Introduction: *Linearization in Functional Discourse Grammar*

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1 Introduction

The current volume aims to further develop and apply the system of morphosyntactic representation in Functional Discourse Grammar (FDG) with regard to its treatment of linearization. FDG is exceptional among functional models in that it has a separate morphosyntactic component, which contains its own system of placement rules, the design of which is inspired by the overall organization of the model: linearization is dealt with in a top-down and dynamic fashion that is consistent with the functional orientation of the model (Hengeveld and Mackenzie 2008: Chapter 4; Hengeveld 2013; Keizer 2015: Chapter 5).

In this introduction to the volume we first present an outline of FDG in Section 2, to provide the reader not familiar with FDG with the necessary theoretical background. In Section 3 we offer a broader perspective on linearization. While recursive hierarchical embedding has dominated the scene of syntactic theorization for several decades, recent research in theoretical syntax (e.g. Pollard and Sag 1994; Broccias 2019; Jackendoff and Audring 2020), linguistic typology (Dryer 2009), psycho- and neurolinguistics, and computational linguistics (e.g. Unger 2010; Frank, and Bod 2011; Frank, Bod, and Christiansen 2012) has been putting more and more emphasis on non-hierarchical linearization. FDG's position in the context of this debate, presented in Section 4, is a balanced one, based as it is on the assumption that the hierarchical relations so prominent in its account of pragmatic and semantic organization may, but need not always be reduplicated in the build-up of actual morphosyntactic structures. The overall system of placement rules is explained, and it is shown how it applies in exactly the same way at the clause, phrase, and word level. Section 5 then presents the contributions to this volume and situates them within the broader context sketched in Sections 3 and 4.

2 Functional Discourse Grammar

2.1 General features

Functional Discourse Grammar is a structural-functional, typologically-based theory of language structure. The term structural-functional indicates that, while recognizing that a language is first and foremost a tool for communication, and as such is constantly adapted to and shaped by the communicative needs of the community of its speakers, the theory also recognizes the cognitive reality of grammar as a structured system of rules and constraints. In this regard, FDG differs from so-called "radical functional" approaches such as Hopper's (1987, 1988, 2015) Emergent Grammar and resembles other theories such as Role and Reference Grammar (Van Valin and LaPolla 1997; Van Valin 2005) and Systemic Functional Grammar (Halliday 1985; Halliday and Matthiesen 2004). The term typologically-based, on the other hand, reflects FDG's fundamental concern with typological adequacy, that is, the requirement that a functional model be capable of providing a grammar for any type of natural language, while also accounting for the differences and similarities between individual languages (Dik 1997: 14).

Typological adequacy is one of the three standards of adequacy set up by Dik (1997: 13-14) as guidelines for the functionalist endeavour, that is, criteria against which to assess the success of a functional model of grammar. The other two standards are those of psychological and pragmatic adequacy. The former is the assumption that a functional model of grammar "must relate as closely as possible to psychological models of linguistic competence and linguistic behaviour" (Dik 1997:

13); the latter is the degree to which the model accounts for the fact that linguistic expressions are "instruments which are used by a Speaker in order to evoke some intended interpretation in the Addressee within a context defined by preceding expressions, and within a setting defined by the essential parameters of the speech situation" (Dik 1997: 13). In the next section we will show how these two concepts inspire the overall architecture of FDG, translating, on the one hand, into its strictly top-down approach to the structure of the grammar and, on the other, into the fact that the Grammatical Component is conceived of as one of four modules of a wider theory of verbal interaction, in constant interplay with a Conceptual, a Contextual and an Articulation Component.

Another definitional property of FDG, which it shares with Systemic Functional Grammar and, especially, Role and Reference Grammar, is its hierarchically organized layered structure. The principle of hierarchical organization is taken very seriously in FDG, so much so that hierarchical relations are assumed to exist both between the four levels of grammatical analysis recognized in the model (such that the information passed on from the higher levels determines the content of the lower ones) and within each of these levels, which are all displayed as a layered structure where linguistic units of the type relevant to each particular level are recursively embedded within one another.

2.2 The structure of the grammar

The four levels of grammatical analysis distinguished in FDG deal with pragmatics (Interpersonal Level), semantics (Representational Level), syntax and morphology (Morphosyntactic Level), and phonology (Phonological Level). As shown in Figure 1, their hierarchical organization is such that pragmatics governs semantics, both govern morphosyntax and all three of the preceding govern phonology.

