

論文

Coordination as a linguistic speed-up mechanism

Thomas Michael Gross

要 旨

本稿では、言語の並列関係の進化を論じる。並列関係は文の構造を組み立てる基本的な原則とは異なり、基本構造の生成には必要なメカニズムではないと考える。それにもかかわらず、並列関係は言語に現れ、基本的な原則で生成されるものを対象に、広がり進化してきた。そのため、並列関係はその基本原則より若いと考えなければならない。言語は一次元的で、一方的なものなので、それらの本質的な特徴に応じて、並列関係が発達してきた。並列関係がどのように働くのかというと、まず、二つの文が統合され、それらの間に並列語が入る。二つの異なる要素は「括弧」となり、統合された文には同様な要素があれば、括弧の中に入っている要素を削除しても文が成立するようになってきている。この提案は英語、ドイツ語、日本語にも当てはまる。

上記の議論に加え、その提案に関連する問題や、並列語の依存関係におけるポテンシャルを論じる。

キーワード：並列・言語進化論

In this paper I shall try to outline a possible scenario for the development of certain — but not all! — linguistic mechanisms and give possible explanations of why these developments took place, what influence this had on linguistic structures, and last what kind of influences

it could supposedly have had on the general development of the language faculty. That seems to be a rather tall order, but what I can realistically say in this paper is bound to stay within the programmatic realm. However, I believe it may help the readers to understand my approach if I clarify my motives.

In Gross (1999), I deliberately added a chapter on language evolution while previously addressing a supposedly completely different topic, namely theoretical dependency grammar. The reason for doing so was the revision of Chapter 8 in which I treated coordination. After rewriting the chapter on coordination and reviewing Chapter 6 where I had treated pronominalization, I felt that coordination and pronominalization as linguistic mechanisms must have a status quite distinct from other linguistic mechanisms. Both these mechanisms share one important property: utterances that contain pronouns or coordination are more complex than semantically equivalent utterances that do not contain them. However, they are usually shorter. These are the reasons why I called pronominalization and coordination *linguistic speed-up mechanisms* in Chapter 10 in my book. A linguistic speed-up mechanism is a device that streamlines linguistic structures to match the needs of an expanding art of verbal communication.

Pronominalization is very well researched, and the principles for it which are called *binding principles* are adhered to throughout the linguistic community. In fact, pronominalization is so well researched that it can be — and often is — used as a test for the syntactic integrity of linguistic structures. However, the same cannot be said about coordination. While there are many papers on coordination, there is not yet a unifying theory of coordination.

Coordination seems to be a very elusive domain of human language. While language users do not display any significant problems when actively or passively using coordination, linguists who tackle coordination do display a significant amount of confusion and frustration. This imbalance can be summed up in the following question: why is coordination so easy to use — but so difficult to describe? This was the problem that bothered me after writing the first nine chapters of my book on the theoretical foundations of dependency grammar.

The second angle of approach was the theory of evolution. Not immediately connected to my research on dependency grammar, I had started reading books on evolution — in particular the British version of sociobiology, which means Dawkins, Maynard-Smith, Ridley and others. Bringing studies on evolutionary biology and language together, I started to research theories on linguistic evolution — which however left me disappointed.

Influential authors from the dominant field of constituent theories who follow a unified-theory approach have mostly nothing revealing to say about linguistic evolution. That does not mean that they do not have controversial things to say, though. Foremost Chomsky (1975) seems to believe that language has not evolved in a similar manner to — let's say — human organs such as the eye. He is quite right, however, to doubt whether it makes sense to follow such a line of investigation, since we simply do not have old enough data on human language. But from this it does not follow that language is not an evolved faculty. Another version offered by Gould (1993) — who is not a linguist but a biologist — is what has become to be known as the *spandrel*-theory: language appeared as a secondary function of another function which had properly evolved — presumably developments in the human brain. Pinker (1994) again believes that language is an instinct, i.e. pure behavior — but still evolved. These three approaches differ very much in what they assume as the underlying acquisition mechanism of language. Behavior can be acquired in four different ways: 1. a behavior is genetically encoded, 2. a behavior is imprinted, 3. a behavior arises from conditioning, and 4. a behavior is learned. For instance, Pinker's assumption that language is an instinct clearly falls into the first class. Instincts are genetically encoded and cannot be reversed. Chomsky's approach is more difficult to locate; on the one hand some language mechanisms seem to be genetically encoded, on the other hand they need an imprint experience to get started. It is also reasonable to assume that Gould would fit into the second class. However, it is quite generally believed that language could not have arisen as a conditioned reflex or as learned behavior. Other authors on language evolution more or less speculate how language has first arisen.

Where I think all authors — regardless of viewpoint — are mistaken is to treat language as a holistic system. While it is true that language *now* seems to be a rather holistic system that does not mean that it always was. And it does not mean that *every* aspect of language must have the same acquisition mechanism. For instance the above-mentioned mechanisms of pronominalization and coordination are from viewpoints of syntax and communication quite different from other mechanisms such as for instance predication. First of all, seen from the view such as a technician might take, they do not seem to be necessary integral components of a symbolic system — regardless of the fact that every language does contain them; and languages are evolved symbolic systems with very high expressive power. However, would languages really lack expressive power if pronouns and coordinators did not exist? My answer is negative, although I admit that a language without pronouns and

coordinators — if that is conceivable — would lack communicative power. However, expressive power and communicative power are not the same. This may be best understood using an example:

(1) Paul said he will come.

In sentence (1), the person referred to by the pronoun *he* is usually understood as the same person as the one that is referred to by *Paul*. In other words, the pronoun *he* in sentence (1) is understood as a *coreferent* to *Paul*. It functions like a bound variable; in (1) *he* is bound by *Paul*. In fact, if we choose to understand the pronoun as referring to Paul, we mentally reverse the substitution: in (1) *he* syntactically and semantically substitutes *Paul*, and we re-substitute *Paul* for *he* — without being aware of this process. This line of thinking offers a specific bonus: if what I said above is true - and I doubt anybody would disagree — we can formulate a first principle:

Order of development (pronominalization):

There must be a logical order of development for expressions that are substituted and substituting expressions. The concept of cause and effect demands that the substituting expression must come technically later than the expression that is substituted. That means that is highly unlikely that substituting expressions evolve before expressions that are substituted.

