

The simplest example of a local maximum parameter setting is one in which there exist no triggers for any parameters, so that the learner cannot move from G_s . Such a state is called an *absorbing state* in the theory of Markov chains. In particular, suppose that the learner's current linguistic hypothesis G_s allows the successful syntactic analysis of the set of sentence patterns $\{a_1, a_2, \dots, a_i, \dots\}$. Suppose also that the target grammar G_t allows perhaps some, but not all, of $\{a_1, a_2, \dots, a_i, \dots\}$ along with the sentence patterns $\{b_1, b_2, \dots, b_j, \dots\}$. The existence of at least one pattern b_j that is in the language generated by G_t (notated $L(G_t)$), but not in $L(G_s)$, means that $L(G_s)$ is not a superset of $L(G_t)$, so that the subset problem is avoided. Finally, suppose that for every parameter P , changing the value of P in G_s gives a grammar that allows the analysis of some but not all of $\{a_1, a_2, \dots, a_i, \dots\}$ along with some other sentence patterns, but where none of the additional sentence patterns overlap with any of the sentence patterns from $L(G_t)$. Thus, after changing a single parameter from G_s , the learner can analyze no sentences from G_t beyond the ones that she could already analyze with the hypothesis G_s , so that the Single Value and Greediness Constraints force her to stay in G_s . Hence, the TLA cannot move the learner to any other grammar. The grammar G_s is therefore an example of a local maximum grammar relative to the target G_t , because there is no path via triggering data from G_s to G_t . Intuitively, if only one parameter is changed in G_s , then there is no previously unanalyzable sentence that now becomes analyzable.

More generally, a source grammar may be a local maximum grammar even if it is possible to move from this grammar to another via triggering data, as long as there is no path from the source to the target via triggering data. For example, suppose that the learner finds herself in grammar G_{s1} relative to target G_t . Suppose also that there is only one parameter that can be triggered given G_{s1} as the source grammar, and that G_s is the resultant grammar when this parameter is changed. Finally, suppose that there is no trigger from $L(G_t)$ to take the learner out of $L(G_s)$ (i.e., G_s is an absorbing state). In such a case both G_{s1} and G_s are local maxima relative to G_t .

3.1 *Verb-Second Effects*

Now consider a concrete example of a parameter space with states like the source state in (8): a parameter space consisting of the X-bar parameters presented in section 2 together with a verb-second (V2) parameter. A V2 parameter, when set, indicates that a finite verb moves from its base position to the second position in root declarative clauses (see Bach 1962, Bierwisch 1963, Thiersch 1978, Den Besten 1983, Travis 1984, and Haider and Prinzhorn 1986 among many others; see Haegeman 1991 for an overview).¹⁶ Many Germanic and Scandinavian languages have this property, including German, Dutch, Swedish, Danish, Norwegian, Icelandic, and Yiddish. For example, consider Dutch and German, languages that allow the following declarative word orders:

¹⁶ In fact, in some languages (e.g., Yiddish; Diesing 1990), the V2 property applies to all tensed clauses, not just root clauses. This is a further parametric difference among languages, which will not be investigated here.

- (9) a. S V O
 b. O V S
 c. S Aux O V
 d. O Aux S V
 e. Adv V S O
 f. Adv Aux S O V
 g. . . . C S O V
 h. . . . C S (Adv) O V Aux

Furthermore, languages like Dutch and German disallow the following word orders:

- (10) a. *S O V
 b. *S Aux V O
 c. *O Aux V S
 d. *Adv S V O
 e. *Adv O V S
 f. *Adv Aux V S O
 g. *Adv V S O Aux
 h. *. . . C S V O

Examples of such patterns from both Dutch and German are given in (11) and (12).¹⁷

- (11) a. Dutch Hans koopt het boek.
 German Hans kauft das Buch.
 Hans buys the book
 ‘Hans buys the book.’
- b. Dutch Het boek kocht Hans gisteren.
 German Das Buch kaufte Hans gestern.
 the book bought Hans yesterday
 ‘The book Hans bought yesterday.’
- c. Dutch Hans heeft het boek gekocht.
 German Hans hat das Buch gekauft.
 Hans has the book bought
 ‘Hans has bought the book.’
- d. Dutch Het boek heeft Hans gekocht.
 German Das Buch hat Hans gekauft.
 the book has Hans bought
 ‘The book Hans has bought.’
- e. Dutch Gisteren kocht Hans het boek.
 German Gestern kaufte Hans das Buch.
 yesterday bought Hans the book
 ‘Yesterday Hans bought the book.’