Another distinctive aspect of FDG that is represented in the figure is that the Grammatical Component, consisting of the four levels just described, is encapsulated within a broader network of components which jointly make up a full-fledged theory of verbal interaction. The role of the Conceptual Component is to develop a prelinguistic communicative intention which the grammatical operations of Interpersonal and Representational Formulation translate into pragmatic and semantic representations; these feed into the two operations of Encoding, which generate the Morphosyntactic and the Phonological Level; finally, the Phonological Level is the input for the Articulation component, which converts the phonological representation into a phonetic, orthographic or visual-spatial one (in spoken, written and signed communication, respectively), which are then converted into a sensorily perceivable output. The Conceptual, Grammatical and Articulation Components work in tandem with the Contextual Component, whose role is to provide the other three components with the information necessary to produce contextually appropriate representations (and, to this very end, is constantly updated by these representations themselves).

Finally, the Grammatical Component includes the primitives used by the four operations of Formulation and Encoding in generating the corresponding levels of representation. These primitives are assumed to be stored in a dedicated section of long-term linguistic memory referred to as the Fund and constitute the "building blocks" of the grammar (Hengeveld and Mackenzie 2008: 19), providing the basic lexical, grammatical and structural units necessary for the production of actual linguistic utterances.

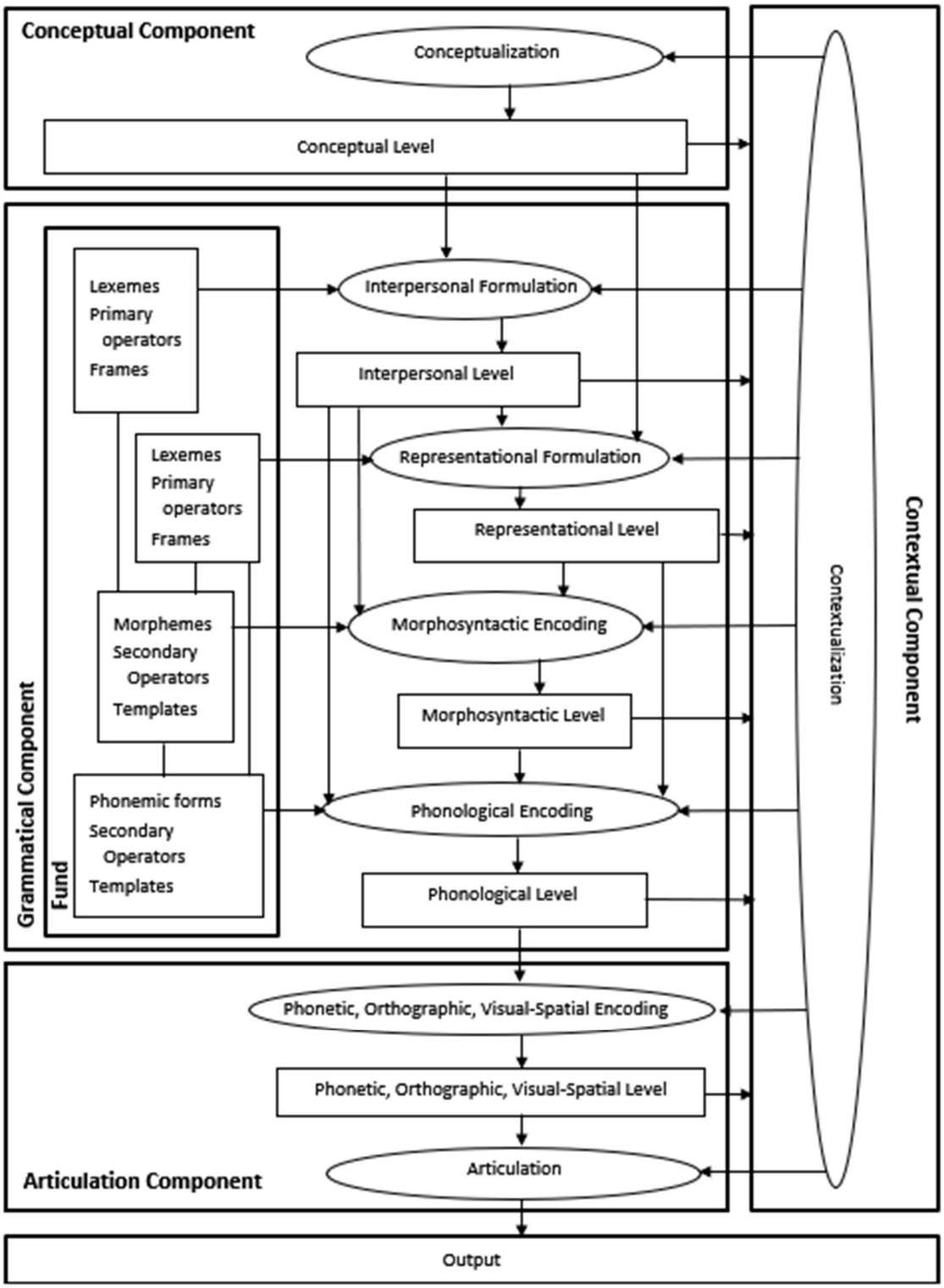

Figure 1. The general architecture of FDG (Hengeveld, Keizer, and Giomi, in prep.).

2.3 The structure of the levels

As mentioned above, the four levels of the grammar are displayed as a hierarchically organized layered structure. Since each level deals with a different aspect of the grammar, it goes without saying that the layers distinguished at each level are very different in nature. Thus, the layers of the

Interpersonal Level form a pragmatic hierarchy of communicative actions performed by the speaker; those of the Representational Level constitute a semantic hierarchy of ontological categories relevant to human communication; and of course, the layers of the two levels of Encoding form hierarchies of syntactic and morphological constituents, on the one hand (Morphosyntactic Level), and prosodic and phonemic units, on the other (Phonological Level). To represent these recursive structures, FDG avails itself of a formalism in which every layer of each level is identified by a distinct bracketed variable, which takes the form of a roman letter.