The small price we pay, however, is that we must explain the almost complete overriding by substitute expressions: it must be clarified why pronominal substitution has evolved into such a strong principle. What I mean is this: if *he* in (1) can be understood as *Paul*, and if we grant that *he* functions as a syntactic and semantic variable for *Paul* in (1), why does it sound strange to say the next sentence?

(2) Paul said Paul will come.

What I believe makes (2) such a strange utterance is the fact that contemporary speakers of English *already use pronouns*. The fact that at a position where we would expect a pronoun, a referential expressions appears, leads us to believe that the first *Paul* in (2) may

not be identical to the second *Paul* in (2). Therefore, there are two possibilities of understanding (2): the first one — which is probably due to our linguistic autopilot — is to understand that there are two different *Pauls*. The second possibility is that we identify the first *Paul* with the second but experience a kind of communicative overload. In the second reading, the utterance is simply not parsimonious and streamlined enough for our — contemporary — taste.

Returning to the distinction made above between expressive and communicative power, it is fairly safe to say that (1) and (2) have the same expressive power — if we choose to identify the pronoun with the referential expression in (1), and the first and second *Paul* in (2). However, in that case, (1) and (2) do not have the same communicative power. For users of contemporary English, (2) has less communicative power than (1) because it invites ambiguous readings.

I would like to hold that the fact that it is more confusing for us to understand (2) than (1) is caused by a secondary development of pronominalization. Once pronominalization is in place and is adapted to the syntax of a given language, it will exert pressure on the speakers to make use of it. At this stage, we can assume three basic steps concerning the development of pronominalization: 1. First a language does not contain pronouns. 2. Pronouns arise, adapt to and reform the syntax. 3. Pronouns override — wherever possible — any expressions they can substitute, thus gradually making it unstylish to use referential expressions whenever pronouns could be used.

It is also noteworthy to mention that classical Binding Theory has nothing illuminating to say about utterances such as (2). Binding Theory can explain why it is possible to understand that *he* refers to *Paul* in utterance (1), but it does not explain why (2) seems strange to us.

I shall now turn to coordination. One reason why coordination is less well researched than pronominalization may be the fact that pronouns are items that substitute other items. Therefore, the syntax is not greatly compromised, although it must be restructured to fit binding domains. In the case of coordination, however, we are not looking at simple substitutions but rather obvious holes in the sentence structures. Consider the next sentence:

(3) In the morning I drink coffee, and in the afternoon tea.

Clearly, sentence (3) says the same as the following utterance:

- (4) In the morning I drink coffee. In the afternoon I drink tea.

However, the words *I drink* do not appear in the second part of sentence (3). This indicates that coordination involves the omission of structurally integral parts of the sentence. Coordination is therefore a much stronger mechanism of syntactic reorganization than pronominalization. However, it shares with pronominalization the notion of being a secondary mechanism because it is structurally not really necessary. This is indicated by the utterances above, namely (3) and (4). In (3), nothing more is said than in (4), but in a much more parsimonious manner. On the other hand, the syntactic structure in (3) is severely compromised while (4) is structurally sound and simple.

Using the concepts of expressive and communicative power, we can again make the case that (3) and (4) have the same expressive power with (3) having more communicative power than (4), because it is more parsimonious.

Not only the argument of parsimony holds for coordination, too, but the principle of the order of development is also applicable. Coordination requires at least two items — not necessarily of the same structural class — to act as conjuncts. It seems evident that the structural rules for compiling the respective conjuncts must have evolved *before* the mechanism of coordination evolved to conjoin items. If we rephrase the principle of the order of development we get:

Order of development (coordination):

There must be a logical order of development for expressions that are coordinated and coordinating expressions. The concept of cause and effect demands that the coordinating expression must come technically *later* than the expressions that are coordinated. That means that it is highly unlikely that coordinating expressions evolve before expressions that are coordinated.

Although, in terms of the order of development, pronominalization and coordination share significant similarities, they differ very much in the way in which the structural principles are understood and accepted. Pronominalization requires the pronoun to be in a structural position from which it does not have a specific hierarchical access to its coreferent. This

relation is called *constituent-command*, or short: *c-command*. Pronouns bound by an expression understood as its coreferent may not c-command that expression. This allows only for a limited amount of structures in which a pronoun and a referential expression can be understood to be co-referential.

The situation is quite different for coordination. Very basic problems still remain disputed. For instance, should we apply a *small conjunct analysis* or a *big conjunct analysis*? The latter assumes that conjoined expressions form at least sentences, and that what is conjoined are sentences. The former only considers the immediate conjoined elements as conjuncts. Thus, in

(5) I like beer and wine.

the small conjunct analysis assumes

(6) I like [beer and wine].

and the big conjuncts analysis assumes

(7) [I like beer] and [~~I~~like wine].

The small conjunct-analytical structure (6) has the benefit that it does not suppose the deletion or omission of elements in the second conjunct. However, it will have difficulties explaining gapping as appeared in sentence (3) where undoubtedly something is missing from the second part of the sentence.

The big conjunct analysis must explain the deletion or omission of *I like* in the second conjunct in sentence (7). However, once that is done, it can be applied to a sentence such as (3) with the benefit that (7) and (3) are theoretically the same. Furthermore, the big conjunct analysis can make a semantic point: sentence (5) means *I like beer* and *I like wine*. Is there a way how to decide whether the small conjunct analysis or the big conjunct analysis is the more appropriate description? — Let us first return to an area less disputed than this one. Coordination is a speed-up mechanism that enhances structural parsimony of utterances. There is a malus and a bonus involved: the malus is that structures are compromised if we look at them from the view point of the linguistic mechanisms that

serve to compile the conjuncts. The bonus is that the application of coordination makes utterances quicker to express and quicker to comprehend. In Gross (1999, 189) I used the next sentence to illustrate the speed-up qualities of coordination:

- (8) After the party, Bill and Tom went to see Mary, I went home, and Joan and Rachel, too.

