be shed on what triggers SAI in yes-no questions by considering the morphological necessity of the complementizer in an interrogative clause. Within the recent Minimalist approaches (Chomsky (1993, 1995a, 1995b)), as noted before, a minimal assumption is that the strong/weak distinction of certain features of functional categories constitutes the parametric variation among languages. Strong features count as illegitimate objects at PF, and thus for convergence at the PF interface level they have to be

checked and eliminated in overt syntax through a process of movement of heads and phrases to appropriate positions (cf. Chomsky (1995b, 1998)). Suppose then that the head of CP in an interrogative clause bears a strong feature in English. If so, the I-to-C movement of an auxiliary in the interrogative clause is ascribed to the procedure of deletion of the strong feature the head of CP bears. However, such an account forces us into a position where non-occurrence of SAI in an embedded question cannot be explained.

An examination of a range of typological differences of the complementizer system in interrogatives will pave the way for a desirable account for the nature of SAI in yes-no questions. According to the report of Radford (1988), there are many natural languages which use an overt interrogative complementizer to introduce a matrix interrogative clause (i.e. they say 'Whether you are leaving?' instead of 'Are you leaving?'), for example, Latvian, Estonian, Persian, Polish, Russian, Irish, Yiddish, German, and so forth. A similar construction was found in Old English.

It is also useful here to take into consideration interrogative patterns which vary across the range of possible interim grammars in language acquisition. Young children learning English grammar may misanalyse preposed auxiliaries in questions as invariable "question particles." Akmajian and Heny (1975) report one three-year-old girl producing questions of the form (see also Crain and Nakayama (1987) and Crain (1991)).

(10) a. *Is* I can do that?

b. *Is* you should eat the apple?

It may be the case that the children use *Is* as an invariable interrogative complementizer. It follows then that the complementizer bears [+Q] feature and the matrix clause is encoded as a yes-no question.

We have observed that an interrogative complementizer plays a role

of encoding the entire clause as a yes-no question. Occurrence of complementizers in matrix clauses is not restricted to interrogatives, which is highlighted by the fact that exclamative clauses, certain imperative constructions, and declarative clauses are introduced by making use of overt distinctive complementizers in the sentence initial position in many natural languages. A more direct relationship between complementizers and encoding of clause type is focused on typology in terms of sentence complementation. In modern Irish, types of finite clauses (e.g. subordinate, relative, interrogative, negative clauses, and such) show up in complementizers (see Chung and McCloskey (1987: 218)).

Many other languages fill in a piece of the argument justifying the direct relationship between sentence complementation and typology of complementizers. Romanian distinguishes indicative and subjunctive complements by using different complementizers. In Bulgarian, the indicative and subjunctive also have distinct complementizers, *če* and *da* respectively. And they differ in inflectional possibilities; the indicative is inflected for tense, while the subjunctive is invariable and uses the same person-number inflections as the indicative present. In Russian, the indicative and subjunctive have distinct complementizers, *čto* and *čtoby* respectively. The complementation system in Greek also differentiates factives and non-factives (non-subjunctives) overtly. In this language, non-factive sentences are introduced by the complementizer *oti* and factive sentences by the specialized complementizer *pu*.⁵

A common property which lies behind the complementizer system presented above is that complementizers have a property which favors indication of clause type. Suppose then that the phenomena observed in the complementizer system are due to a constraint favoring just this situation, which I call CLAUSE TYPE (CL-TYPE).

(11) CLAUSE TYPE (CL-TYPE)

Clause type must be manifested.

If syntactic and morphological encodings are available, economy consideration will block the former in that it aggravates a *trace violation.⁶ The constraint *trace is one of Faithfulness constraints which ensure that the input and the output of a derivation differ as little as possible and which minimize the effects of syntactic operations (i.e. economy constraints). However, English does not have rich morphology to indicate varieties of clause type. Adult Grammar of English therefore resorts to syntactic encoding (move), i.e. SAI, in the case of yes-no questions.⁷

2.4 Inversion in Yes-no Questions

With this much background, let us consider again question particles that young children acquiring English grammar use in yes-no questions as in (10). Under OT, constraints are ranked and the interactions of constraints offer various empirical phenomena particular to a language. The other key constraints for the exploration of SAI in English interrogatives are CASE, HEAD, and *trace. We posit here that CL-TYPE dominates CASE, HEAD, and *trace, and that they are stratified as CL-TYPE >> CASE >> HEAD >> *trace. HEAD requires that a projection have an overt head.⁸ The head may be filled by a lexical element or a trace of the moved lexical element. CASE, which requires that one member of the chain of an argument be Case-marked, leads a subject to undergo movement from VP-SPEC to IP-SPEC. In (10), the examples satisfy CL-TYPE, since the question particle *Is* appears in the head of CP. Take a closer look at the OT assessment of (10a), for example.