In a nutshell, the principle of recursive hierarchical embedding means that each layer of each level contains (is headed by) one or more layers of lower rank. In addition, each layer may take on grammatical operators and/or functions, as well as lexical modifiers. Operators specify grammatical information that is only relevant to the layers to which they apply (e.g. definite or singular in the noun phrase), whereas functions are also grammatical in nature but specify the relation of the layer to other units (for instance the semantic function that an argument bears to the predicate, e.g. Actor or Undergoer). Finally, modifiers are lexical means to provide additional information on the unit represented by the layer (e.g. the adjective *blue* in the noun phrase *a blue balloon*). Summing up, this means that the maximal structure that a layer may take is the one represented in (1), where *v* stands for 'any variable' and the symbols π, σ and φ stand for 'operator', 'modifier' and 'function', respectively. As explained above, the head position may be taken by one or more layers of lower rank.

(1) $(\pi\ v_1\text{: head } (v_1)\text{: } \sigma\ (v_1))_{\Phi}$

Numerous more specific instantiations of this general structure are stored in the Fund in connection with each type of variable of the Interpersonal and the Representational Levels. These constitute the inventory of frames that are retrieved during Formulation to allow for the build-up of the various layers of those levels, and are, in turn, connected to the templates used by Encoding in building up the corresponding constituents of the Morphosyntactic and Phonological Levels.

The Interpersonal Level

The overall structure of the Interpersonal Level is given in (2)[1]; note that round brackets indicate hierarchical embedding, whereas units enclosed within square brackets stand in a configurational relation of equipollence with respect to each other:

(2) $(\Pi\ M_{1(+n)}\text{: [}$	Move
$(\Pi\ A_{1(+n)}\text{: [}$	Discourse Act
$(\Pi\ F_1\text{: ... } (F_1)\text{: } \Sigma\ (F_1))$	Illocution
$(\Pi\ P_1\text{: ... } (P_1)\text{: } \Sigma\ (P_1))_{\Phi}$	Speaker
$(\Pi\ P_2\text{: ... } (P_2)\text{: } \Sigma\ (P_2))_{\Phi}$	Addressee
$(\Pi\ C_{1(+n)}\text{:[}$	Communicated Content
$(\Pi\ T_{1(+n)}\text{: ... } (T_{1(+n)})\text{ : } \Sigma\ (T_{1(+n)}))_{\Phi}$	Subact of Ascription
$(\Pi\ R_{1(+n)}\text{: ... } (R_{1(+n)})\text{: } \Sigma\ (R_{1(+n)}))_{\Phi}$	Subact of Reference
$]\ (C_{1(+n)})\text{: } \Sigma\ (C_{1(+n)}))$	Communicated Content
$]\ (A_{1(+n)})\text{: } \Sigma\ (A_{1(+n)}))_{\Phi}$	Discourse Act
$]\ (M_{1(+n)})\text{: } \Sigma\ (M_{1(+n)}))_{\Phi}$	Move

