The Relation between *Wh*-islands and the Semantic Properties of Complementizers

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0. Introduction[1]

In this paper I want to defend the thesis that the relation between the semantic properties of the matrix verb and those of the complementizer is one of the crucial factors when extracting NPs out of complement phrases. I will propose to capture this relationship in the semantic notions developed within the theory of Generalized Quantifiers to explain the behaviour of for instance Negative Polarity Items (NPIs) (e.g. Ladusaw 1979, Hoeksema 1983, Zwarts 1986, 1990). Although it will turn out that there still remain a lot of problems to be solved, I hope to convince the reader that a genuine semantic approach towards *wh*-extraction provides the well-defined terms to explain this phenomenon.

This paper is organized as follows. In the first section I will show that within the syntactic accounts of *wh*-extraction some semantic-like notions have been buzzing around for quite a while. Because these notions are, from a semantic point of view, not very well-defined, I turn in the second section to the semantic approach proposed by Szabolcsi and Zwarts (1989, 1991). I will highlight the main characteristics of their approach and will point out some problems. In the third section I will focus on verbs and complementizers. I will show that, contrary to what is widely believed, the factivity of verbs is not the right property to explain the (im)possibilities of extraction. Instead, we have to look at the combination of the monotonicity properties of both verbs and complementizers.

1. Syntactic Approaches

With regard to the *wh*-extraction phenomena one might distinguish, within the Government and Binding-framework, between an "American" and a "European" branch. Within the former, Huang (1982) and Chomsky (1986) (to name only two) have proposed to explain the differences in extractability in terms of *arguments* and *adjuncts*. On their view it is easier to extract an argument than an adjunct. This view is challenged by the European branch, notably Cinque (1990) and Rizzi (1990). Rizzi, elaborating an idea of Cinque's, proposes to replace the argument/adjunct distinction by a distinction between *referential* and *non-referential* NPs. Rizzi coins referentiality in terms of theta roles: *agent* and *patient* are *referential roles*; *measure*, *manner* etc. are *non-referential*. But neither the argument/adjunct nor the referential/non-referential account serves to explain the facts in (1) to (4).

(1) a Haroun said that he had seen the Water Genie
    b Who did Haroun say that he had seen _ ?
    c Which Genie did Haroun say that he had seen _ ?
(2) a Haroun said that the Water Genie behaved generously
    b How did Haroun say that the Water Genie behaved _ ?
(3) a Haroun wondered whether he had seen the Water Genie
    b Who did Haroun wonder whether he had seen _ ?
    c Which Genie did Haroun wonder whether he had seen _ ?

(4) a Haroun wondered whether the Water Genie behaved generously
b *How did Haroun wonder whether the Water Genie behaved _ ?

In (2) and (4) *generously* is both an adjunct and non-referential. Nevertheless it can be extracted in (2), but not in (4). On the other hand, *who* and *which Genie* in (1) are extracted arguments, whereas *how* in (2) is an extracted adjunct. Still the sentences are ok. Moreover, Cinque notices that some arguments with referential roles are still sensitive to various kinds of islands, as is illustrated in (5) to (7). In all of these cases both *how much water* and *which fish* are referential arguments, but only *which fish* can be extracted.

Wh-island:
(5) a *How much water did Haroun wonder whether he drank _ ?
b Which fish did Haroun wonder whether he ate _ ?

Negative island:
(6) a *How much water didn't Haroun think that he drank _ ?
b Which fish didn't Haroun think that he ate _ ?

Factive island:
(7) a *How much water did Haroun regret that he drank _ ?
b Which fish did Haroun regret that he ate _ ?

Pesetsky (1987) explains the difference between *how much water* and *which fish* using the noting of *D(iscourse)-linking*. This notion serves to explain why *which*-phrases are often easier to extract than other *wh*-phrases. The reason is, according to Pesetsky, that *which*-phrases are in some sense more definite than other *wh*-phrases. That is, a *which*-phrase "limits the range of felicitous answers both speaker and hearer have in mind", whereas the other *wh*-phrases do not.