Sentence (8) contains multiple forms of coordination, some of which are treated very differently by different researchers. Whatever approach these researchers follow, they will surely admit that what is expressed in sentence (8) is the same as the list of the following sentences:

- (9.1) After the Party, Bill went to see Mary.
(9.2) After the Party, Tom went to see Mary.
(9.3) After the Party, I went home.
(9.4) After the Party, Joan went home.
(9.5) After the Party, Rachel went home.

It is evident that (8) is much more parsimonious than (9) — and still expresses the same. Now, coordination as a linguistic mechanism is a procedure, and what we see in (8) is the result of applying different forms of coordination to (9.1–5). What happens first is that (9.1) and (9.2) are coordinated. In a second step, (9.4) and (9.5) are coordinated. The product resulting from this coordination is then coordinated with (9.3). In the final step the products {9.1+9.2} and {9.3+{9.4+9.5}} are coordinated. The result is sentence (8). The first product and the second product are — depending on whether you favor a small conjunct analysis or a big conjunct analysis approach — different forms of coordination or not. {9.1+9.2} and {9.4+9.5} can be treated as was done in (6) by the small conjunct analysis. However, the product {9.3+{9.4+9.5}} becomes a gapping structure.

I have pointed out that according to the principle of the order of development, coordination cannot evolve before the mechanisms for compiling basic expressions that are to be coordinated have evolved. That implies that (9) is evolutionary older than (8). Accordingly, (9.1) and (9.2) must also be older than their possible product by coordination. Since coordination is a procedural mechanism it means that the coordination procedure

changes something in the basic set-up of rules that are applied to compile (9.1) and (9.2). (9.1) is changed insofar as the string *and Tom* is inserted between *Bill* and *went*. (9.2) is changed insofar as the elements *after the party, went, to, see, and Mary* are deleted.

However, it is the question whether that is what can be assumed to happen with good reasons. Technically, language is a one-dimensional and uni-directional medium. One-dimensionality means that the only parameter by which the serial order of elements in an utterance can be determined is a temporal *sooner* or the converse *later*. Element A occurs either after element B or before it, but not both at the same time, and it neither does it occur at the same time as B. Uni-directionality means that the flow of time from *sooner* to *later* is oriented in one direction: from *sooner* to *later*. These two properties are constitutive for language as a medium and pose severe restriction on what is possible and what is not.

Language is also processed in the brain, which means that while uttering — encoding a message — or hearing — decoding a message — something must happen in the brain, although there certainly are differences between active and passive language use. What would the technically best operation be to fuse (9.1) and (9.2) into the next coordinative expression?

(10) After the party, Bill and Tom went to see Mary.

One possible way would be to first coordinate (9.1) and (9.2) and interposing the coordinator *and*.

(11) After the party, Bill went to see Mary and after the party Tom went to see Mary.

This will not yield a parsimonious expression since (11) is even longer than just uttering (9.1) and then (9.2). In the next step (11) must be shortened. Otherwise coordination does not stand a chance of living up the evolutionary gamble. In (11), the elements between *Bill* and the coordinator, and between the coordinator and *Tom* also appear in the beginning and the end of the sentence. If they are deleted, sentence (10) will be the result:

(12) After the party, Bill ~~went to see Mary~~ and ~~after the party~~ Tom went to see Mary.

A structure such as (12) using strike-out letters for deleted elements shall be called a *collapsed structure*. The relevant procedure in this case would be something like this:

Coordination procedure (hypothesis):

1. *Combine*: Combine two sentences and insert a coordinator.
2. *Collapse*: Delete any element that is located between non-identical elements that bracket the coordinator if it is also present outside this bracket.

Let's see whether that works in other cases, too. If we want to produce a result such as

(13) I drink tea and coffee.

we first need to combine the sentences

(14.1) I drink tea.

(14.2) I drink coffee.

and get

(15) I drink tea and I drink coffee.

Non-identical elements are *tea* and *coffee* which bracket the coordinator. Inside this bracket the string *I drink* is located which is also present outside this bracket, namely in the beginning of the sentence. Therefore, we get the collapsed structure

(16) I drink tea and ~~I drink~~ coffee.

which is equivalent to sentence (13). In sentence (10), there were elements to be deleted in front of and after the coordinator. In sentence (13), the deleted element was located after the coordinator. It is possible to also delete something in front of the coordinator? Yes — if that element is located between the non-identical elements and if it has another representation after the second non-identical element. Consider the next sentence:

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(17) Tom and Tim write articles on coordination.

The first step is to combine the next two sentences

(18.1) Tom writes articles on coordination.

(18.2) Tim writes articles on coordination.

in order to form

(19) Tom writes articles on coordination and Tim writes articles on coordination.

The string *writes articles on coordination* between *Tom* and the coordinator can be deleted because it is also present after *Tim*. Therefore, we get the collapsed structure

(20) Tom ~~writes articles on coordination~~ and Tim *write* articles on coordination.

In sentence (17), elements in front of the coordinator had to be deleted. However, we also had to adjust the inflection of the verb. Since we deleted the first verb, and as a result there are now two subjects, the verb inflection must change from singular to plural.

Next, can the hypothesis of this coordination procedure made above also account for gapping? Consider the next sentence:

(21) In the morning I drink tea, and in the afternoon coffee.

First, we have to combine the next sentences

(22.1) In the morning I drink tea.

(22.2) In the afternoon I drink coffee.

to form

(23) In the morning I drink tea, and in the afternoon I drink coffee.

Now it is necessary to concentrate on which elements are non-identical because non-identical elements are the reference points for the left and right bracket. In (23), there are two pairs of non-identical elements, namely *in the morning* and *in the afternoon*, and *tea* and *coffee*. It seems that we have to choose a pair of non-identical elements, not just any non-identical elements. If we chose *tea* and *in the afternoon* then there would be no other element inside the bracket. But which pair should we choose?