The grammatically well-formed structures are those that optimally satisfy the set of constraints. OT relies on a notion of constraint

Tableau 1

Candidates	CL-TYPE	CASE	HEAD	*trace
[_{CP} e [_{IP} I _i can [_{VP} t _i do that]]]]	*!		*	*
[_{IP} I _i can [_{VP} t _i do that]]]	*!			*
[_{CP} e [_{IP} I _i can [_{VP} t _i do that]]]]	*!		*	*
☞ [_{CP} Is [_{IP} I _i can [_{VP} t _i do that]]]]				*

interaction whereby the satisfaction of one constraint can be designated to take absolute priority over the satisfaction of another. When a choice must be made between satisfying one constraint or another, the stronger must take priority and thus the weaker will be violated in a well-formed structural representation. In Tableau 1, every candidate, including the optimal one, has at least one constraint violation, since a subject has been raised from VP-SPEC to IP-SPEC. All the candidates except the last one do not satisfy CL-TYPE, since the head of CP is not occupied by the question particle. Those candidates are not regarded as yes-no questions due to a CL-TYPE violation. The first and third candidates violate HEAD because of no lexical element in the head of CP. The last candidate marked with ☞ violates only *trace, whereas all the other candidates violate at least one constraint ranked higher than *trace. Thus the last candidate marked with ☞ is selected as optimal.

In adult English, introduction of the question particle *Is* at the left edge of a sentence never takes place. In this case, however, the C position of the clause cannot have an interpretation as yes-no question due to the absence of the question particle *Is*, inducing a CL-TYPE violation.

If an element bearing an interrogative feature occupies the C position of the clause, a CL-TYPE violation is evicted. Recall that a Q-feature may be specified in Tense of the I head of IP (see Section 2.1).

Tableau 2

Candidates	CL-TYPE	CASE	HEAD	*trace
$[_{CP} [_C e [_{IP} you_i can [_{VP} t_i buy the car]]]]$	*!		*	*
$[_{CP} [_C can_i-C [_{IP} you_j t_i [_{VP} t_j buy the car]]]]$				**

If an auxiliary is inserted under the head of the matrix IP, it can obtain a Q-feature from the INFL. If the auxiliary undergoes I-to-C movement (i.e. syntactic encoding for yes-no questions), it can play an essential role of the question particle *Is*, satisfying CL-TYPE and HEAD at the same time. Hence SAI in matrix yes-no questions in adult English. Once young children learn this fact from linguistic data which are vastly common in adult English, they make productive use of inverted matrix yes-no questions.

Having shown a straightforward account of SAI exhibited in matrix yes-no questions, in the following section we shall consider *wh*-movement and SAI accompanied by it by making use of the Optimality Theoretic constraints developed thus far, focusing primarily on inverted matrix *wh*-interrogatives.

3. Matrix *Wh*-questions

3.1 I-to-C Movement

As mentioned before, in English declarative sentences SAI is disallowed, whereas it is required in *wh*-interrogatives, as shown in (12b).

- (12) a. $*[_{CP} \text{Which book } e [_{IP} \text{they will } [_{VP} \text{read}]]]]?$
 b. $[_{CP} \text{Which book will } [_{IP} \text{they } [_{VP} \text{read}]]]]?$

The external argument undergoes movement from VP-SPEC to IP-SPEC, where it is Case-marked by the INFL. The movement for Case-marking induces a *trace violation, which has the benefit of allowing CASE to be satisfied.

Tableau 3

Candidates	CL-TYPE	OP	CASE	HEAD	*trace
[_{IP} DP _i will [_{VP} t _i read what]]	*!	*!			*
[_{CP} e [_{IP} DP _i will [_{VP} t _i read what]]]	*!	*!		*	*
[_{CP} what _j e [_{IP} DP _i will [_{VP} t _i read t _j]]]				*!	**
\mathcal{E} [_{CP} what _j will _k [_{IP} DP _i t _k [_{VP} t _i read t _j]]]					***
[_{CP} will _j [_{IP} DP _i t _j [_{VP} t _i read what]]]		*!			**

Wh-movement establishes an operator-variable relation and thus *wh*-phrases are subject to the constraint OP, which requires that *wh*-operators be in specifier positions.⁹ We posit that this constraint dominates the constraints other than CL-TYPE. Due to the requirement of OP, the *wh*-operator in (12) undergoes movement to the specifier position of an additional projection erecting over IP (i.e. CP) at the cost of a *trace violation. The *wh*-phrase in CP-SPEC encodes the entire clause as a *wh*-question and thus satisfies CL-TYPE. However, the additional projection has no visible head as shown in the third candidate in Tableau 3, leading to a HEAD violation. Such a situation is eschewed via I-to-C movement of the auxiliary despite its being disfavored by *trace, as illustrated in the fourth candidate. In this case, the auxiliary, which is base-generated under the head of IP and obtains [+Q] feature from it, has provided the feature for the head of CP. In the last candidate, on the other hand, SAI has the head of CP filled by the auxiliary, and thus satisfies HEAD. And the C bearing the [+Q] feature encodes the entire clause as a yes-no question, which results in the satisfaction of CL-TYPE. But notice that the candidate induces an OP violation because it has not undergone *wh*-movement. Consequently, we obtain the result that the fourth candidate marked with \mathcal{E} is selected as optimal. Hence *wh*-movement and SAI in matrix *wh*-interrogatives as in (12b).¹⁰

3.2 Subject *Wh*-phrases

In the case where a sentence contains a *wh*-subject, a conceivable derivation is that it is base-generated in the specifier position of V and subsequently undergoes movement to IP-SPEC, where it is Case-marked by the INFL. The movement leads to the satisfaction of CASE, and moreover, it respects OP, since the *wh*-subject has occupied the specifier position of INFL. It follows then that it need not move up to CP-SPEC, which is in accordance with the Vacuous Movement Hypothesis (see Chomsky (1986)).

