1 Introduction

Tree Adjoining Grammar (TAG) is a computationally well-defined model of tree construction which can be applied to natural language (Joshi et al. 1975). In this formalism, tree structures serve as the minimal units, which are combined to form larger and more complex structures. With its restricted generative power, characterised as “mildly context-sensitive”, TAG is an attractive means of providing elegant and computationally-sound accounts of syntactic phenomena.

In this paper, the TAG account of subject-to-subject raising (SSR) is examined, with particular emphasis on the textbook example of an English raising verb: seem. It will be shown that the current analysis of seem as given in the TAG literature will not adequately capture examples in which the verb seem appears with an experiencer. The outline of the paper will be as follows: first, there will be a brief introduction to TAG syntax, followed by a comparison of the TAG and more “traditional” generative/minimalist approaches to SSR constructions. Then, data will be presented illustrating that the existing TAG account will not capture examples in which the verb seem appears with an experiencer. An examination of this data will lead to the proposal of a new TAG-based account of the verb seem, in which it is treated in a manner similar to a ditransitive verb. In conclusion, there will be a discussion of the broader applicability of the ditransitive-like analysis of seem given here. The overarching goal of this paper is to introduce TAG by illustrating a simple, yet novel problem, and showing how a solution based on recognised syntactic argumentation can be applied to the formalism. Those already familiar with TAG, and especially LTAG syntax, can safely jump ahead to section 4.

2 Tree Adjoining Grammar and Natural Language Syntax

As noted above, a TAG in isolation is merely a computational system for tree composition; in this paper, I make use of a Lexicalised Tree Adjoining Grammar (LTAG) in which the elementary trees of the grammar are constructed in a manner compatible with the Minimalist Program (Chomsky 1995), as described in Frank (2002)1. In this LTAG, each elementary tree in the grammar is anchored by a single lexical head. Trees are constructed using the familiar operations of Move and Merge, such that the result is a lexicon in which each lexical item has one or more associated tree structures. As in the Minimalist Program, a set of lexical items will be collected in a numeration for the derivation of a given sentence, and for each, an associated tree structure is selected. TAG then describes the mechanisms by which the trees for each lexical item are combined to form a final derived structure for the sentence. This structure is termed the ‘Derived Tree’; TAG also generates a ‘Derivation Tree’, which records the compositional steps used in the construction of the Derived Tree. While derivation trees can have important applications, they are not considered in this paper.

In the system developed in Frank (2002), three key concepts are introduced which will be of relevance to the discussion of this paper. The first of these is the TAG version of the $\theta$-Criterion:

\begin{enumerate}
  \item \hspace{1cm} a. Part I
    \hspace{1cm} If H is the lexical head of elementary tree T, H assigns all of its $\theta$-roles within T.
  \item \hspace{1cm} b. Part II
    \hspace{1cm} If A is a frontier nonterminal node of elementary tree T, A must be assigned a $\theta$-role in T.
\end{enumerate}

The first part dictates a strict locality condition upon a lexical predicate and all of its arguments. For example, a verb-headed elementary tree must provide a structural representation of all the arguments of the verb. In this respect, an elementary tree can be seen as providing an illustration of predicate-argument structure. The second part precludes the presence of non-arguments (which would not receive a $\theta$-role from the local predicate) within this privileged local domain.

Another key concept is the Fundamental TAG Hypothesis:

\begin{enumerate}
  \item \hspace{1cm} The fundamental TAG hypothesis:
    \hspace{1cm} Every syntactic dependency is expressed locally within a single elementary tree.
\end{enumerate}

1The choice of Minimalism here is purely arbitrary. There is no one system which can be used to describe the structure of a “good” elementary tree; the choice is up to the individual analyst. Minimalism is used here as a common base, which makes the analysis accessible to a wider audience.
This can be seen as making the somewhat the same claim as the \( \theta \)-criterion above, but it also covers the relationship between a moved element and its trace. According to the fundamental TAG hypothesis, all movement operations in an LTAG must remain local to a single elementary tree. No movement between trees is permitted.