By way of summarizing this very sketchy overview of some of the GB accounts for *wh*-extraction, I point out that within this syntactic framework we have come across two terms with a certain semantic flavour, namely referential roles and discourse-linking. I notice in passing that also other syntacticians have used semantic or semantic-like notions to explain *wh*-extraction, e.g. *dominance* in the work of Erteschik-Shir (1977, 1986) and *definiteness* and *indefiniteness* in for instance Guéron (1980) and Fiengo (1987), respectively. With this in mind, we can try and find out what a real semantic approach like algebraic semantics has in store.

2. A Semantic Approach

Scholars in the line of research I am here referring to as *algebraic semantics*, have been concerned in the past decade with for instance the intricacies of the conditions on the appearance of NPIs (cf. references above). Recently, De Swart (1991) has demonstrated that algebraic semantics can also be used to explain the behaviour of temporal expressions, like temporal adverbs. The necessary equipment is delivered by researchers like Barwise and Cooper (1981), Keenan and Faltz (1985), Van Benthem (1986, 1991) and Westerståhl (1989). They have brought to light that quantified expressions can be regarded

as generalized quantifiers, that there are inference patterns associated with these quantifiers, and the monotonicity properties of phrases.

The monotonicity properties of quantified expressions are demonstrated in (8) to (10). The quantifier *all Floating Gardeners* is called *upward monotonic* since it allows one to draw conclusions about the state of affairs in a larger set from the state of affairs in a smaller set. With *no Egghead* it is just the other way around, whereas NPs like *exactly four N* are non-monotonic, since they do not allow to make inferences either way.

(8) Upward monotone (+)
All Floating Gardeners weep incessantly ==>
All Floating Gardeners weep
(9) Downward monotone (-)
No Egghead talks ==>
No Egghead talks slowly
(10) Non-monotone
Exactly four Shadow Warriors fight <=/=>
Exactly four Shadow Warriors fight grimly

In a paper presented at the 1989 Amsterdam Colloquium Szabolcsi and Zwarts (henceforth *S&Z*) opened up a whole new area of research by applying the semantic apparatus named above to the *wh*-extraction problems. The central issue in their research is to define the semantic environment from which *wh*-phrases can be extracted. To establish the semantic environment they do two things. First they state the monotonicity properties of phrases in terms of functions instead of sets (cf. Zwarts 1983). Second they use the mechanism of function composition to calculate, so to speak, the semantic value of the environment. Monotonicity properties behave under composition as is summarized in the calculus under (11). That is, the composition of either two upward or downward monotonic functions delivers another upward monotonic function. In the two other cases (b and c) the result of the composition is downward monotonic.

(11) Calculus:

a	+ & +	==>	+
b	+ & -	==>	-
c	- & +	==>	-
d	- & -	==>	+

Having established this technique, S&Z formulate their *Weak Islands and Monotonicity* (*WIM*):

(12) Upward monotonic contexts are good extraction domains. But paths that are not upward monotonic, viz. either downward monotonic or non-monotonic, constitute weak islands.

In addition, they notice that so-called *affective islands* seem to be the most robust, i.e. the hardest to extract from. This is illustrated in (13). According to S&Z the crucial elements in (a) to (d) (*who*, *regret*, *exactly five Glumfishes* and *often*) are all non-monotonic. This accounts for the bad extraction

possibilities of *how*. Since *wonder* and *regret* can, on top of that, be called "affective", extraction from (a) and (b) is really out of the question.

(13) a *How did Rashid wonder who behaved _ ?
b *How did Rashid regret that Haroun behaved _ ?
c ?How did exactly five Glumfishes think that Haroun behaved _ ?
d ?How did Rashid often think that Haroun behaved _ ?

I refrain from spelling out the criticism of De Swart (1992) with respect to the alleged non-monotonicity of *often*. But I do want to draw the reader's attention to the semantic status of *wonder* and *regret*. I think there are good reasons to consider these verbs downward monotonic.

Within the group of downward monotonic functions a group of anti-additive functions can be discerned (Zwarts 1986). According to De Mey (1990) these functions obey the definition in (14).[2] In this definition *f* is the function (in our case *regret*), *X* is the first argument of the function (*Haroun*) and *p* the second (the proposition *Haroun saw four Water Genies*). The second clause (*p implies q*) means: *q* is a stronger statement than *p*, i.e. *q* is true in less situations than *p*.

(14) f(X,p) & (q --> p) ==> f(X,q)

In (15) *regret* is tested on its anti-additiveness. Since the inference pattern in (15) is valid, *regret* is indeed anti-additive. The same kind of reasoning holds for *wonder*.