- (13) a. [_{CP} Who e [_{IP} t' I [+Q] [_{VP} t met the president]]]?
 b. [_{IP} Who I [+Q] [_{VP} t met the president]]?

If the phrase undergoes movement from IP-SPEC to CP-SPEC, it aggravates a *trace violation, and moreover, induces a HEAD violation because of the representation where the head of CP is not filled by a lexical element.

This section has argued that *wh*-movement and SAI are explained as a consequence of the interactions of the OT constraints stratified as CL-TYPE >> OP >> CASE >> HEAD >> *trace. The section that follows develops an account for embedded questions and the language variation of SAI in embedded contexts.

4. Indirect Questions

4.1 I-to-C Movement in Embedded Contexts

A familiar problem for analysis of SAI is that although SAI systematically fails to take place in an embedded question and thus the C in the embedded clause is not filled by an overt element, it bears an interrogative feature. In the spirit of Chomsky's principle of Full Interpretation, each occurrence of a substantive feature must be licensed. One obvious licensing mechanism is selection. The occurrence of [+Q]

in an embedded COMP is determined by a standard licensing device, viz. lexical selection by complement-taking verbs like *wonder* (Chomsky (1981), Stowell (1981), Lasnik and Saito (1984, 1992), Rizzi (1990, 1996), among others).

(14) I wonder [_{IP} who C [+Q] [_{IP} John met *t* there]]

As for the specification of [+Q] feature in matrix questions, we have claimed that it is specified in the matrix INFL.

(15) [_{IP} I [+Q] [_{VP}]]

Notice that the subject/non-subject asymmetry is absent. In the case of (14), in the embedded clause, the C has features imposed by the selectional requirements of the matrix head. The features of C are [\pm Q], where [$-$ Q] may be spelled out as *that* and [+Q] as a complementizer *whether/if*. This is in contrast to matrix environments in which C is typically empty, except in yes-no questions where it bears an abstract Q-feature. In (14), the *wh*-phrase has moved to the specifier position of CP and the C which has contents imposed by the matrix verb. However, when a *wh*-phrase appears in the CP in an embedded clause, the head of CP is not spelled out, thereby inducing a HEAD violation. In matrix questions, as pointed out before, SAI takes place due to the requirement of HEAD, in marked contrast to embedded questions.

(16) [_{CP} who_i did_j-C [+Q] [_{IP} you *t_j* [_{VP} meet *t_i*]]]

Much attention has been focused on the contrast between matrix and embedded context in terms of SAI. From the perspective of the OT framework, Grimshaw (1997) offers the following constraint:¹¹

(17) PURITY OF EXTENDED PROJECTION (PURE-EP):

No adjunction takes place to the highest node in a subordinate extended projection; and no movement takes place into the highest head of a subordinate extended projection.

Suppose here that this constraint dominates all the other constraints

presented thus far: CL-TYPE, OP, HEAD, and *trace. The requirement of the relatively high constraint predicts that SAI never occurs in embedded questions.

As already mentioned, however, there are some varieties of English where SAI is observed in embedded questions. Cases in point are Hiberno-English (spoken in Ireland), Belfast English (spoken in Belfast, the capital of Northern Ireland), Black English, etc. (for details, see Grimshaw (1979), McClosky (1992), Cheng (1991), Weverink (1991), Rivero (1994), Henry (1995), among others). Some typical examples are presented in (18) and (19).

- (18) a. Ask your father does he want his dinner.
b. I was wondering would he come home for the Christmas.
c. Do you remember did they live in Rosemount?
d. I've never found out would he really have come with me.
e. Did he tell you how did he do it?

(McCloskey (1992: 15))

- (19) a. They asked who did we see.
b. I wonder what did John think would he get.

Adjunction of some element to an embedded clause is within the scope of PURE-EP, since all varieties of English disallow such an operation in concord with Standard English.

- (20) a. *I know [tomorrow [_{CP} he is going or not], but I'm not letting on.
b. *We couldn't establish [last month [_{CP} he met them]].

Nevertheless, PURE-EP predicts that examples such as (18) and (19) and adjunction to embedded clauses are equally unacceptable in varieties of English, contrary to the fact. The constraint is thereby untenable.

What makes the matter fascinating is that SAI in embedded questions is not restricted to varieties of English. As reported by Stromswold (1990), Weverink (1991), Plunkett (1991), Inada and Imanishi (1997), etc., SAI is observed in embedded questions when

young children begin to make productive use of embedded clauses.

- (21) a. Now I wonder how can you make # does step.
 b. Tell me what is it.
 c. They don't say where is my Great Pumpkin book any more.
 d. I know what time is it.
 e. I don't understand why is the grass poisoned up?

According to Inada and Imanishi (1997), in the embedded questions young children produce, some predicates selecting embedded questions are used in modal contexts (imperatives, interrogatives, and clauses *want*-type verb takes as their complement, all of which make embedded question available). SAI occurs not only in a context where genuine questions appear in adult speech but also in a complement where only semi questions can appear as in (21d), and some of the embedded questions are accompanied by the rising intonation (this is indicated by a question mark) as in (21e).