The final concept which will have a bearing upon this paper is the Condition on Elementary Tree Minimality (CETM):

\begin{enumerate}
\item Condition on Elementary Tree Minimality:

The syntactic heads in an elementary tree and their projections must form an extended projection of a single lexical head.
\end{enumerate}

The CETM determines the validity of elementary trees in an LTAG. It dictates that all the functional architecture of an elementary tree must be a part of the extended projection of that tree’s lexical anchor. Again, taking the example of a verb-anchored tree, a verb’s extended projection will legitimately contain functional heads such as T or C, but not D.

Once elementary trees have been formed (in compliance with the criteria outlined above), they are combined using two composition operations: substitution, and adjunction. In cases of substitution, the root node of an initial tree is merged into a non-terminal leaf node, marked for substitution in another tree, producing a new tree. Substitution is only permitted where there is a match between the node labels of the substitution site and the root node of the tree being merged at that point. Adjunction requires a certain type of elementary tree, known as an auxiliary tree. Auxiliary trees are distinguished by the fact that they have one leaf node, the foot, which has the same label as the root, effectively making them a recursive structure. An auxiliary tree may be adjoined into an elementary tree at a node which bears the same label as the recursive root and foot nodes; the original elementary tree is “broken” at the adjunction site, the auxiliary tree is inserted at that node, and the material which was below the adjunction site in the original elementary tree appears at the foot node of the auxiliary tree.

These two operations are illustrated schematically in Figures 1 and 2; a stepwise derivation below will illustrate these operations, and provide a bridge into the main subject matter of this paper.
3 TAG and raising

The raising predicate *seem* is often cited as one of the core examples in discussions of TAG’s application to natural language syntax. Under a generative/minimalist account, a sentence such as (4a) will have the structure given in (4b):

\[(4)\]
\[a. \text{John seems to like coffee.}\]
\[b.\]
\[\begin{array}{c}
\text{TP} \\
\text{DP}_1 \quad \text{T}' \\
\quad \text{John} \quad \text{T} \quad \text{VP} \\
\quad \text{V} \quad \text{TP} \\
\text{seems} \quad \text{t}_i \quad \text{T}' \\
\text{T} \quad \text{to} \quad \text{VP} \\
\quad \text{V} \quad \text{DP} \\
\text{like} \quad \text{coffee}
\end{array}\]

This is the classic SSR analysis, in which *John*, the subject of the embedded verb *like*, raises from the lower clause into the matrix subject position for reasons of case assignment and EPP. The matrix verb *seem* assigns no agent \(\theta\)-role, thus leaving an open position for the embedded subject to raise. Recalling the CETM, being an argument of the verb *like*, *John* will need to remain local to the elementary tree headed by the verb *like* in an LTAG analysis. As such, a move analogous to the one in the generative account will not be permitted.

In TAG, (4a) will be generated through the composition of four elementary trees: *John*, *coffee*, *like*, and *seem* will be the lexical anchors. The internal structure of the two DP trees will not enter into the analysis here, so they will be shown in a simplified form. The elementary tree for infinitival *like* will be as follows:

\[(5)\]
\[\begin{array}{c}
\text{TP} \\
\text{DP}_1 \quad \text{T}' \\
\quad \text{T} \quad \text{VP} \\
\quad \text{V} \quad \text{DP}_1 \\
\quad \text{like}
\end{array}\]

The substitution nodes in this tree are marked with arrows; these correspond to the two arguments of the verb *like*: the subject experiencer and the object theme. It is equally possible to define a structure which shows the VP-Internal subject hypothesis and subsequent raising of the experiencer from [Spec, VP] to [Spec, TP]. Such an analysis will be within the confines of the TAG \(\theta\)-criterion and the Fundamental Hypothesis, as the dependencies will remain local to the same tree. Such details are omitted here in the interests of simplicity. In accordance with the CETM, the functional projections up to TP form the extended projection of the lexical anchor, in this case the verb. The T head in this case is marked as an infinitive, carrying the phonological material *to*; as this is functional, not lexical, content, it can appear in the same elementary tree as *like*. Substitution of the relevant DP trees at the argument positions will yield the following:

\[(6)\]
\[\begin{array}{c}
\text{TP} \\
\text{DP} \quad \text{T}' \\
\quad \text{John} \quad \text{T} \quad \text{VP} \\
\quad \text{V} \quad \text{DP} \\
\text{like} \quad \text{coffee}
\end{array}\]
Here, the arguments of the predicate like are substituted into the like-headed tree, receiving their θ-roles in accordance with the θ-criterion. It now remains to introduce the verb seem. As with the tree in (5), the extended projection of the verb will include a T head, but there will be one crucial difference in this case: as seem has no external argument, there is no justification for a [Spec, TP] position. Thus, the seem tree’s root label will be T’, as will the complement of V. This will result in an auxiliary tree recursive on T’:

(7)  
\[
\begin{array}{c}
T' \\
T \\
\text{VP} \\
V \\
T' \\
\text{seems}
\end{array}
\]

The seem tree then adjoins into the T’ node of the like tree, yielding the final derived structure of (8):

(8)  
\[
\begin{array}{c}
\text{TP} \\
\text{DP} \\
\text{John} \\
T' \\
\text{VP} \\
V \\
T' \\
\text{seems} \\
T \\
\text{to} \\
V \\
\text{DP} \\
\text{like} \\
\text{coffee}
\end{array}
\]

Of key importance here is that the subject John remains local to the elementary tree headed by like, the elementary tree in which its theta role is assigned. The observed displacement effect is a result of the extension of the like-headed tree after the adjunction of an auxiliary tree headed by seem. Through this adjunction operation, TAG provides an elegant means of describing recursive operations while keeping local dependencies intact.

The derivation described here shows LTAG only in its most basic form. As with minimalism, LTAG can be augmented with features and feature checking relationships which can further constrain the well-formedness of derived trees in the grammar. In the case of seem, for example, Frank also uses case and EPP to describe why the tree in (6) can not stand on its own, and how the seem auxiliary can serve to “complete” the derivation. In this respect, LTAG syntax is not that much of a departure from minimalism, or other syntactic theories; all the same concepts are in play, they are just represented in a stricter formal setting. The exact details of the feature system for LTAG are omitted here, as the discussion would go astray from the question at hand.

4 Seems Like an Experiencer

Now that the basic TAG analysis of the SSR formulation has been established, more complex examples can be considered. At issue in this paper will be the structure of sentences such as those in (9):

(9)  
\begin{enumerate}
\item a. John seems to me to like coffee.
\item b. John seems to like coffee to me.
\end{enumerate}

Here, a prepositional phrase to me now appears in the sentence; as illustrated, its position is variable. The individual introduced in this prepositional phrase is interpreted as being an experiencer of the verb seem, in no way dependent upon the embedded like predicate. As such, according to the Fundamental TAG Hypothesis, this experiencer must be composed as a part of the seem auxiliary tree. For discursive ease, the case in (9a) will be termed a medial experiencer, and the (9b) case will be a final experiencer. Assuming that a recursive analysis of the seem tree ought to be maintained, the sentences in (9) raise two important questions: firstly, where in the seem auxiliary tree is this prepositional phrase located, and secondly, is there a derivational relationship between the two sentences (9a) and (9b)?
4.1 An Existing Account

In Frank (2002), a structure is given for *seem* with an experiencer:

(10)

The *seem* tree pictured here is a well-formed auxiliary tree, recursive on T', with a DP substitution site for the experiencer inside the PP. Because this is a substitution within the *seem* tree, it is clear that the experiencer is being considered an argument of the verb. This tree would adjoin into the T' node of an infinitival clause tree, such as (6), yielding the correct string order for a raising sentence with a medial experiencer, and the following derived structure:

(11)

Frank’s discussion of this ternary structure is essentially limited to the well-formedness of its functional architecture, and the fact that a stipulation will need to be put in place to obviate the satisfaction of the *seem* tree’s T head’s EPP feature by the experiencer. Without this stipulation, the experiencer argument could occupy the [Spec, TP] node of a *seem* elementary tree with a TP root node, which would lose the necessary recursive structure. While a valid point, there are still two key unanswered questions with regards to this structure: first of all, are the complements of the verb *seem* straightforwardly interchangeable (to account for the variable position of the experiencer), and is there any evidence for or against the ternary branching structure?