Whichever we choose, we must make sure that the pair of non-identical elements bracket an identical element *after* the coordinator. Checking back in sentence (21), we realize that we must choose *tea* and *coffee* as the bracket. This leads us to the next collapsed structure where the bracketing elements are now indicated by bold letters:

(24) In the morning I drink **tea**, and in the afternoon I ~~drink~~ **coffee**.

Therefore, our hypothesis seems to be able to generate what are called gapped structures by linguists. If we look further we notice that it does not matter in what order the pairs of non-identical elements occur. Consider a variation of (21):

(25) I drink tea in the morning and coffee in the afternoon.

This sentence must result from

(26) I drink **tea** in the morning, and I ~~drink~~ coffee in the **afternoon**.

Here, we could suppose that the first or the second pair of non-identical elements as the bracket, and since both choices are possible, the bracket is indicated before the first non-identical element.

However, we have to retreat one step and look at all possible variations of sentence (21), i.e. all possible word orders. Since there are two pairs of non-identical elements, there may be four possible word orders. That turns out to be true:

(27.1) I drink tea in the morning and coffee in the afternoon.

(27.2) I drink tea in the morning and in the afternoon coffee.

(27.3) In the morning I drink tea and coffee in the afternoon.

(27.4) In the morning I drink tea and in the afternoon coffee.

The sentences (27) must be made up of four elementary sentences, namely:

(28.1) I drink tea in the morning.

(28.2) In the morning I drink tea.

(29.1) I drink coffee in the afternoon.

(29.2) In the afternoon I drink coffee.

Sentence (21) — now equal to (27.4) — was based on sentences (28.2) and (29.2) — given above as (22). Sentence (25) is equal to (27.1) and based on (28.1) and (29.1).

The combination of (28.1) and (29.2) produces sentence (27.2):

(30) I drink **tea** in the morning and in the afternoon ~~I drink~~ **coffee**.

In (30) the bracketing pair of non-identical elements must be *tea* and *coffee*, since the other pair does not bracket either identical element. Last, the combination of (28.2) and (29.1) produces sentence (27.3):

(31) In the morning I drink **tea** and ~~I drink~~ **coffee** in the afternoon.

In sentence (31) *tea* and *coffee* form the bracket because only this pair brackets an element that is also present outside of this bracket. Evidently that would not be the case if we chose *in the morning and in the afternoon*.

Let us summarize what we have found so far: We found that one possible technical way of coordination to occur was to first combine two sentences and insert a coordinator between them. Then we found that there can be some elements in the combined product which are identical and some which are not identical. Further we established that non-identical elements form brackets that contain the coordinator, and that all identical elements inside this bracket could be deleted if a corresponding identical element was located outside this bracket. The result of this procedure — until now — always resulted in utterances that are considered grammatical in contemporary English.

But we also found that there are some restrictions pertaining to the deletion of identical elements: sometimes elements are deleted which are located in front of the coordinator, and sometimes elements are deleted which are located after the coordinator. In so-called gapping structures, the identical element which could be deleted was always located *after* the coordinator. The question now is: is this always so?

The answer is Yes because gapping is defined in that way. By this definition, however, there are languages where gapping does not occur because the verb in the second conjunct cannot be deleted for structural reasons. Japanese is a case in point.

However, the above-said only pertains to identical elements if they are verbs. Other elements can be deleted in coordinated structures even if they are located in front of the location where a coordinator can appear. At least, this is true for German. Consider the next sentence:

- (32) Peter mag Tee mit und Paul Kaffee ohne Milch.
 “Peter likes Tee with (milk) and Paul coffee without milk.”

Sentence (32) is clearly a gapped structure because there is no verb after the coordinator — thus it must be identical to the one in front of the coordinator. However, the noun *Milch* is missing at a location *in front of* the coordinator. Sentence (32) should derive from the next combination:

- (33) Peter mag Tee **mit ~~Milch~~ und** Paul mag Kaffee **ohne** Milch.

Since gapping is restricted to structures with deleted identical elements after the location where a coordinator can appear, the deletion of *Milch* in front of the coordinator is not an instance of gapping. Let us concentrate on the noun: it is also possible to delete the identical element after the coordinator in (32) if the one in front of the coordinator is not deleted:

- (34) Peter mag Tee mit Milch und Paul Kaffee ohne.

Sentence (34) is an instance of gapping and should derive from a structure similar to (33) but with the difference that the *Milch* and *Milch* are reversed. It is also clear that the right

bracket must now include *Milch* but it should not include *Milch*. In such a case, however, the problem arises where we should locate the left bracket. It should include *mit* but not *Milch*. This, however, is absolutely impossible. Since the deletion of *Milch* after the coordinator cannot be accounted for by our collapse mechanism, it must be due to another mechanism. It is, however, possible to offer a principle that covers these instances. Let us first assume that sentence (34) derives from

(35) Peter mag Tee **mit** Milch und Paul mag Kaffee **ohne** Milch.

We then find that the following principle may hold:

Bracket deletion blocking:

If one of two identical elements is located inside the bracket and in front of the location where a coordinator can appear or if it forms the bracket, but is not deleted during the collapse then the element outside the bracket may be deleted if it is located after the location where a coordinator can appear.

This principle also holds for the subordinate clause versions of (32) and (34):

(36) ...dass Peter Tee mit und Paul Kaffee ohne Milch mag...

Expression (36) derives from

(37) ...dass Peter Tee **mit** Milch ~~mag~~ und dass Paul Kaffee **ohne** Milch mag...

where *Milch* located in front of the coordinator is deleted. The noun *Milch* is not bracketed. Sentence (36) is not a gapped structure because the verb in the second conjunct is not deleted. The subordinate clause equivalent of (34) is

(38) ...dass Peter Tee mit Milch und Paul Kaffee ohne mag...

Expression (38) derives from

(39) ...dass Peter Tee **mit** Milch ~~mag~~ und ~~dass~~ Paul Kaffee **ohne** ~~Milch~~ mag...

where *Milch* located after the coordinator and is deleted. Here, both identical nouns are bracketed, and thus bracket deletion blocking applies.