As pointed out before, occurrence of [+Q] feature in an embedded C is determined by the lexical selection of the verb in the matrix clause. If I-to-C movement occurs in an embedded question, the C position of the embedded question which is specified as [+Q] by the lexical selection of the verb in the matrix clause will doubly have [+Q] feature, since [+Q] feature is specified in the I head as well and thus the I-to-C movement of the auxiliary carries it in the C (for details of the specification of [+Q] feature in INFL, see Section 2). Adult Grammar of Standard English does not allow SAI in embedded questions. This fact suggests that Adult Grammar of Standard English favors non-redundancy of feature specification over redundancy of it. Suppose then that systematic failure of SAI in embedded questions is due to a constraint favoring just this situation, which I call NO-REDUNDANCY (*REDUN).

(22) NO-REDUNDANCY (*REDUN)

Redundant feature specification is not allowed.

Under OT, language variations follow from the role of the constraints within particular languages. The difference of constraint ranking of two languages characterizes the distinctive patterns of them and thus leads to variation between them. This point carries over to language acquisition. Part of acquiring a language is acquiring the critical rankings of that language. We assume then that *REDUN dominates HEAD and *trace in Adult Grammar of Standard English.

Having laid out the basic constraints, we take a closer look at the failure of SAI in embedded questions of Adult Grammar of Standard English. As shown in the first candidate in Tableau 4, if SAI occurs in an embedded question, [+Q] feature is doubly specified in the C position, since the I head of the embedded question can bear [+Q] feature and thus provides it for the C via SAI. Hence a *REDUN violation. Given that *REDUN outranks HEAD and *trace in Adult Grammar, SAI does not take place in embedded questions, as shown in the second candidate in Tableau 4.

Now turn to the language variation in embedded *wh*-questions. The only parametric difference to Adult Grammar of Standard English that is relevant in this context concerns the relative ranking of *REDUN and HEAD. HEAD dominates *REDUN by virtue of the minimal reranking of *REDUN and HEAD, thereby providing a different interrogative system. This requires focusing on languages in which

Tableau 4
 Embedded *Wh*-questions

Candidates	CL-TYPE	OP	*REDUN	HEAD	*trace
...V [_{CP} wh AUX _j [+Q] -C [+Q] [_{IP} DP _i t _i [_{VP} t _i V]]]			*!		**
☞ ...V [_{CP} wh C [+Q] [_{IP} DP _i AUX [+Q] [_{VP} t _i V]]]				*	*

SAI takes place in embedded *wh*-questions. These languages where this is the case are children's English and some varieties of English (e.g. Belfast English). SAI in embedded *wh*-questions is allowed, as shown in the first candidate in Tableau 5 despite its being disfavored by *REDUN due to the double specification of [+Q] feature in the embedded C. Given the partial ranking HEAD >> *REDUN, however, the *REDUN violation has the benefit of allowing HEAD to be fulfilled.

The argument made above carries over to embedded yes-no questions. In embedded yes-no questions of adult English, the complementizer *if* or *whether*, which plays a crucial role of encoding yes-no question, is introduced to the embedded C position by Merge.

(23) I wonder [_{CP} *if/whether* [+Q] [_{IP} they are [+Q] [_{VP} leaving]]]
 In this case, no double specification of [+Q] feature is yielded, predicting no *REDUN violation. And the complementizer in the head of the embedded CP encodes the embedded clause as a yes-no question and thus satisfies CL-TYPE.

If the complementizer *if* or *whether* is not introduced into embedded yes-no questions, syntactic operation is the last resort to satisfy CL-TYPE, i.e. I-to-C movement of an element bearing [+Q] feature.

Tableau 5

Candidates	CL-TYPE	OP	HEAD	*REDUN	*trace
☞ ...V [_{CP} <i>wh</i> AUX _j [+Q] -C [+Q] [_{IP} DP _i t _j [_{VP} t _i V]]]				*!	**
...V [_{CP} <i>wh</i> C [+Q] [_{IP} DP _i AUX [+Q] [_{VP} t _i V]]]			*!		*

Tableau 6

Children's English and Varieties of English

Candidates	CL-TYPE	OP	HEAD	*REDUN	*trace
...V [_{CP} e- [+Q] [_{IP} DP _i AUX [+Q] [_{VP} t _i V]]]	*!		*!		*
☞ ...V [_{CP} AUX _j [+Q] -C [+Q] [_{IP} DP _i t _j [_{VP} t _i V]]]				*	**

Hence SAI in embedded yes-no questions. These languages where this is the case are children's English and varieties of English, as already pointed out.

4.2 *Wh*-COMP Configuration

We have seen that non-occurrence of SAI in embedded *wh*-questions of Standard English is ascribed to the partial ranking *REDUN >> HEAD. In this case, the C position in embedded *wh*-questions is not filled by a lexical element and thus leads to a HEAD violation. If, however, the C position is filled by some element which is introduced by a syntactic operation other than SAI, the HEAD violation will be eschewed. And moreover, non-occurrence of SAI induces no *REDUN violation.

Such a situation is highlighted by a range of empirical phenomena exhibited in a complementizer system of other languages than Standard English. Some varieties of English and Middle English allow the complementizer *that* in embedded questions as follows:¹²

(24) I wonder what street that he lives in. (varieties of English)

(25) At his upriste Men tolden him how that it ferde. (Middle English)

At his uprise men told him how that it fared

'At his uprise, men told him how it fared.'