In dealing with the second of these questions first, a basic constituency test can show that the ternary structure is not sufficient:

(12) a. John seems [to Karen to like coffee] and [to Tina to like tea].

   b. John seems [to Larry to like coffee] and [to hate it to Harry].

The sentences of (12) show that the embedded clause material and the PP experiencer can form a constituent without the verb *seem*, and that the ordering of the elements within this constituent is variable. This fact alone can be taken as reason enough to seek an explanation beyond the ternary structure of (10).

4.2 Seeking a New Analysis

Familiar syntactic tests for c-command relations can be employed in order to determine what structure should be adopted in lieu of the ternary-branching tree. First, it can be noted that the experiencer of *seem* appears to c-command the embedded clause material. This is illustrated using examples testing whether or not the experiencer c-commands the embedded clause object:

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2 Jackendoff (1990) notes cases wherein such c-command relations hold despite the fact that the c-commander is within an A-position PP.
The tests employed here are actually a subset of those used by Larson (1988) to illustrate asymmetric c-command between the objects of a ditransitive verb in alternations between the canonical construction and the double object construction. The results found here for *seem* indicate that an asymmetric c-command relation does exist in this construction. In (13a), the negative polarity item (NPI) *anything* is licensed by the experiencer *nobody*. In (13b), ungrammaticality results when the embedded object is Wh-extracted to the front of the sentence, which indicates that the Wh-experiencer *whom* lies in the c-command path; this is a clear-cut superiority violation. Finally, in (13c), it is possible to get a reading where the variable *him* is bound by the QP *every boy*. All of these phenomena boil down to c-command: the experiencer clearly c-commands the embedded object. The reverse c-command relation, unsurprisingly, does not hold. It seems unlikely that the embedded clause object should c-command the experiencer of *seem* in any case, so it is left as an exercise for the reader to construct the parallel examples for (13) which demonstrate this.

Having now established the necessary c-command relations that must exist within this structure, along with the fact that the experiencer and embedded clause must form a constituent exclusive of *seem*, a new tree can be proposed that will account for *seem* with a medial experiencer:

\[
\begin{align*}
T' & \quad \text{VP}_2 \\
& \quad \text{VP}_1 \\
& \quad \text{seems}_i \\
& \quad \text{PP} \quad \text{VP}_1' \\
& \quad \text{to me} \quad \text{V}_1 \quad \text{Spec, T} \\
& \quad \text{t}_i \quad \text{V}_1'
\end{align*}
\]

This structure is also modeled upon Larson’s treatment of ditransitive verbs. In this case, *seem* has two internal arguments in a lower VP shell, then raises to an upper verbal projection, here indicated as VP$_2$. Unlike a ditransitive though, this upper projection does not host an external argument, as it has already been noted that *seem* does not θ-mark an external argument. This tree remains consistent with the TAG θ criterion, the Fundamental TAG hypothesis, and the CETM. All and only those arguments assigned a θ-role by *seem* appear in the *seem*-headed tree, all syntactic dependencies within the tree (for example, the verb raising) remain local to this tree, and the extended projection of the verb goes no further than is warranted. As was the case for Frank, it will need to be stipulated that the experiencer can not move to [Spec, TP] in this tree, but this is a small trade-off when measured against the gain in matching the constituency facts. The final derived structure for (9a) with this auxiliary tree for *seem* will be:

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3 $\theta$ is just as viable a choice.
In turning to the case of the final experiencer, it must be determined whether there is a derivational relationship between the two sentences of (9). One possibility is that the final experiencer is derived from the medial experiencer through simple extraposition. If indeed the experiencer has been post-posed, it will be right-adjoined to the lower VP-node:

Given the c-command facts already observed, this tree predicts that the final experiencer will similarly c-command the embedded clause object. To test this, the sentences of (13) are repeated with final experiencers:

In the examples of (17), the exact opposite pattern of judgements from (13) are found. This indicates that the experiencer in final position does not c-command the embedded clause. Not only does this point away from the extraposition analysis, but it also indicates that the final experiencer can not be analysed as a simple reversal of the final elements in Frank’s ternary structure, as that too would predict that the experiencer should c-command into the embedded clause.