The possible assumption that a principle could restrict these cases to prepositional phrases dependent on a noun as was the case in (32), (34), (36) and (38) is not valid. Consider the next examples:

(40) Peter reiste gestern ohne, und Paul heute morgen mit Gepäck.
“Peter traveled without (luggage) yesterday and Paul with luggage today.”

Sentence (40) is a gapped structure with one noun, namely *Gepäck* deleted in front of the coordinator. The derivation structure should be

(41) Peter reiste gestern **ohne** ~~Gepäck~~, und Paul reiste heute morgen **mit** Gepäck.

The next sentence, however, is full gapping since it must also invoke the principle of bracket deletion blocking:

(42) Peter reiste gestern ohne Gepäck, und Paul heute morgen mit.
“Peter traveled without luggage yesterday and Paul with (luggage) today.”

In sentence (42) the second noun *Gepäck* is deleted because the first one has not been deleted.

There is a further indication that bracket deletion blocking occurs in German. The next two sentences

(43.1) Kaffee und Tee mag ich.

(43.2) Kaffee mag ich und Tee.

can both be derived from the same combined structure:

(44) **Kaffee** mag ich und **Tee** mag ich.

However, to derive sentence (43.1), the bracket must be collapsed in (44).

(45) **Kaffee mag-ich** und **Tee mag ich**.

But in order to derive sentence (43.2), the bracket may not be collapsed but the bracket deletion blocking principle must be invoked:

(46) **Kaffee mag ich** und **Tee mag-ich**.

Sentence (43.2) is thus a case of gapping. In case two or more elements are deleted outside the right bracket, the adverb *auch* (eng. *too*) is often used:

(47) Kaffee mag ich und Tee auch.

I suspect, however, that the mechanism that is described by the principle of bracket deletion blocking is secondary even to coordination, i.e. it is evolutionary younger than coordination. Let us quickly address another problem that has already appeared but not been commented on. In the sentences (40) and (42) we found that there could be more than just two pairs of non-identical elements. However, there seem to be limits how many non-identical elements can appear in front of and after a verbal gap. Still, this seems to be largely parameterized by typological properties of a language.

Let us turn now to another problem. Leaving the realm of what linguists call gapping we now can ask whether it is also possible to generate multiple coordination with our hypothesis of an operational procedure. The answer is positive, although we have to apply the procedure recursively. Consider the next sentence:

(48) Peter and Paul read Goethe and Schiller in German.

In sentence (48) we have two double coordinated structures: *Peter and Paul* and *Goethe and Schiller*. Sentence (48) is equivalent to the following list of sentences:

(49.1) Peter read Goethe in German.

(49.2) Peter read Schiller in German.

(49.3) Paul read Goethe in German.

(49.4) Paul read Schiller in German.

We first combine (49.1) and (49.2), then (49.3) and (49.4), and last the respective products.

The product of the first combination and its collapse is

(50) Peter read ~~Goethe in German~~ and ~~Peter read~~ **Schiller** in German.

The product of the second combination and its collapse is

(51) Paul read ~~Goethe in German~~ and ~~Paul read~~ **Schiller** in German.

The product of the combination and collapse of (50) and (51) is

(52) ~~Peter read Goethe and Schiller in German~~ and **Paul** read Goethe and Schiller in German.

After this rather long detour we can return the question which approach is the better one: the small conjunct analysis or the big conjunct analysis. I believe I have very thoroughly illustrated how to emulate coordination by relying on the idea of combining two (or more) sentences and deleting all identical elements that appear in a specified yet very general position. This approach has thus basically been a big conjunct analysis, although there is still room for dispute how the actual syntactic structure of products of the coordination procedure is to be determined. Although I hope to remain open to other ideas and proposals, I cannot imagine how a coordination procedure could be developed on the basis of a small conjunct analysis. As long as a small conjunct analysis — and for that matter any other analysis, too — fails to explain how coordination as a mechanism evolutionary younger than more basic mechanisms for generating a sentence structure, uses the building blocks already available, it fails to explain coordination altogether.

However, there are also grave arguments against a big conjunct analysis. It is claimed that the following sentences cannot be derived by a procedure that is based on combining two sentences:

- (53.1) Two and three is five.
(53.2) John didn't read the book or Mary the paper.
(53.3) Tom and Bill met.

It is evident neither sentence above can be derived from the following combinations:

- (54.1) * Two is five and three is five.
(54.2) * John didn't read the book or Mary didn't read the paper.
(54.3) * Tom met and Bill met.

Sentence (53.1) is an arithmetic term, sentence (53.2) a complex logical term, and sentence (53.3) a sentence with a symmetric predicate. Since the problem posed by sentence (53.1) is easiest to tackle, I start with that. The word *and* in (53.1) is understood as a coordinator by those who use sentences like (53.1) as a counter-argument to a big conjunct analysis. However, in (53.1) *and* can be replaced by the Latin word *plus* without changing the meaning. But *plus* cannot replace *and* in sentences such as for instance (52). Thus, *plus* is not a coordinator. If *plus* can replace *and* then *and* does not function as a coordinator in the expression where it is replaced by *plus*. A further indication that (53.1) is not a valid argument against the big conjunct analysis is the fact that there are languages where arithmetic addition is not rendered as *pseudo-coordination*. In Japanese, sentence (53.1) becomes

- (55) 2 たす 3 は 5。
ni tas.u san=wa go.
2 add +present_tense 3 =exclusive_focus; 5

Since we already employ an evolutionary view of coordination we may point out that addition as pseudo-coordination must have evolved after coordination was established.

Sentence (53.2) poses a logical problem: the coordinator *and* cannot appear inside the scope of a negator in a gapped structure. It must be *or*. However, in the combined structure (54.2), the coordinator is not inside the scope of the negator and thus should be *and* not *or*. Disregarding for the moment, that logics certainly has appeared as *after* the coordination mechanism, it is not impossible to integrate demands of logics into a theory of coordination,

since we deal not only with a logical matter but also with a syntactic issue. In case of collapse hierarchy relations change significantly, and if the coordinator *and* is moved into the scope of a negator due to coordination collapse why should it not be possible to assume that it changes to *or*? Even a small conjunct analysis must concede that (53.2) means

(56) John didn't read the book and Mary didn't read the paper.