(John Gower, *Confessio Amantis*, I. 116)

And the complementizer system in Middle English allows the complementizer *that* immediately follows something which is unquestionably in C (i.e. "doubly filled COMP").

(26) a. Blameth nat me if that ye chese amis

Blame not me if that you choose amiss

'Don't blame me if you make the wrong choice.'

(Geoffrey Chaucer, *The Miller's Prologue*, 3181)

- b. Though that my tale be of an hostileer...
 Though that my story is about an innkeeper
 'Though my story is about an innkeeper...'

(Geoffrey Chaucer, *The Cook's Prologue*, 4359)

Although the head of the embedded CP is filled by the lexical element *that* and thus HEAD is satisfied, the complementizer seems to have no relevance to an interrogative context.¹³ Standard English disallows the complementizer *that* in the head of CP of an embedded question, however. We posit then that non-occurrence of elements incompatible with a given context is due to a constraint which favors such a situation, which I call ECONOMY OF REPRESENTATION (ECO-REP).¹⁴

(27) ECONOMY OF REPRESENTATION (ECO-REP)

There can be no irrelevant symbols in a representation.

Cross-linguistic variation is derived from the different ranking of the same set of constraints. The only parametric difference to Standard English that is relevant in this context concerns the ranking of ECO-REP and HEAD; by assumption, ECO-REP dominates HEAD in Standard English. If HEAD outranks ECO-REP, it is predicted that doubly filled COMP is allowed, as in the varieties of English and Middle English.

We have seen that the interactions of the constraints presented thus far (i.e. CL-TYPE, OP, ECO-REP, *REDUN, HEAD, *trace) provide a straightforward account of SAI in interrogatives. As already mentioned, some varieties of English allow SAI in both of an embedded question (whether it be a yes-no question or a *wh*-question) and sentential subject CPs, other varieties of English allow SAI not in the complement of semi-factive verbs but in the complement which matrix verbs take as genuine questions. ECO-REP has been motivated with malice aforethought, since it offers a foundation to provide a deeper

account for the recalcitrant dialect variation of SAI in embedded contexts. In the section that follows we demonstrate that the constraint based analysis establishes further empirical validity by proving that the dialect variation of SAI in embedded questions and sentential subject CPs is derived from the different ranking of the same set of constraints presented thus far.

5. Dialect Variation

5.1 Belfast English

Belfast English, as mentioned before, exhibits SAI in indirect questions as well as in direct questions.¹⁵ In this dialect, SAI takes place after any verb which takes an interrogative complement or governing predicates which bear illocutionary force of interrogative viz. under circumstances where [+Q] feature is specified.

(28) a. They asked who did we see.

b. I wonder what did John think would he get.

(29) a. Do you remember did they live in Rosemount?

b. I've never found out would he really have come with me.

We have shown that the occurrence of SAI in embedded questions is explained as a consequence of the interactions of the stratified constraints, CL-TYPE >> OP >> HEAD >> *REDUN >> *trace.¹⁶

The next step is to consider how to deal with the fact that SAI can take place even in the complement of semi-factive verbs in this dialect.

(30) a. The police found out had the goods been stolen.

b. I know is he going or not.

Although complements *wonder*-type verbs (e.g. *ask*, *wonder*, etc.) take and complements semi-factive verbs (e.g. *know*, *find out*, etc.) take are assumed as the same class of embedded questions, they have

some different properties. According to Inada and Imanishi (1997), complements semi-factive verbs take exhibit parallelism to embedded declarative sentences, where *wh*-phrases are interpreted as indefinite or indeterminate, whereas complements *wonder*-type verbs take are embedded as genuine indirect questions parallel to direct questions. Supporting evidence for this comes from the following contrastive paradigms. First, interrogative complements of *wonder*-type verbs can take appositive disjunctives whereas those of semi-factive verbs can co-occur with appositive conjunctions.

- (31) a. They asked who, {John or Bill/*John and Bill}, could help her.
 b. They knew who, {John and Bill/*John or Bill}, could help her.

(Inada and Imanishi (1997))

Second, negative polarity items as *ever*, *at all*, and such can appear in the complement of *wonder*-type verbs.

- (32) a. They {asked/wondered} who could ever help her.
 b. *They {knew/found out} who could ever help her.

ibid.

A question arises here about what property the auxiliary undergoing I-to-C movement in semi-factive verbs' complement has if semantics of semi-factive verbs' complement are different from those of *wonder*-type verbs' complement. In contrast to the complement of *wonder*-type verbs, that of semi-factive verbs does not seem to bear a genuine interrogative feature viz. [+Q] feature. Although it is not the same feature as [+Q], some abstract feature is specified in the complement of semi-factive verbs.¹⁷ If I-to-C movement of an auxiliary takes place in the complement, it induces a *REDUN violation, since an abstract feature is doubly specified in the C head by virtue of the movement and the selection imposed by the matrix governing predicate. Notice that HEAD dominates *REDUN in this dialect. Thus it is predicted that SAI takes place due to the requirement of HEAD. Although

Tableau 7

The Complement of Semi-factive Verbs

Candidates	CL-TYPE	OP	HEAD	ECO-REP	*REDUN	*trace
☞ ...V [_{CP} wh AUX _j -C [_{IP} DP _i t _j [_{VP} t _i V]]]				*!	*	**
...V [_{CP} wh C [_{IP} DP _i AUX [_{VP} t _i V]]]			*!			*

HEAD is respected by the I-to-C movement of the auxiliary, it puts on a semblance of an auxiliary in genuine indirect questions and only plays a role for satisfying HEAD. The C thereby leads to be a verbal head irrelevant to an interrogative context and violates ECO-REP, which disallows irrelevant symbols in a representation (see Section 4.2).