A Move (M) constitutes an autonomous contribution to an ongoing interaction (Hengeveld and Mackenzie 2008: 50), or in Kroon's (1995: 66) terms, a "minimal free unit of discourse". Roughly speaking, it usually coincides with a speech turn in dialogue and with a paragraph in a text. As the representation in (2) illustrates, the head of a Move may consist of one or more Discourse Acts (A),

[1] Note that, following Smit (2010), some authors in this volume furthermore incorporate a Comment layer (Cm) within the Communicated Content.

that is (again following Kroon 1995: 65) "the smallest identifiable units of communicative behaviour", which basically corresponds to the notion of speech act. Note that Discourse Acts may bear functions: more specifically, a subsidiary Discourse Act that occurs alongside a nuclear one within a Move, that is, serves to provide additional information about the latter, will be assigned a rhetorical function indicating the exact type of relation it bears to the nuclear Act. In (3), for instance the connective *because* does not mark the semantic relation Cause between two events of the real world (a type of relation that would be captured at the Representational Level) but a rhetorical relation of Motivation, i.e. the Discourse Act introduced by *because* specifies the speaker's reason for uttering the preceding, nuclear Discourse Act:

(3) *The guests must have arrived yesterday, because I think I saw their car in the parking lot.*
(M_I: [(A_I:–the guests must have arrived yesterday–(A_I)) (A_J:–I think I saw their car in the parking lot–(A_J))$_{MOTIVATION}$] (M_I))[2]

The head of a Discourse Act contains, at the very least, an Illocution (F) ('DECL(arative)', 'INTER(rogative)', 'IMPER(ative)', etc.) and one speech Participant – the Speaker (P_1): this is the case of expressive Discourse Acts that do not require the presence of an interlocutor (e.g. *Ouch!, Damn!*, etc.). Normally, however, Discourse Acts also contain a slot for the Addressee (P_2) and a Communicated Content (C), i.e. the totality of the referents that the speaker wishes to evoke and the properties they wish to ascribe. This is because, in FDG, reference and ascription are understood as communicative actions whereby the speaker attempts to influence the addressee's pragmatic information by instructing them to evoke the referents or properties in question. In this sense, reference and ascription may broadly speaking be understood as the pragmatic counterparts of the semantic notions of designation and predication, respectively; since they are actional, and not denotational in nature, they must be represented as separate layers of the Interpersonal Level, namely, Subacts of Reference (R) and Ascription (T).

Subacts are the locus for the assignment of the pragmatic functions Topic, Focus and Contrast, that is, it is at this layer that different information-structural articulations are captured. Suppose for instance that (3) is uttered as a reply to the question *When did the guests arrive?*: in that case, the most salient piece of information in the first, declarative Discourse Act is the Subact of Reference *yesterday*, so it is this Subact that will get the pragmatic function Focus (in English, this is typically signalled by final position, pitch movement and accentuation), leading to the analysis in (4). While any contentive Discourse Act, in any language, must be assumed to contain at least one focal Subact, the other pragmatic functions need not necessarily be assigned; as argued in Mackenzie and Keizer (1991), for instance, English does not seem to have formal means to encode the Topic function, hence this will not be explicitly represented at the Interpersonal Level.

(4) (A_1: [(F_1: DECL (F_1)) (P_1)$_S$ (P_2)$_A$ (C_1: [(T_1) (+id +s R_1: (T_2) (R_1)) (R_2: (T_3) (R_2))$_{FOC}$] (C_1))] (A_1))
where (T_1) = *arrive*, (R_1) = *the guests,* (T_2) = *guests*, (R_2), (T_3) = *yesterday*

Note that the two Subacts of Reference in this utterance are both headed by a Subact of Ascription: this is meant to indicate that, by producing the corresponding noun phrases, the speaker is instructing the addressee to construe the referents in question by evoking the properties *guest* and *yesterday*. The exact lexical content of these properties, however, is descriptive and not interactional in nature and will therefore only be made explicit at the Representational Level. Finally, the first Subact of Reference is assigned the operators '+id(entifiable)' and '+s(pecific)', representing identifiability for the speaker and the addressee, respectively, and resulting in the encoding of this Subact as a definite