¹⁷ The examples either are taken directly from Haegeman 1991 or derive from Haegeman’s examples.

- f. Dutch Gisteren heeft Hans het boek gekocht.
 German Gestern hat Hans das Buch gekauft.
 yesterday has Hans the book bought
 'Yesterday Hans has bought the book.'
- g. Dutch . . .dat Hans het boek koopt.
 German . . .daß Hans das Buch kauft.
 . . .that Hans the book buys
 ' . . .that Hans buys the book.'
- h. Dutch . . .dat Hans (gisteren) het boek gekocht heeft.
 German . . .daß Hans (gestern) das Buch gekauft hat.
 . . .that Hans (yesterday) the book bought has
 ' . . .that (yesterday) Hans bought the book.'
- (12) a. Dutch *Hans het boek koopt.
 German *Hans das Buch kauft.
 Hans the book buys
 'Hans buys the book.'
- b. Dutch *Hans heeft gekocht het boek.
 German *Hans hat gekauft das Buch.
 Hans has bought the book
 'Hans has bought the book.'
- c. Dutch *Het boek heeft gekocht Hans.
 German *Das Buch hat gekauft Hans.
 the book has bought Hans
 'The book Hans has bought.'
- d. Dutch *Gisteren Hans kocht het boek.
 German *Gestern Hans kaufte das Buch.
 yesterday Hans bought the book
 'Yesterday Hans bought the book.'
- e. Dutch *Gisteren het boek kocht Hans.
 German *Gestern das Buch kaufte Hans.
 yesterday the book bought Hans
 'Yesterday Hans bought the book.'
- f. Dutch *Gisteren heeft gekocht Hans het boek.
 German *Gestern hat gekauft Hans das Buch.
 yesterday has bought Hans the book
 'Yesterday Hans has bought the book.'
- g. Dutch *Gisteren gekocht Hans het boek heeft.
 German *Gestern gekauft Hans das Buch hat.
 yesterday bought Hans the book has
 'Yesterday Hans has bought the book.'

- h. Dutch * . . .dat Hans koopt het boek.
 German * . . .daß Hans kauft das Buch.
 . . .that Hans buys the book
 ‘ . . .that Hans buys the book.’

As a result of data like these, German and Dutch are assumed to be languages whose underlying word order is SOV (spec-first, comp-final), with V2 effects in main clauses. Thus, although the word order *S O V* is an appropriate base structure for these languages, this word order is not an appropriate surface form in matrix clauses. Constraints on the surface form necessitate (a) the presence of the matrix tensed verb in the C position (to the left of the IP sentential structure) and (b) the presence of a constituent in the specifier position of the complementizer phrase (to the left of the C position). Hence, although *S O V* is not a possible matrix clause word order, both *S V O* and *O V S* are acceptable matrix word orders in Dutch and German.

There are many theories about why this V2 movement takes place, most of which rely on a property of the zero-level complementizer C^0 . Although the results we obtain here do not rely on a particular theory of V2, for concreteness let us assume, following Holmberg and Platzack (1991), that in +V2 grammars Comp has the finiteness feature [+F], which is only licensed if the X^0 that bears this feature governs an element with nominative Case.¹⁸ Thus, a +V2 grammar is one in which C must have the feature [+F]; a –V2 grammar has no such requirement. Adding this parameterization to the X-bar parameters presented in section 2, we now have three parameters, each with two values, giving a total of eight possible grammars.

As in section 2, suppose that a child faces a simplified acquisition problem. In particular, suppose that the child hears sentences from a single grammar in which an object may not appear without a subject also being present. Furthermore, assume that the child knows (or can compute from the context) which grammatical function—subject or object—is appropriate for each noun phrase. Since all +V2 grammars are identical in the set of surface orders that they admit when only a subject, a verb, and an optional object are considered—namely, all and only the surface declarative orders SVO, SV, and OVS—additional constituents must be considered in order to tell the eight possible grammars apart.

The additional patterns that we will consider here derive from including (a) a second object; (b) a single finite (tensed) auxiliary verb, notated *Aux*, which is assumed to subcategorize for the verb, following the grammar’s standard complement-head word order; and (c) a sentence-initial adverbial adjunct, notated *Adv*.

Furthermore, we will consider only cases in which C^0 is on the left of its complement IP, so that verb movement to C^0 in +V2 grammars is leftward movement. Of course, the C^0 -IP word order is not universal (e.g., C^0 is assumed to be on the right in Japanese

¹⁸ See Vikner 1991 for a summary of other approaches to V2 phenomena.