A closer inspection of the complementizer system reveals that an ECO-REP violation has the benefit of allowing HEAD to be satisfied in this dialect. In this dialect as well as Middle English, the complementizer *that* can co-occur with a *wh*-phrase in interrogative complements and fills the head of CP, which leads to the satisfaction of HEAD, as shown in (33).

(33) I wonder which book that they bought.

The complementizer plays only a role for satisfying HEAD. It follows then that ECO-REP is dominated by HEAD and thus an ECO-REP violation does not militate against SAI in embedded contexts of this dialect. SAI can thereby take place even in the complement of semi-factive verbs.

Let us turn to SAI in sentential subject CPs in this dialect. In embedded questions, [+Q] feature is imposed in the C of the embedded clause by virtue of a standard licensing device, viz. lexical selection by the matrix verb or the governing predicate. Thus a semantic discrepancy between the matrix verb (or predicate) and its complement is banned as shown in (34).

- (34) a. *I wonder [that John will attend the meeting].
 b. *I believe [if John will attend the meeting].

SAI does not take place in embedded questions of Standard English. The parallel to embedded questions also shows up in sentential subject CPs. Although *wh*-phrases can be fronted in sentential subject CPs, SAI and *do*-support never apply in Standard English.

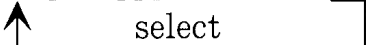
- (35) a. What John said is a mystery.
 b. What to select is the question.
 c. That John left is well-known.

When a semantic discrepancy is found between the predicate and its sentential subject, the sentences result in the ungrammaticality, as shown in (36)-(37).

- (36) *That John married her is the question.

- (37) *Why he left is a fact.

Therefore, it is plausible that sentential subject CPs may have some feature imposed in their head by virtue of selection by some element. We assume then that it is the predicates that select the sentential subject CPs, as illustrated in (38).

- (38) [_{IP} [_{CP} [_C C [_{IP}]]] [_{I'} I [_{VP} _____]]]


If sentential subject CPs undergo selection as well as embedded questions, it is predicted that the parallel to embedded questions also shows up in sentential subject CPs. In fact, Belfast English exhibits SAI even in sentential subject CPs in marked contrast to Standard English, as shown in (39).

- (39) a. Can you get a good job depends on who can help you.
 b. Should he go or not was the question.
 c. What did John say is a mystery.

Notice that in (39), no semantic discrepancy is found between the predicate and the sentential subject CP. Given that HEAD dominates

ECO-REP, *REDUN, and *trace in this dialect, the violations of the constraints ranked lower than HEAD have the benefit of allowing HEAD to be satisfied. Thus I-to-C movement of an auxiliary can take place even in sentential subject CPs.

5.2 Hiberno-English

Hiberno-English, as mentioned before, exhibits SAI in embedded questions as in (40a, b) as well as Belfast English. An intriguing disparity between these dialects shows up, however. According to McCloskey (1992), in Hiberno-English, SAI occurs only after a subset of verbs, for example, verbs which select interrogative complements, but it is not allowed in the complement of semi-factive verbs in marked contrast to Belfast English.

(40) a. I wonder when would they leave.

b. I wonder is he going.

(41) Semi-factive Verbs

a. *I remember why did he leave.

b. *We know what did they buy.

c. *The police found out had it been stolen.

Neither is SAI allowed in questions appearing subject position in this dialect.

(42) a. *Should he go or not was the question.

b. *What did John say is a mystery.

In a restricted context, however, SAI is allowed in this dialect. Semi-factive verbs in negative and some modal predicates that bear request for information can allow it in their complement.¹⁸

(43) a. Do you remember did they live in Rosemount?

b. I've never found out would he really have come with me.

c. She wants to know who did I appoint.

We assume that matrix semi-factive verbs can select interrogative

complements in the modal context where matrix predicates express lack of information or desire for information and thus the C of the embedded CP is specified as [+Q]. Then how do we deal with the dialect variation? Constraints subject to ranking by individual grammars offer language typology. The only parametric difference to Belfast English that is relevant in this context concerns the ranking of ECO-REP and HEAD; by assumption, in Hiberno-English, ECO-REP dominates HEAD, as shown in (44).

(44) CL-TYPE >> OP >> ECO-REP >> HEAD >> *REDUN >> *trace

With this in mind, let us take a closer look at genuine indirect questions and the complement of semi-factive verbs in some restricted contexts. As shown in (40) and (43), the auxiliary in the embedded clause bears [+Q] feature and undergoes I-to-C movement. HEAD is satisfied by the movement, whereas *REDUN is not, which is ascribed to the double specification of [+Q] feature. The auxiliary is not incompatible with an interrogative context. Hence the satisfaction of ECO-REP. Although the I-to-C movement induces a *REDUN violation, it is allowed due to HEAD outranking *REDUN.