The burden is then on the small conjunct analysis to explain why (53.2) and (56) mean the same.

Sentence (53.3) contains a symmetric predicate since this sentence means:

(57) Tom met Bill and Bill met Tom.

Thus, (57) and not (54.3) is the combined structure needed to derive (53.3). The collapsed structure must invoke — exactly like the cases of gapping I have shown above — not only the coordination procedure but also the bracket deletion blocking:

(58) **Tom met Bill** and **Bill met Tom**.

The elements *met* and *Bill* are deleted because they appear inside the bracket formed by the first *Tom* and the second *Bill*. The word *Tom* after the coordinator is deleted according to bracket deletion blocking: the first *Tom* cannot be deleted for structural reasons; chiefly because there would be no element in front of the coordinator. Thus, the second *Tom* is deleted. If we look at the definition of bracket deletion blocking we find that the second element *may* be deleted. However, the first element does not have to be deleted either. In (58), however, the first element *must not* be deleted, while the second *must* be deleted. I will rephrase the relevant principle later.

I want to address a further problem. It has been pointed out that in coordinated expressions it matters quite a lot where elements are positioned in order to refer to both conjuncts. Remember that we established the concept of a *bracket* and that elements inside this bracket could be deleted if they have an identical counterpart located outside the bracket. Therefore what remains after the operative procedure has been applied are all elements outside of the bracket, and those elements inside the bracket that could not be deleted. The

problem addressed here only involves noun phrases — and in particular attributive adjectives — and must not be expanded to other phrase types:

(59) old women and men from Canada

Sentence (59) can be understood in the way that *old* and *from Canada* refer both to *women* and *men*. If this should be so, then the collapsed structure should be

(60) old **women** ~~from Canada~~ and ~~old~~ **men** from Canada

In the next sentence, however, *old* can seemingly not refer to *men*:

(61) old women from Canada and men from Mexico

If this should be true, then there are two possible collapsed structures of which (61) cannot have derived:

(62.1) * old women from **Canada** and ~~old~~ men from **Mexico**

(62.2) * old **women** from Canada and ~~old~~ **men** from Mexico

Note that we have two possible collapsed structures in (62), because it is not quite clear which elements form the bracket. The proper collapsed structure must rather be

(63) old women from Canada **and** men from Mexico

In (63) there is no bracket, viz. the bracket only contains the coordinator. In this case I think we can safely dispense with the bracket indicators altogether. Now consider the next sentence:

(64) young women with red hair and old men with brown hair from Europe

In (64), the element *from Europe* can be understood to refer to both *women* and *men*. Thus the collapsed structure should look like

- (65) young **women** with red hair ~~from Canada~~ and old **men** with brown hair from Canada

Obviously what seems to be the problem here is that there is a restriction for how far elements can refer to elements on the other side of the coordinator. The collapsed structure (60) of sentence (59) illustrates that the undeleted elements outside the bracket can refer to elements on the other side of the coordinator: *old* can refer to *men*, and *from Canada* can refer to *women*. The sentences (61) and (64) illustrate an anti-symmetry for possible coreference of undeleted elements in front of the coordinator and undeleted elements after the coordinator. Sentence (61) shows that an element located outside the bracket and in front of the coordinator cannot refer to an element after the coordinator: *old* cannot refer to *men* in (61). Sentence (64) shows that an element located outside the bracket and after the coordinator *can* refer to an element in front of the coordinator: *from Canada* can refer to *women*.

These findings have a very important implication for the hypothesis made above: the second part of the coordination procedure stated that *every* element could be deleted if it was located inside the bracket and if there was an identical element outside the bracket. It seems that this principle is too liberal because it would cause *old* in front of *men* to be deleted. However, this reading is impossible in sentence (61).

When I introduced the term *collapsed structure* I did so with a certain idea in mind. What is actually happening when coordination collapses two sentences is the collapse of the syntactic structure of the sentence. We find indirect proof for this assumption in the fact that linguists have grave difficulties describing the syntax of coordinated structures. It seems that coordination can wield a rather free hand when collapsing sentences, however, there are evident restrictions when it comes to noun phrases. The chief reason for this difficulty must be that the structure of noun phrases has already become ossified to a degree that it was not malleable enough anymore to allow for coordination collapse to the degree sentences are able to allow. Sentences have to be — by nature — very malleable, noun phrases are not as soft. Inside a noun phrase adjectives refer to the noun inside this phrase. If coordination collapse yields a sequence of two nouns connected by a coordinator, the attributive relation is still possible, because the coordinated elements are simple nouns. However, if the first conjunct is a noun phrase, then coordination collapse would result in a situation where the adjective had to form an attributive relation with two noun phrase

conjuncts. And that seems to be too tall an order for an adjective to accomplish. If our hypothesis can be adjusted to account for this phenomenon, then it should be valid for all types of coordination. I propose to leave the Coordination Procedure as it is and add two constraints. Below the formulation of the Coordination Procedure is repeated:

Coordination Procedure:

1. *Combine*: Combine two sentences and insert a coordinator.
2. *Collapse*: Delete any element that is located between non-identical elements that bracket the location where a coordinator can appear if it is also present outside this bracket.

Further, two constraints are needed. The first one handles the problem of incompletely collapsed noun phrases:

NP-Constraint:

Do not delete an identical element E in front of a noun after the coordinator if there are undeleted elements between the coordinator and the noun immediately after E.

Next a constraint is needed that addresses instances where an element inside the bracket stays undeleted although it has an identical element outside the bracket. We covered that as the bracket deletion block.

Bracket Deletion Constraint:

If one of two identical elements is located inside the bracket and in front of the location where a coordinator can appear or if it forms the bracket, but is not deleted during the collapse then the element outside the bracket may be deleted if it is located after the location where a coordinator can appear. If it cannot be deleted then the second element must be deleted.