(15) a Haroun regretted that he saw four Water Genies
b Haroun saw five Water Genies -->
Haroun saw four Water Genies
c (a & b ==>) Haroun regretted that he saw five Water Genies

Now that we have established the downward monotonicity of *regret*, it is not difficult to explain the facts in (16). The NPI *any* can only appear in downward environments. Therefore (16a) is impeccable, while (16b) and (16c) are ungrammatical, due to the non-monotonic status of *exactly five Glumfishes* and *often*.

(16) a Rashid regrets that Haroun saw any Water Genie
b *Exactly five Glumfishes said that any boat would sink
c *Rashid hoped that he would often hear any story

Munsat (1986) provides some "circumstantial support" for the claim that *wonder* is downward monotonic. Munsat points out that *wonder* behaves in exactly the same way as *don't know* when it comes to what he calls *'that is'-expansion*. Both *wonder* and *don't know* expand in a conjunction of things, whereas a verb like *know* expands in a single item, as is shown in (17) to (19). Since *don't know* is unmistakably downward monotonic, I think there are good reasons to consider *wonder* to be downward monotonic too.

(17) I wonder what he wants: {namely/that is} {does he want/ is it} a watch, or a sweater, or etc?
(18) I don't know what he wants: {namely/that is} {does he want/ is it} a watch, or a sweater, or etc?
(19) I know what you bought: {namely/that is} {(I know that) you bought} a watch.

I close this section with a serious problem, which has also been noticed by S&Z themselves. According to the simple calculus in (11), a sentence with a double negation should provide a good extraction domain, for downward composed with downward results in upward. This expectation is not born out, as is demonstrated in (20).

(20) a *How didn't Haroun think that no one behaved _ ?
b *How does no one deny that Haroun behaved _ ?

I notice in passing that these sentences show that mere upward- and downwardness are too crude categories. Subcategories like anti-additivity should be brought in. This will result in a calculus far more complex than (11). The more complex calculus should provide an explanation for (20).

3. Verbs and Complementizers

In the previous two sections we have come across several factors that influence the extraction possibilities of *wh*-phrases. Pesetsky pointed out that the semantic contents of the *wh*-phrase itself is a factor to reckon with (cf. also Szabolcsi (1991)). And S&Z have examined the extraction environment. In this section I will concentrate on the semantic nature of the boundary that has to be crossed when extracting a *wh*-phrase.

In (21) to (24) I have kept the verb and the *wh*-phrase constant and have varied the contents of the complementizer place. We see that things get increasingly worse. The question is: why?

(21) a Haroun knows that the Water Genie needs a Disconnector.
b What does Haroun know that the Water Genie needs _ ?
(22) a Haroun knows whether the Water Genie needs a Disconnector.
b ?What does Haroun know whether the Water Genie needs _ ?
(23) a Haroun knows why the Water Genie needs a Disconnector.
b *What does Haroun know why the Water Genie needs _ ?
(24) a Haroun knows who needs a Disconnector.
b **What does Haroun know who needs _ ?

Let me start by assuming that intuitively there is some kind of "binding" relation between the matrix verb and the complementizer. This means that the verb exercises some kind of "power" over the complementizer. We can illustrate this clearly with data from the West-African creole language Krio, as reported in Nylander (1984).[3] Nylander relates that Krio has three kinds of complementizers, *sé*, *wé* and *mék*, each of which can only be used in connection with certain kinds of verbs. *Sé* can only be used with utterance verbs (like *álà* 'shout' in (25a)), cognition verbs and sensory verbs, *wé* is used with factive verbs (see (25b)) and *mék* is associated with verbs of volition, intention and completed actions.

(25) a ì gò álà sé ì táyà
he-PROS-shout-that-he-be tired
he will shout that he is tired

b ì bìn dàmú wé à wín
he-PAST-be surprised-that-I-win
he was surprised that I won

c à bìn wán mèk dèn kám
I-PAST-want-that-they-come
I want that they come/I wanted them to come

The three complementizers have specific uses with respect to presupposition. Complement sentences introduced by *sé* never presuppose the truth of the embedded clause. Complements with *wé*, however, *always* presuppose the truth of the embedded clause. And complements with *mék* are sometimes truth presupposing.