In the case of embedded yes-no questions in this dialect, SAI can take place at the cost of a *trace violation (i.e. the I-to-C movement of an auxiliary) and a *REDUN violation (i.e. the double specification of [+Q] feature in the C). However, the two constraint violations have the benefit of allowing HEAD and the highest ranked constraint CL-TYPE to be satisfied because the embedded clause is encoded as a

Tableau 8

Embedded *Wh*-questions

Candidates	CL-TYPE	OP	ECO-REP	HEAD	*REDUN	*trace
$\text{[E]} \dots V_{[CP\ wh\ AUX_j\ [+Q]\ -C\ [+Q]\ [IP\ DP_i\ t_j\ [VP\ t_i\ V]]}]$					*!	**
$\dots V_{[CP\ wh\ C\ [+Q]\ [IP\ DP_i\ AUX\ [+Q]\ [VP\ t_i\ V]]}]$				*!		*

yes-no question and has no empty headed CP by virtue of SAI¹⁹.

In the case of the complement of genuine semi-factive verbs and sentential subject CPs, on the other hand, the C head of CP is not specified as [+Q] unlike genuine indirect questions. Thus the auxiliary that has undergone I-to-C movement renders the C incompatible with an interrogative context, which thereby leads to an ECO-REP violation. Furthermore, a *REDUN violation results, since the movement yields double specification of an abstract feature in the C position. Thus, as shown in the second candidate in Tableau 10, SAI does not take place in the complement of genuine semi-factive verbs.

The same argument carries over to the explanation of non-occurrence of SAI in sentential subject CPs. Sentential subject CPs lack interrogative force and thus do not exhibit parallelism to genuine indirect questions. Although in sentential subject CPs, I-to-C movement of an auxiliary fulfills HEAD, it renders the C incompatible with an interrogative context and thus is disfavored by ECO-REP. Given the partial ranking ECO-REP >> HEAD, however, uninverted sentential subject CPs are born out in Hiberno-English.

Tableau 9
Embedded Yes-no Questions

Candidates	CL-TYPE	OP	ECO-REP	HEAD	*REDUN	*trace
☞ ...V [CP AUX _j [+Q] -C [+Q] [IP DP _i t _j [VP t _i V]]]					*!	**
...V [CP C [+Q] [IP DP _i AUX [+Q] [VP t _i V]]]	*!			*		*

Tableau 10
Complements of Semi-factive Verbs²⁰

Candidates	CL-TYPE	OP	ECO-REP	HEAD	*REDUN	*trace
...V [CP wh AUX _j [F] -C [F] [IP DP _i t _j [VP t _i V]]]			*!		*	**
☞ ...V [CP wh C [F] [IP DP _i AUX [F] [VP t _i V]]]				*!		*

6. Concluding Remarks

It has been argued that in addition to the trigger of *wh*-movement, systematical occurrence of SAI in matrix questions and systematical failure of SAI in embedded questions in Standard English immediately follow from the interactions of the following stratified constraints:

(45) Standard English

CL-TYPE >> OP >> ECO-REP >> *REDUN >> HEAD >> *trace

And it has been demonstrated that the variable acceptance of inversion in embedded contexts in varieties of English is explained as a consequence of the different ranking of the same set of constraints. ECO-REP dominates *REDUN in Standard English as in (45), whereas HEAD dominates *REDUN in Hiberno-English as in (46). The relative rankings of the constraints result in non-occurrence of SAI in embedded contexts in Standard English one hand and in occurrence of SAI confined in genuine embedded questions in Hiberno-English on the other.

(46) Hiberno-English

CL-TYPE >> OP >> ECO-REP >> HEAD >> *REDUN >> *trace

(47) Belfast English

CL-TYPE >> OP >> HEAD >> ECO-REP >> *REDUN >> *trace

And consistent occurrence of SAI in embedded contexts in Belfast English is ascribed to the stratified constraint hierarchy (47).

NOTES

- 1 Under the framework of Chomsky (1998), a *wh*-phrase has an uninterpretable feature [wh-] and an interpretive feature [Q]. Driving force of *wh*-movement is due to attraction by the

uninterpretable feature that the C of CP bears (i.e. Suicidal Greed). The [wh-] feature the *wh*-phrase bears is deleted after the checking between the *wh*-phrase and the C, while the [Q] feature remains after the checking (cf. Chomsky (1993, 1995b)).

- 2 The numeration as a background notion in need of clarification is different from the concept of reference set developed by Chomsky (1995b) in that the latter is based on identical numerations, i.e. simplifying somewhat on identity of lexical numerations. Although matters turn out to be a little more complex on closer inspection, it may suffice for the analysis presented here to note that if competing candidates have non-distinct logical forms, they are truth-functionally equivalent. If the sentences have distinct logical forms, they can be syntactically different.
- 3 Although in the version of the split INFL hypothesis of Pollock (1989) and Chomsky (1991, 1993), INFL is divided into the two distinct projections, TP and AgrP, the traditional IP is employed instead of them here.
- 4 Infinitives may describe something unrealized, thereby predicting the ungrammaticality of the following sentences.
(i) a. *John tried to have examined the dog.
 b. *John managed to have examined the dog.
For details of unrealized tense, see Bresnan (1972).
- 5 For details of sentence complementation in these languages, see Noonan (1985).
- 6 Morphological encoding is executed by an operation Merge. Merge preempts Move in that the latter requires selection of a phrase as a candidate for pied-piping and Remerge (see Chomsky (1998)).
- 7 At the stage where children produce telegraph speech, they have not expressed yes-no questions by either syntactic or morphological encoding, and thus they resort to the rising intonation at the end

of utterance, which indicates that CL-TYPE is violable at the stage.