The above constraint is a nice example of how language uses its properties of one-dimensionality and uni-directionality. If the *first* element is not deleted, even though it is in a position where it could be deleted, then the *second* element is deleted. This

constraint is also in part responsible for some cases of gapping — in particular examples such as sentence (43.2) — where the — first — verb in the bracket is not deleted but rather the second one outside the bracket. The reason for this deletion block is syntax. And here we approach the second most discussed problem concerning coordination.

There are two major models in syntax studies. The constituency model primarily assumes that words form phrases, and that syntactic rules and relations act on phrases. The dependency model assumes words as basic entities, and thus syntactic rules and relations act only on words. Which model is better suited to syntactic analysis is a discussion I do not want to start here. However, the important property that both models share is that they both assume hierarchies between the assumed syntactic elements. Some elements have a higher syntactic status and others a lower status. The most pertinent question concerning coordination is what kind of hierarchy status coordinators must have. In the majority of contributions we find two approaches: 1. the coordinator is assigned a hierarchy potential that is equivalent to its logical function. For instance, the coordinator *and* coordinates two elements and is thus placed above *both* elements. 2. The coordinator is not assigned a hierarchy potential but merely placed between the conjuncts. The problem is which assumption fits the data.

Consider the next sentence:

(66) Peter likes football, and he often goes to watch games.

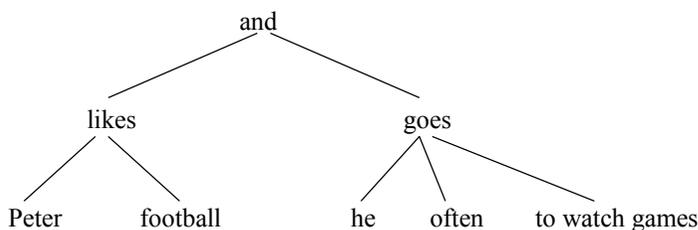
In sentence (66) we have coordination as well as pronominalization. If *Peter* would occur instead of *he* it would have been deleted, thus forming a perfectly acceptable sentence. However, it has not been deleted in (66), and (66) is also a perfectly acceptable sentence. Binding Theory states that referential expressions cannot be ranked on the same level or lower than pronouns if a co-referential reading should be acceptable. Thus, *Peter* must be ranked higher than *he*, if we want to understand both expressions as referring to the same person. On the other hand, if we mutually substitute *Peter* and *he* as in the next sentence

(67) He likes football, and Peter often goes to watch games.

Peter and *he* cannot be understood as the same person. However, both *Peter* and *he* have the same syntactic function in their sentences: they are subject of their respective verbs.

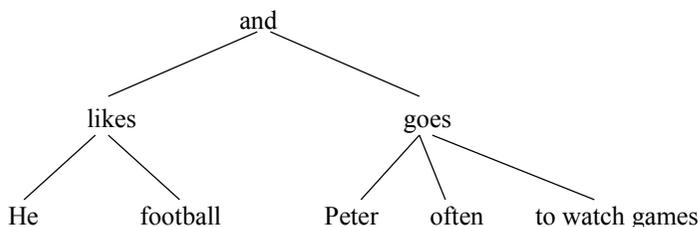
Coordination as a linguistic speed-up mechanism

This indicates that neither the assumption of assigning coordinators a hierarchy potential over both conjuncts, nor the assumption of just placing the coordinator between the conjuncts can be correct because it would violate the binding principle explained above. The sentence after the coordinator must be ranked lower than the sentence in front of the coordinator. The only device that can make that happen is the coordinator. Thus, the coordinator *and* must be ranked lower than the first conjunct but ranked higher than the second conjuncts. First consider two dependency trees for (66) and (67) where the coordinator is ranked higher than both conjuncts:



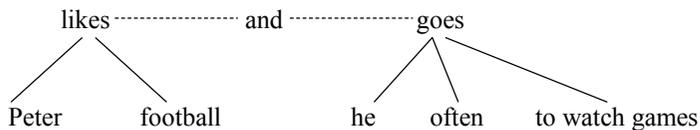
Picture 1: Tree of (66) with higher ranked coordinator

This tree could be correct, since the pronoun cannot c-command *Peter*. However, neither would same tree for sentence (67) allow such a relationship.



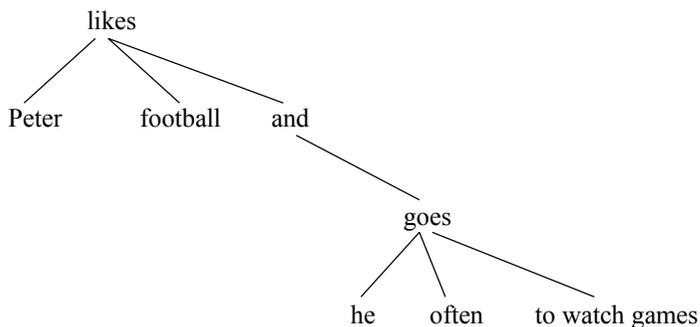
Picture 2: Tree of (67) with higher ranked coordinator

According to picture 2, the pronoun should not be able to c-command *Peter*. Hence, the pronoun and *Peter* should be able to be read as co-referential. Since this is not possible, the assumption of a coordinator ranked higher than both conjuncts must be judged incorrect. Consider now a tree where the coordinator is not assigned a hierarchy potential:



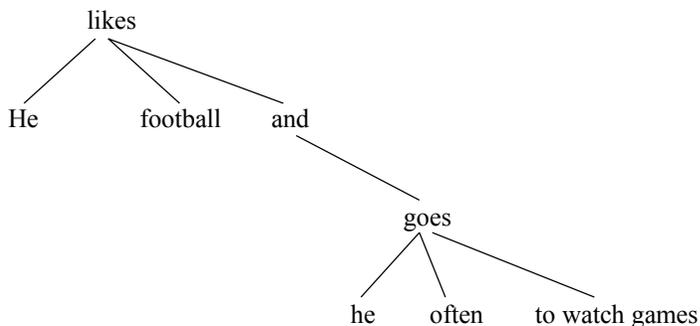
Picture 3: Tree of (66) with inserted coordinator

