

PROCESSING SUBJECT EXTRACTIONS*

1. INTRODUCTION

Subject extractions have often been presumed to be unlike other extractions. This has some support from the fact that the subject argument is often given a special status within grammatical theory. This paper discusses this possibility from a psycholinguistic perspective, arguing that if subject extractions are unusual, then this should have an effect on the way they are processed. If there is evidence that this is not so, then we would have evidence that a correct linguistic treatment of subject extractions will not be distinct from the treatment of other extractions (such as object extractions). We describe an experiment concerned with the processing of subject extractions and discuss the results in the context of a range of grammatical theories. In contrast to most psycholinguistic work on unbounded dependencies, we consider the possibility that the grammar underlying processing may not involve any traces, and hence that no specific 'gap-filling' mechanism is used in the analysis of unbounded dependencies.¹

2. THE PARALLELISM HYPOTHESIS

2.1. *Comparing relative clauses*

Consider the following set of four sentences with different types of relative clause. We shall refer to these sentence types by the terms in brackets after each sentence:

- (1) The man who loved Mary arrived yesterday. (simple subject relative)
- (2) The man who Mary loved arrived yesterday. (simple object relative)
- (3) The man who I thought loved Mary arrived yesterday. (embedded subject relative)
- (4) The man who I thought Mary loved arrived yesterday. (embedded object relative)

These four sentences have surface forms that differ in only very minimal ways. The subject relatives have the word order *loved Mary*, the object relatives have this reversed. The embedded relatives have the additional words *I thought* that the simple relatives do not have. Therefore in surface form embedded object relatives differ from embedded subject relatives in exactly the same way that simple object relatives differ from simple subject relatives. In other words, adding an embedding clause has a constant surface effect.

But the similarity may only exist on the surface, and an accurate linguistic treatment of relative clauses (or of extractions in general) may require more than a reflection of this simple relationship. If extraction from subject position is special, unrelated to extraction from other positions, then it is quite possible that embedding will not have a constant effect. If so, assuming some degree of isomorphism between linguistic analysis and sentence processing, we would further expect that embedding on subject position would have a different effect on processing from embedding on object position. Hence the processing relationship between embedded subject and object relatives would be different from that between simple subject and object relatives.

We shall call the claim that embedding does have a constant effect on subject and object extraction, both on linguistic analysis and processing, the *Parallelism Hypothesis*. We shall almost exclusively concentrate on sentences with relative clauses, as in the quartet above. In the next section we shall review some linguistic evidence for and against the hypothesis, and shall conclude that there is no overwhelming evidence either way.

2.2. Linguistic evidence

2.2.1. *Simple subject relatives.* Transformational approaches to grammar assume that (2) involves movement of the object of *loved*. This is because 'canonical' sentences with a transitive verb, for instance *Mary loved the man*, have the object directly after the verb, and it is assumed that the only way that a constituent can serve as the object of a verb is to be located in this position. Hence, trace-theoretic approaches, as used in Government-Binding Theory (Chomsky, 1981) give (2) an analysis like (5):

- (5) The man [who]₁ Mary loved 0_1 arrived yesterday.

A trace is positioned immediately after *loved*, and is coindexed with the relative pronoun, in order to allow the relative pronoun to serve as the object of *loved*. This analysis therefore involves movement from an underlying or deep structure where *who* is represented after *loved*. Similar analyses have to be given for embedded subject and embedded object relatives, because in both cases an argument of the verb *loved* is not in its canonical location.

It is possible to regard simple subject relatives as involving no traces or movement at all. But the standard assumption is that they are analysed in a similar way to other relatives:

- (6) The man [who]₁ 0_1 loved Mary arrived yesterday.

We note that the movement in this case is string-vacuous, because there is no lexical material between *who* and the trace. We therefore get a unified treatment of relative clauses, where simple subject relatives involve movement. A unified treatment is also expected in theories that have no level of syntactic representation with traces or empty categories, and do not assume that a constituent needs to be associated with a canonical location in order for it to be given the correct interpretation. This is the position taken by a range of non-transformational generative linguistic theories, for instance flexible categorial grammars (Steedman, 1987; Moortgat, 1988), Word Grammar (Hudson, 1984) and recent Lexical-Functional Grammar (Kaplan and Zaenen, 1988). In these theories we can regard the relative pronoun as associated with the verb directly, rather than via an empty category. If this is correct, there is no obvious reason to regard simple subject relatives as fundamentally different from other relative clauses.