Nylander's conclusion is that in Krio "the choice of complementizer depends on the semantic value of the matrix verb" (p.132).

In Krio the relation between verb and complementizer manifests itself on the surface. In English things are not so clear. There is a long standing suspicion that factivity plays a role in *wh*-extraction. The sentences in (26) are adapted from Ross's (1967) dissertation and provide the standard example to compare between *wh*-extraction with a factive verb (*confirm*) and a non-factive verb (*allege*).

(26) a ??What did Haroun confirm that prince Bolo had eaten _ ?
b What did Haroun allege that Prince Bolo had eaten _ ?

Erteschik-Shir (1977), however, points out that this cannot be the whole story. In (27) *hope*, *resent* as well as *rejoice* are factive, but still there is a gradual difference in acceptability.

(27) a Which princess does Haroun hope that the prince likes - ?
b ?Which princess does Haroun resent that the prince likes - ?
c *Which princess does Haroun rejoice that the prince likes - ?

In order to explain these differences, Erteschik-Shir calls in the help of the feature [+/- emotional], without defining it.

This emotivity feature reminds us of the affectivity of *wonder* and *regret* in (13). These words turned out to be downward monotonic. Nevertheless, it would be too simple to say that all affective or emotional verbs are downward monotonic: in (27) *resent* is indeed downward, but *rejoice* is not.

In (28) to (35) I have listed the various categories of factivity that have been proposed in the literature[4], subdivided with respect to their monotonicity properties.

Upward monotonic + factive

(28) a What did Haroun realize that the Glumfishes had seen _ ?
b *What did Haroun realize whether the Glumfishes had seen _ ?
c *What did Haroun realize who had seen _ ?

Downward monotonic + factive

(29) a What did Haroun regret that the Glumfishes had seen _ ?
b *What did Haroun regret whether the Glumfishes had seen _ ?
c *What did Haroun regret who had seen _ ?

Upward monotonic + neg-factive

(30) a What did the Shadow Warrior pretend that he had seen _ ?
b *What did the Shadow Warrior pretend whether he had seen _ ?
c *What did the Shadow Warrior pretend who had seen _ ?

Downward monotonic + neg-factive

(31) a What did the Shadow Warrior lie that he had seen _ ?
b *What did the Shadow Warrior lie whether he had seen _ ?
c *What did the Shadow Warrior lie who had seen _ ?

Upward monotonic + semi-factive

(32) a What did the Walrus know that Haroun had said _ ?
b ?What did the Walrus know whether Haroun had said _ ?
c **What did the Walrus know who had said _ ?

Downward monotonic + semi-factive

(33) a ?What did the Walrus forget that Haroun had said _ ?
b ?What did the Walrus forget whether Haroun had said _ ?
c ??What did the Walrus forget who had said _ ?

Upward monotonic + non-factive

(34) a What did Khattam-Shud think that the Plentimaws shouted _ ?
b ?What did Khattam-Shud think whether the Plentimaws shouted _ ?
c *What did Khattam-Shud think who shouted _ ?

Downward monotonic + non-factive

(35) a ?What did Khattam-Shud doubt that the Plentimaws shouted _ ?
b ??What did Khattam-Shud doubt whether the Plentimaws shouted _ ?
c ??What did Khattam-Shud doubt who shouted _ ?

We can distinguish two groups. The first consists of the factives and the neg-factives, the second of the semi-factives and the non-factives. In the former extraction from a *wh*-complement is always impossible. This comes as no surprise, if we consider the declarative versions of (28) to (31).

(28') a Haroun realized that the Glumfishes had seen a boat
b *Haroun realized whether the Glumfishes had seen a boat
c *Haroun realized who had seen a boat

(29') a Haroun regretted that the Glumfishes had seen a boat
b *Haroun regretted whether the Glumfishes had seen a boat
c *Haroun regretted who had seen a boat

(30') a The Shadow Warrior pretended that he had seen a sword
b *The Shadow Warrior pretended whether he had seen a sword
c *The Shadow Warrior pretended who had seen a sword

(31') a The Shadow Warrior lied that he had seen a sword
b *The Shadow Warrior lied whether he had seen a sword
c *The Shadow Warrior lied who had seen a sword

We see that also the declarative sentences with *wh*-complements are unacceptible. Munsat (1986) provides an explanation for the unacceptability of the sentences with factives. Factive verbs presuppose the truth of their complements. This presupposition is at odds with *wh*-complements, since these complements extend to a conjunction of possibilities (cf. (17) to (19) above). This explanation can easily be applied to the neg-factives as well, since neg-factive verbs presuppose the falsity of their complements, and therefore do not allow a range of possible extensions either.