According to the structure depicted in picture 3, the pronoun now c-commands *Peter* and thus disallows a reading that identifies the pronoun with *Peter*. Since this is not possible the assumption that coordinators have no hierarchy potential at all, must be judged incorrect as well. Now consider two trees where the coordinator is placed hierarchically between the conjuncts:



Picture 4: Tree of sentence (66) with hierarchical coordinator

In picture 4, the pronoun cannot c-command *Peter*. Thus a co-referential reading of the pronoun and *Peter* is acceptable. The inversion of both expressions yields the next tree:



Picture 5: Tree of sentence (67) with hierarchical coordinator

In picture 5, the pronoun c-commands *Peter* and thus disallows a co-referential reading. Picture 4 and 5 plus well established claims made by Binding Theory lead us to accept that coordinators have a specific hierarchy potential. The only linguist — besides my humble self — who has ever proposed such an anti-symmetrically directed hierarchy potential for coordinators in a dependency framework is Mel'čuk (1988).

Returning to the discussion of the Bracket Deletion Constraint, we realize that if finite verbs, i.e. elements that for all practical purposes rank highest in the sentence structure, appear inside the bracket they may not be deleted because this deletion would corrupt the hierarchy potential of the coordinator.

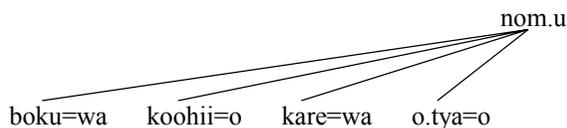
However, the direction of the hierarchy potential of coordinators is of course typologically parameterized. While in English and German coordinators are ranked lower than the head of the first conjunct, but higher than the head of the second adjunct, it is just the opposite in Japanese, although Japanese does not know coordinators as a word-class. The next sentence displays an instance of coordination in Japanese where a coordinator cannot occur:

- (68) 僕はコーヒーを，彼はお茶を飲む。
 boku=wa koohii=o, kare=wa o.tya=o nom.u.
 I =exclusive_focus coffee =accusative he =e_f honorific- tea =acc drink
 +present_tense
 I drink coffee, he tea.

In (68), there is no coordinator, and there cannot be one. The collapsed structure of (68) is:

- (69) boku=wa **koohii=o nom.u** kare=wa **o.tya=o** nom.u.

A dependency tree of (68) looks like picture 6:



Picture 6: Dependency tree of (68)

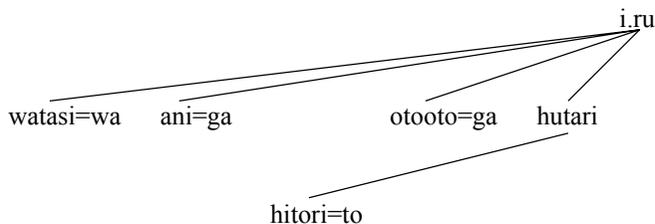
The next sentence contains a coordinator, however, as a suffix:

- (70) 私は兄が一人と弟が二人いる。
 watasi=wa ani=ga hitori=to ootoo=ga hutari i.ru.
 I =e_f elder_brother =nominative one_person =coordinator younger_brother
 =nom two_persons be +present_tense
 I have one elder and two younger brothers.

Sentence (70) derives from the next collapsed structure:

- (71) watasi=wa **ani=ga** hitori ~~i.ru~~ COORD watasi=wa **otooto=ga** hutari i.ru.

In (71), we have to assume an abstract coordinator. If the verb *i.ru* is deleted during the collapse, the next word left of *i.ru* is a noun. Coordination between nouns is expressed — among others — by the particle =*to* which is agglutinated to *hitori*. This particles — and others with coordinative function — instantiates a hierarchy relation opposite to German and English coordinators. However, since =*to* is not a word, it cannot have a hierarchy potential itself; it rather transfers a hierarchy rank to the noun to which it is assigned. Thus, *hitori* ranks lower than its counterpart *hutari*. In a two-dimensional dependency trees this hierarchy causes a discontinuity:



Picture 7: Dependency tree of (70)

I shall now summarize what I think coordination as a speed-up mechanism is, what it does, and how it influences other language faculties.

The first function of a coordinator-like expression was probably to signal that the speaker wished to continue with his utterance. Thus two sentences were combined. In the beginning, they probably stayed combined, but did not collapse. In a second phase, collapse occurred if the combined sentences each included an identical element. Non-identical

elements came to serve as borders for the identical expressions within to be deleted. This produced the first coordinated structures in the way we think of coordination. Noun phrases were probably already so far evolved and ossified that they needed to be fully collapsed in order for an adjective outside the left bracket to refer to a noun after the location where a coordinator can appear. In a third phase constraints for the deletion of bracket blocking appeared. An identical element inside the bracket could stay undeleted if its correspondent outside the right bracket was deleted.

Since the mechanisms for basic sentence structuring had already — though yet not fully — evolved coordination collapse had to adapt to these structuring principles. That means that if a language has lexical coordinators, they must have anti-symmetrically directed hierarchy potentials. In SOV-languages the head of the first conjunct is ranked lower than the coordinator, and the coordinator itself is ranked lower than the head of the second conjunct. In other languages the hierarchy potentials are the opposite. In languages that have no or very rarely lexical coordinators, affix coordinators emulate the same hierarchy directions a lexical coordinator would have in a language with the same typological properties.

Coordination collapse evolved because it could effectually make communication more rapid than had been the case before. Once rapidity become a feature that could be enhanced by the use of mechanisms designed to do just that, it is quite imaginable that this contributed to their rapid procreation. Since coordination collapse involved the collapse of sentence structuring that is used for generating basic sentence structures, it also quite imaginable that this contributed in no mean degree to the development of human brain faculties such as for instance expansion of short-term memory and enhancement of planning faculties located in the left frontal lobe from which the language centers are not very distant.

In what particular way this has happened is hard to prove, but there can be no doubt that coordination is a linguistic mechanism uniquely distinct from any other mechanism.

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