The same battery of c-command tests can be used to ensure that the final experiencer is not at the very bottom of the derived tree, c-commanded by the embedded object:

Again, the results here indicate that there is no apparent c-command relation between the embedded object and the experiencer of *seem*; neither c-commands the other. This fact must be captured in a structure which still maintains the correct constituency, without making reference to a derivational relationship between the two structures.

Once more looking to parallel research on ditransitive verbs, a solution can be found in the Harley (2002) response to Larson’s treatment of ditransitives. She rejects a derivational analysis of the double object construction,
which is similar to what has been shown so far with *seem*: two internal arguments of a single predicate apparently changing positions. In order to preserve the intuitions of Baker (1988)'s UTAH, Harley proposes that such transpositions are in fact the result of two distinct yet homophonous predicates whose argument structures have different syntactic representations. Extending this to the verb *seem*, a second version of the tree in (14) can be proposed, in which the specifier and complement of VP₁ have simply been transposed as the arguments of a distinct, yet homophonous *seem* predicate:

(19)

This tree remains well-formed in the eyes of all the constraints outlined earlier, and still has a T′ foot node, making it a legitimate auxiliary tree. The final result of adjunction into the *like* tree is shown below:

(20)

Thus, an analysis has been reached which demonstrates that *seem* with an experiencer can shift its internal arguments in much the same way as a ditransitive verb. The final derived structure of (20) correctly captures all the constituency and c-command predictions outlined above for the final experiencer.

The exact nature of the distinction between the two versions of *seem* remains unclear. For Harley, the alternation in the ditransitive verbs was captured in the notion of contrasting a locative predicate and a possessive predicate:

(21)  
   a. John sent\textsubscript{Loc} a book to Philadelphia.  
   b. John sent\textsubscript{Poss} Bill a book.

This distinction captures a subtle nuance of the double object construction, in which one can note that the goal argument of (21b) must be an animate recipient and not a destination. No similar pattern has yet been observed between the medial and final experiencers of *seem* which may distinguish the two, but the structural tests given above are taken as proof that the proposed structures are well-motivated for independent syntactic reasons. It is also worth noting that there was nothing explicitly TAG-based in the argumentation for these modified structures; the same tests could be used to argue for a similar modification to the minimalist account of *seem*.

5 Remaining Questions

With this analysis in place for the simple examples of SSR structures, there remain some further questions to be answered. The first concerns the broader applicability of these new *seem*-headed auxiliaries. It appears that while
the experiencer and the embedded clause can be transposed in cases where *seem* is adjoined into an infinitival clause, problems emerge when examining small clauses:

(22) a. John seems happy to me.
    b. *John seems to me happy.

From this, it appears that the medial experiencer is not permitted in the small clause example. As Frank (2002) establishes that the same *seem* auxiliaries can be used for both infinitival and small clause cases, there may be something new at play in the interaction between the experiencer of *seem* and the small clause. On the face of it, this could be the kind of evidence needed to motivate a difference between the medial and the final experiencers, but more work is needed before this can be answered definitively.

Another more difficult question is that raised by one final example:

(23) John likes coffee to me.

In this case, the apparent experiencer of *seem* is present, but the verb itself is absent. Native speakers generally agree that this has the same meaning as the sentences of (9), but there are fundamental differences between the two structures. (23) is a mono-clausal structure, and it is difficult to see how one could argue that the prepositional phrase is an argument of *like*. This raises the question of whether the experiencer is even an argument of *seem* at all, or if it would be better analysed as some sort of VP adjunct.

These questions are held over for future work.

**References**


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*Further discussion of these issues appears in the proceedings of the TAG+8 Workshop.*