[2] Note that the internal structure of both Discourse Acts is omitted for simplicity; this is indicated by dashes enclosing the orthographic representation of the simplified unit. In FDG work, this convention is often applied to units of whatever type when the details of their internal structure are not the focus of the discussion.

noun phrase at the Morphosyntactic Level. The Discourse Act in (4) does not contain any further interpersonal operators or modifiers, but as shown in (2), these are actually possible at all layers, e.g. operators like Emphasis and Mitigation at the highest layers, social status markers for the Participants, Reportativity on the Communicated Content, and any lexical modifiers expressing similar notions at the respective layers.

The Representational Level

Turning now from pragmatics to semantics, the general layout of the Representational Level is as follows:

(5) (π $p_{1(+n)}$:	Propositional Content
($ep_{1(+n)}$:	Episode
(π $e_{1(+n)}$:	State of Affairs
(π $f^c_{1(+n)}$: [	Configurational Property
(π $f_{1(+n)}$: ... ($f_{1(+n)}$): σ ($f_{1(+n)}$))	Lexical Property (predicate)
(π $v_{1(+n)}$:	any semantic category (argument)
(π $f_{2(+n)}$: ... ($f_{2(+n)}$): σ ($f_{2(+n)}$))	Lexical Property
: σ ($v_{1(+n)}$))$_{φ}$	any semantic category
] ($f^c_{1(+n)}$): σ ($f^c_{1(+n)}$))$_{φ}$	Configurational Property
($e_{1(+n)}$): σ ($e_{1(+n)}$))$_{φ}$	State of Affairs
($ep_{1(+n)}$): σ ($ep_{1(+n)}$))$_{φ}$	Episode
($p_{1(+n)}$): σ ($p_{1(+n)}$))$_{φ}$	Propositional Content

Once again, any layer may bear grammatical operators and functions, as well as lexical modifiers. Like at the Interpersonal Level, however, these grammatical and lexical specifications differ from layer to layer, which is a corollary of the fact that each layer of the Representational Level stands for a different type of ontological category.

Propositional Contents (p) are mental constructs that only exist in the mind of language users and may be evaluated in terms of their truth or falsehood; accordingly, operators and modifiers expressing such notions as subjective epistemic modality or inferential evidentiality will belong to this layer.

Episodes (ep) are thematically coherent sets of one or more States-of-Affairs (e). Episodes differ from States-of-Affairs in that they are more subjective in nature, so that they may be specified for such notions as deictic tense, evaluative deontic modality (see Olbertz and Gasparini Bastos 2013) and deductive evidentiality (Hengeveld and Hattnher 2015), all of which presuppose some degree of subjective judgement or involvement on the part of the speaker. By contrast, States-of-Affairs are the domain of operators and modifiers specifying more objective properties such as relative tense, perceptual evidentiality and event-oriented deontic modality (which characterizes events as being generally permitted or obligatory), among others.

The Configurational Property (f^c) (also referred to as Situational Property, see Hengeveld and Keizer, this volume and Giomi, this volume) represents the nuclear predication that characterizes a given State of Affairs, that is, it consists of a predicate and all its arguments. It follows that, while operators and modifiers of the Episode and the State of Affairs perspectivize events "from outside" (for instance locating them in time or space or with respect to the speaker's more or less subjective vantage point), those of the Configurational Property perspectivize the State of Affairs "from within". It is thus at this layer that we find such operators and modifiers as, among others, phasal aspect (which specifies the internal temporal structure of events) and participant-oriented modality (which concerns the relation between a participant in the event and the realization of the event, e.g. the participant's ability or need to carry out the action indicated by the predicate).