Coordination evidence suggests that simple subject relatives are like other relatives. Let us make two minimal assumptions about coordination, that the conjuncts must be of like category (under some loose enough definition of 'category'), and that a conjunct with an element extracted from it cannot be of the same category as a conjunct with no element extracted. Now, (7) is acceptable:

- (7) This is the candidate who is extremely objectionable but we still hope will become president.

The second conjunct must involve an extraction from embedded subject position. Hence, in order for the first conjunct to be of the same category as the second conjunct, it must involve an extraction as well. For instance, if we analyse the second conjunct with a trace, we must do likewise for the first conjunct. This therefore suggests that simple subject relatives must have essentially the same analysis as other relatives.²

2.2.2. *Embedded subject relatives.* The default assumption for embedded subject relatives is that they do not fundamentally differ from other relatives (except perhaps simple subject relatives). However, there is at least some evidence that they are not like other relatives, but are marked in some way. Below we review the evidence for this, which is certainly suggestive but by no means conclusive.

As we have seen, embedded subject extractions can be coordinated with simple subject extractions. However, they can also be coordinated with simple object extractions:

- (8) This is the candidate who everyone admired and hoped would become president.

However, it is not possible to coordinate simple subject and simple object extractions:

- (9) *This is the candidate who became president and we admired.

Presumably these two conjuncts do not have the same category, and so the fact that embedded subject extractions can coordinate with both suggests that their category is underspecified in some way. However, this is not a property of embedded extractions generally, because we cannot coordinate embedded object extractions and simple subject extractions:

- (10) *This is the candidate who became president and we hoped everyone admired.

Therefore this free coordinability appears to be a special property of embedded subject extractions. This suggests that the construction should be regarded as marked, so long as the coordination possibilities cannot be explained in some other way.

Two other arguments for markedness are based on analogy, from other constructions and other languages. First, consider the addition of an overt complementizer *that* to the embedded relatives:

- (11) *The man who I thought that loved Mary arrived yesterday.
 (12) The man who I thought that Mary loved arrived yesterday.

The ungrammaticality of (11) is known as the Fixed Subject Constraint (Bresnan, 1972) or *That-Trace Filter* (Chomsky and Lasnik, 1977). Here we have a clear subject-object asymmetry. Indeed it is specifically extraction from subject position that is proscribed, because we can extract from other positions as well as direct object. This constraint holds in English (for exceptions see Sobin, 1987), and is common but not invariably found in other Germanic languages (Maling and Zaenen, 1978; Engdahl, 1985). There is no doubt that there is a restriction on embedded subject extraction with an overt complementizer, in at least some cases, that is not found with extractions from other embedded positions. This fact suggests that embedded subject relatives, without the complementizer, may be a marked construction as well; there is something unusual about embedded subject extractions in general. But the analogy may not hold, and the proper analysis of the Fixed Subject Constraint may be unrelated to that of embedded subject extractions without the complementizer.

There is also evidence that embedded subject extractions are cross-linguistically rarer than might be expected. Keenan and Comrie (1977) propose that relativization is guided by an Accessibility Hierarchy, where certain grammatical positions are cross-linguistically more commonly relativized on than others. Comrie (1981) argues that there is a very simple hierarchy Subject > Object > Non-Direct Object³ > Possessor, and that this hierarchy is governed by a strong and very nearly universal principle that if a language can relativize on a particular position in the hierarchy, then it can relativize on all positions

higher in the hierarchy, but no reverse implication holds. Hence for instance if a language can relativize objects then it will also be able to relativize subjects. English can relativize on all four positions, but there are languages that are more restricted. For instance, Malagasy can only relativize subjects. There is evidence for a more general notion of obliqueness within English which is closely related to the hierarchy, for instance from the possibilities of passivization and perhaps reflexivization (see e.g., Pollard and Sag, 1987). Some linguistic theories encode obliqueness as a primitive, e.g., Relational Grammar (Perlmutter, 1983; Perlmutter and Rosen, 1984), HPSG. There is therefore considerable evidence for the general significance of the ordering of the Accessibility Hierarchy.