- (i) a. You want eat?
 b. You see my doggie?

When competing candidates tie with respect to the higher ranked constraint violation, the candidate which best satisfies the lower ranked constraints is selected as optimal.

- 8 HEAD is equivalent to the constraint OBLIGATORY HEAD of Grimshaw (1997), and it is transcribed as HEAD for terminological convenience.
- 9 Some OT constraints constraining *wh*-fronting have been proposed. Legendre, Smolensky and Wilson (1998) offer the constraint which requires no empty question operators, one member of a family of constraints which requires that the scope-marking heads of operator chains be overt. OP yields similar effects to the constraint presented by Grimshaw (1997), called OPERATOR IN SPECIFIER (OP-SPEC) in that both of them prefer to a clause-initial specifier position.
- 10 In contrast to English, overt multiple *wh*-fronting is observed in some natural languages, e.g., Romanian, Bulgarian, and so forth.
- (i) a. Cine cui ce ziceai [că i -a promis ____]? (Romanian)
 who to whom what said-2s that to him has promised
 ‘Who did you say promised what to whom?’
 b. Koj kŭde misliš [ce e otišŭl ____]? (Bulgarian)
 who where think-2s that has gone
 ‘Who do you think has gone where?’

In multiple *wh*-interrogatives, one *wh*-fronting to an appropriate position where a *wh*-phrase is accommodated is enough to encode the entire clause as a *wh*-question which is within the scope of the *wh*-phrase just like *wh*-fronting in English, though the *wh*-phrases

in situ violate OP. Nonetheless, Romanian and Bulgarian execute overt multiple *wh*-fronting, which has the benefit of inducing no violation of OP. This fact indicates that CL-TYPE and OP are independently necessary constraints.

- 11 This constraint is a revised version of the constraint PROJECTION PRINCIPLE (PROJ-PRIN) of Grimshaw (1993). Inversion into the head of a selected projection violates the Projection Principle. Matrix CPs are one kind of unselected projection, so inversion can occur. But as for embedded CPs, they are selected projection. If Subject-AUX inversion occurs in an embedded clause, then it violates the Projection Principle. Thus Subject-AUX inversion in an embedded clause cannot apply.
- 12 Dutch exhibits idiolectal variation, and some speakers allow the Doubly-filled COMP Filter to be violated (see Haegeman (1992), for details).
- 13 According to Visser (1963-1973: 2239-2240), *that* can occur in the infinitival complement of *command*-type verbs or ECM verbs as a complementizer in Middle English, which is superfluous in such an embedded context in Modern English.
- 14 This constraint is one member of a family of economy constraints (cf. the Least Effort Principle of Chomsky (1991)).
- 15 Henry (1995) argues that SAI in embedded clauses are cases of true embedded inversion, not merely quotations of direct speech. One type of this evidence comes from the fact that embedded questions in this dialect show "sequence of tenses" with a verb spoken in the present tense changed into the past when it appears embedded under a past tense verb, and allow pronoun change as in indirect questions.
 - (i) a. She asked, "Are they leaving?"
 - b. She asked if they were leaving.

- c. She asked were they leaving.
- (ii) a. They asked me, "Have you read *War and Peace*?"
- b. They asked me had I read *War and Peace*.
- 16 In Belfast English, the complementizer *if* or *whether* is available in embedded questions. Then a question arises about whether a candidate including an auxiliary which undergoes I-to-C movement and a candidate including *if* or *whether* can compete. It is not the case that SAI always takes place in embedded questions in this dialect. SAI does not take place if *if/whether* is introduced in embedded yes-no questions.
- (i) a. She asked if they were leaving.
- b. She asked were they leaving.
- c. *She asked if were they leaving.
- In this circumstance, SAI in embedded questions aggravates a *trace violation whereas introduction of *if/whether* does not. Economy consideration would block the derivational operation as in (ib) and thus a sentence like (ia) would always be selected as an embedded question if the two were in competition. This suggests that (ia) and (ib) are not in the same candidate set.
- 17 I leave open the matter about what feature is to be preferred.
- 18 In Standard English, when embedding verbs which select a proposition with a declarative clause type (e.g. *know*, *admit*, *hear*) take the form of a subordinate yes-no question, the structure yields an odd interpretation.
- (i) a. I knew/admit/hear/said that the bartender was happy.
- b. ??I knew/admit/hear/said that the bartender was happy.
- However, according to Adger and Quer (1997), the oddness of a question embedded by such verbs disappears if the matrix is questioned or negated.
- (ii) a. Did Julie know/admit/hear/say if the bartender was

- happy? (yes-no)
- b. Julie didn't know/admit/hear/say if the bartender was happy. (Neg)
- 19 Notice that an embedded yes-no question with *if/whether* and an embedded yes-no question without it are not in the same candidate set.
- 20 [F] in the schema indicates some abstract feature.

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