Finally, Lexical Properties (f) are abstract concepts that only exist in relation to some other entity, for instance the sheer notion of an action, process or state denoted by a lexical predicate. As shown in (5), however, Lexical Properties are not only found in predicate position but also occur as heads of any lexically expressed unit, of any layer. In other words, all lexemes inserted at the Representational Level are heads of a Lexical Property, which in turn may either be the head of another unit or function as a predicate or modifier. This may be observed in (6), which offers a full analysis of the first Discourse Act in (3) and a simplified analysis of the second one:

(6) (infer p_i: (past ep_i: (e_i: (f^e_i: [(f_j: arrive (f_j)) (m x_i: (f_k: guest (f_k)) (x_i))$_A$] (f^e_i)) (e_i)) (ep_i): (t_i: (f_l: yesterday (f_l)) (t_i)) (ep_i)) (p_i))
(p_j:–I think I saw their car in the parking lot–(p_j))

Both the Actor argument *the guests* and the modifier *yesterday*, which express variables of the categories Individual (x) and Time (t), respectively, are headed by a Lexical Property. Also note the assignment of operators and modifiers to the different layers: as explained above, an operator like 'infer(ential evidentiality)' is relevant to the Propositional Content, while deictic tense (in this case, 'past') and the absolute-time modifier *yesterday* apply to the Episode; number (in this case 'm' for plural), on the other hand, is typically relevant to tangible entities such as Individuals.

The Morphosyntactic Level
The general structure of the Morphosyntactic Level is represented in (7):

(7)
($Le_{1(+n)}$:	Linguistic Expression
($Cl_{1(+n)}$:	Clause
($Xp_{1(+n)}$:	Phrase
($Xw_{1(+n)}$:[	Word
($Xs_{1(+n)}$: ... ($Xs_{1(+n)}$))	Stem
($Xr_{1(+n)}$: ... ($Xr_{1(+n)}$))	Root
($Aff_{1(+n)}$: ... ($Aff_{1(+n)}$))	Affix
] ($Xw_{1(+n)}$))	Word
($Xp_{1(+n)}$))	Phrase
($Cl_{1(+n)}$))	Clause
($Le_{1(+n)}$))	Linguistic Expression

The highest layer of the Morphosyntactic Level, the Linguistic Expression (Le), corresponds to what goes by the terms sentence or clause complex in other frameworks. Another terminological peculiarity of the FDG approach concerns the distinction between Stems (Xs) and Roots (Xr), which are defined as morphological units that can and cannot occur as the sole lexical morpheme of a word, respectively. For the rest, the terminology used for this level is the same as what most readers will already be familiar with and should not require further explanation.

Continuing with the analysis of our example sentence, an FDG morphosyntactic representation of the Move in (3) will appear as shown in (8). Syntactic-category labels mostly follow the usual linguistics practice, e.g. Np stands for 'Noun Phrase' and Nw for 'Nominal Word'; Adp stands for 'Adpositional Phrase' and Adw for 'Adpositional Word', etc.; Gw stands for 'Grammatical Word'. Note that, since none of the chapters in this volume deals with the internal structure of words, the analysis in (8) stops at that layer; for detailed discussion of morphology in FDG, see Hengeveld and Mackenzie (2008: Chapter 4) and Guerrero Medina and Portero Muñoz (2018).

(8) (Le_i: [(Cl_i: [(Np_i: [(Gw_i: the (Gw_i)) (Nw_i:–guests–(Nw_i))] (Np_i)) (Vw_i:–must–(Vw_i)) (Vw_j:–have–(Vw_j)) (Vp_i: (Vw_k:–arrived–(Vw_k)) (Vp_i)) ($Advp_i$: ($Advw_i$: yesterday ($Advw_i$)) ($Advp_i$))] (Cl_i)) (Cl_j: [(Gw_j: because (Gw_j)) (Np_j: (Nw_j:–I–(Nw_j)) (Np_j)) (Vp_j: (Vw_l:–think–(Vw_l)) (Vp_j)) (Cl_k: [(Np_k: (Nw_k:–I–(Nw_k)) (Np_k)) (Vp_k: (Vw_m:–saw–(Vw_m)) (Vp_k)) (Np_k:

[(Gw_k: their (Gw_k)) (Nw_k:–car–(Nw_k))] (Np_k)) (Adp_i: [(Adw_i: in (Adw_i)) (Np_l: [(Gw_l: the (Gw_l)) (Nw_l:–parking–(Nw_l))] (Np_l))] (Adp_i))] (Cl_k))] (Cl_j))] (Le_i))

Abstracting away from the details, two particular aspects of this representation deserve mention here, as they are especially relevant to the overarching topic of this volume – linearization. First, the selection of morphosyntactic templates is dictated by properties of the underlying interpersonal and representational structures. Restricting ourselves to the highest layers, in the case at hand the fact that both Discourse Acts in (3) have a declarative Illocution triggers the selection of a template for the two corresponding main Clauses (Cl_i) and (Cl_j) where the subject Noun Phrase precedes the finite Verbal Word. In fact, a property of the FDG morphosyntactic (and phonological) representations that crucially distinguishes them from the representations provided at the pragmatic and semantic levels is that the former reflect the linear order of constituents, whereas the latter are only concerned with capturing the hierarchical scope relations between units, when relevant, and otherwise display non-hierarchically related units alongside each other in a purely conventional fashion. This can be seen in (4) and (6), where, by convention, Subacts of Ascription precede Subacts of Reference and predicates precede arguments, irrespective of the actual order of the corresponding morphosyntactic constituents.