Thus I conclude that the inextractability from both factives and neg-factives can be explained for independent reasons.

The patterns in the second group (semi-factives and non-factives) are more or less the same as in (21) to (24), regardless of the factivity-status of the verb. That is: the combination verb + *that* gives better extraction results than verb + *whether*. And this combination gives on its turn better results than verb + *who*.

To account for these facts, we have to establish three factors that play a role. First we can put to use an idea of Givón (1980). Givón argues that there is a closer bond between verbs and *wh*-complements than between verbs and *that*-complements. It turns out that algebraic semantics provides a formal device to express this difference in "binding". Besides the operation of function composition I referred to above, there exists an operation called *application*. Informally, the difference between composition and application is that in composition two functions are entirely merged, whereas in application a function "swallows" an argument (Cf. Van Benthem 1991). Therefore composition is a suitable mechanism to represent a "close bond" and application a more "loose bond". Thus, Givón's notion of binding can be formalized by defining the connection between a verb and *that* as an application, and the connection between verbs and a *wh*-complementizer as composition.

Second, I have to assume that *wh*-complementizers are downward monotonic.[5]

Third, we can note that *that* and *whether* differ from *who*, *what* and the like, in that they introduce complete sentences. Functionally they do not belong to the matrix or the complement sentence, whereas complementizers like *who* do.

These three factors influence each other. The monotonicity property of *that* is of no importance, since this property gets lost when the verb is applied to it. Therefore sentences with upward verbs and *that*-complements provide good extraction environments. In contrast, the properties of the *wh*-complementizers are merged with those of the matrix verb through function composition. If the verb is upward the result is (in some sense) downward. This accounts for the bad extraction results in sentences with *wh*-complements (cf. (32b/c) and (34b/c)). If the verb is downward, we would expect, according to the simple calculus under (11), the composition result to be upward. However, although these extractions seem to be somewhat better than the upward verb + *wh*-complement-cases (compare (33b/c) with (32b/c) and (35b/c) with (34b/c)), the results are pretty bad, suggesting that the

environment is still downward. I suspect that the more complex calculus needed anyway to handle the double negation problem (see section 2), will be useful in giving a detailed account of these facts as well.

Finally, that the extraction possibilities of *whether*-complements tend to be better than those out of the other *wh*-complements, can be attributed to the loose relation *whether* has with both the matrix sentence and complement sentence.

From this analysis of the facts in (32) to (35) I draw the conclusion that it is feasable to explain them without recourse to their factivity-status. Added to the conclusion I reached earlier about the facts in (28) to (31), this means that *wh*-extraction is independent of factivity.

Notes

1. This paper has benefitted from comments by Jack Hoeksema, Anna Szabolcsi, Frans Zwarts and the audience at the BLS18-meeting. All remaining errors are mine.
   This research was financed by the Faculty of Arts of the University of Groningen, project LETT8-21, which is hereby gratefully acknowledged.
2. In fact, Zwarts (1986) gives another definition of anti-additivity than De Mey (1990). For presentational reasons, I use De Mey's definition. Hoekstra (1989) has shown that the same results can be obtained by using Zwarts's version.
3. See also Givón (1973, 1980). The same kind of phenemenon seems to exist in other languages as well. See for instance Szabolcsi and Zwarts (1991) about facts from Korean and the paper presented at this BLS-conference by Legendre and Rood about facts from Lakhota.
4. I refer for factives to Kiparsky and Kiparsky (1970) and Givón (1973), for neg-factives to Givón (1973, 1980), for semi-factives to Karttunen (1971) and Munsat (1986), and for non-factives to Givón (1973).
5. The problem is that the usual monotonicity tests (as applied by Szabolcsi and Zwarts (1991)) provide little convincing results. S&Z found that *who* is non-monotonic. Although I cannot come up at this point with something better, I think that non-monotonicity is too obstructive a property. If *wh*-complementizers were non-monotonic, we would lose a way of accounting for the gradual and subtle differences shown in the facts.

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