The simplest extension of the Accessibility Hierarchy would predict that embedding would not change the ordering, so embedded subject extractions should be more frequent than embedded object extractions (and these should be more frequent than more oblique positions). As Comrie points out, this does not appear to be the case. In fact, the evidence suggests the opposite, that embedded subject extractions are cross-linguistically rarer than embedded object extractions, even when there is no overt complementizer. For instance embedded subject extractions but not embedded object extractions are ungrammatical in Hungarian and Imbabura Quechua. Comrie has no explanation of why this should be so. Thus we have evidence that the relationship between embedded subject extractions and simple subject extractions may be different from the relationship between embedded object extractions and simple object extractions (and similar more oblique pairs), but it is by no means conclusive. The argument is again by analogy, and depends crucially on the assumption that cross-linguistically rare constructions will be in some sense hard or special in a language that does permit those constructions. In conclusion, there is some evidence to suggest that embedded subject relatives are marked in a way that we would not predict from their surface form.

2.3. *Grammatical theories and parallelism*

The linguistic data does not offer conclusive evidence for or against the Parallelism Hypothesis. This is important given that many linguistic

theories have implicitly taken a position on this hypothesis. Let us briefly consider how two theories treat subject extractions.

Government-Binding Theory, like all versions of transformational grammar, treats simple object relatives and embedded subject relatives using movement. Simple subject relatives are usually treated with string-vacuous movement (see above). Embedded subject relatives, on the other hand, clearly involve movement. With respect to such constructions, Chomsky (1981) and others have taken *that*-trace violations to be 'typical', and have assumed some 'relaxation' involving the Empty Category Principle in order to allow acceptable *that*-less embedded subject extractions. Standard GB accounts therefore treat embedded subject extractions in a very construction-specific manner. However, this does not necessarily hold of all more recent GB accounts (see for instance Koopman, 1984, ch. 7), but we shall not make any further comment on such developments.

Generalized Phrase Structure Grammar (Gazdar, Klein, Pullum and Sag, 1985) treats both embedded and simple subject relatives in ways that are fundamentally different from more oblique relatives, in a manner that clearly does not respect the Parallelism Hypothesis. Extractions in general are analysed using a slash-category. A slash-introduction rule indicates that a sentence consists of a phrase XP and a sentence which contains a null XP. This XP is treated as the value of a feature, which is then passed down the tree. If we regard a relative as involving an extraction if and only if it uses the slash mechanism, as seems reasonable, then GPSG regards simple subject relatives as canonical, because the slash mechanism is not used. The body of the relative clause is not a sentence lacking a subject NP, but rather a simple VP.

Like GB, GPSG has an ad hoc treatment of embedded subject extractions. All other constructions using the slash-category are resolved by passing the feature down until we get an XP lacking an XP, at which point this category can be rewritten as a trace. But this is prohibited for embedded subject extractions, and hence a special rule ('Slash Termination Metarule 2') is introduced in order to allow this construction. No trace is in fact postulated at all. This analysis is unrelated to the treatment of any other relative clause type.

We can conclude that both GPSG and standard GB reject the Parallelism Hypothesis. The treatments of embedded subject relatives

are interestingly similar and highly ad hoc. If this construction is very marked then these analyses can be supported, because a very unusual construction may require a very unusual analysis. But if parallelism is supported, then both theories lose the justification for their analyses, and the fact that both theories go wrong at the same point would suggest that these theories have something in common that is seriously adrift.

2.4. *Summary*

The linguistic evidence on the status of the Parallelism Hypothesis is inconclusive. First, simple subject relatives may pattern with other relatives, or they may pattern with canonical sentences in contrast to other relatives, by not making use of traces. This latter position only seems sustainable in theories that make use of empty categories, such as transformational grammars. Second, embedded subject relatives may be marked in a way that differentiates them from all other extractions, but the evidence is inconclusive. Hence the Parallelism Hypothesis cannot be convincingly supported or rejected.

If the hypothesis is in fact correct, then the analyses used in GB and GPSG should be seriously questioned. GPSG treats both simple and embedded subject relatives as different from other relatives, while GB treats embedded subject relatives as different and is not committed either way on simple subject relatives. These approaches would then be more clearly unsatisfactory.

The linguistic means we have considered so far do not allow us to test the hypothesis convincingly. A very different approach is to look at how we process such constructions. If either simple or embedded subject relatives are processed in an unusual way that distinguishes them from other relatives, we will have evidence to reject it. Alternatively, if no unusual processing is found, the hypothesis would be supported.

3. PROCESSING SUBJECT RELATIVES

Unless we assume that linguistic theories have no psychological reality, there must be some relation between complexity of linguistic analysis