Second, note that the sequence of verbal units *must have arrived* is not analysed as a single Verb Phrase, which entails that each unit is assigned a separate clausal position in the process of syntactic linearization. While this analysis follows Hengeveld (2013), it should be stressed that it does not exemplify the only account that has been put forth in the FDG literature: others, in fact (for instance Hengeveld and Mackenzie 2008: 290), have proposed more traditional analyses for the English verb group, where hierarchical organization is favoured over linear ordering, such that all the verbal words in the sequence would form a single Verb Phrase together. The hierarchy *vs* linearity debate in contemporary linguistics and the position of FDG within this debate are precisely the topic of Section 3.

The Phonological Level

Since most details of the FDG approach to phonology do not play a role in the following chapters, only the basics of the Phonological Level are presented here; for more in-depth discussion, the reader is again referred to Hengeveld and Mackenzie (2008: Chapter 5).

The overall organization of the Phonological Level is displayed in (9):

(9)

(π $U_{1(+n)}$:	Utterance
(π $IP_{1(+n)}$:	Intonational Phrase
(π $PP_{1(+n)}$:	Phonological Phrase
(π $PW_{1(+n)}$:	Phonological Word
(π $F_{1(+n)}$:	Foot
(π $S_{1(+n)}$)	Syllable
($F_{1(+n)}$))	Foot
($PW_{1(+n)}$))	Phonological Word
($PP_{1(+n)}$))	Phonological Phrase
($IP_{1(+n)}$))	Intonational Phrase
($U_{1(+n)}$))	Utterance

Once again, the selection of templates at this level is largely determined by the structure of the higher levels; the insertion of phonological operators is also sensitive to the information specified at those levels. For instance, the fact that the Move in (2) consists of two separate Discourse Acts triggers the selection of an Utterance template containing slots for two Intonational Phrases; the declarative Illocution of both Discourse Acts is reflected in the falling contour of these two Intonational Phrases, which is formalized as an operator 'f(all)' on the units in question:

(10) (U_i: [(f IP_i: [(PP_i:–/ðə'gɛsts/–(PP_i)) (PP_j:–/mʌsthævə'raɪvd/–(PP_j)) (PP_k:–/'jɛstəʳdeɪ/–(PP_k))] (IP_i)) (f IP_j: [(PP_l:–/bɪ'kɒz/–(PP_l)) (PP_m:–/aɪ'θɪŋkaɪsɔː/–(PP_m)) (PP_n:–/ðɛəʳ'kɑːʳ–(PP_n)) (PP_o:–/ɪnðə'pɑːʳkɪŋlɒt/–(PP_o))] (IP_j))] (U_i))

Note that the focal status of the Subact of Reference *yesterday* at the Interpersonal Level need not be explicitly marked at the Phonological Level: this is because this pragmatic unit is expressed as the last Phonological Phrase of the respective Intonational Phrase, i.e. in the default position for focal elements in an end-focus language like English. Thus, the falling contour of the overall Intonational Phrase will naturally be realized on the nuclear (most prominent) syllable of the Phonological Phrase in question. It should be stressed, however, that an alternative, perhaps more straightforward account has been proposed by Kojadinović (2022), who argues that Focus is marked by an operator 'h' on the relevant Phonological Phrase, representing the high pitch accent falling on its nuclear syllable (see Mittendorfer, this volume, for an implementation of this idea).

3 Hierarchy versus linearity

3.1 Linearity at the Morphosyntactic Level

The preceding section has clarified the crucial role played by hierarchical structure at the various levels of FDG. As we saw in (2), (5), (7) and (9), the higher *vs* lower relations implied by the notion of hierarchy are formalized as nested layers, such that higher layers have scope over all the layers nested within them. We may note strong parallelism in this respect in how the four levels are organized. However, there are also some crucial differences. At the Interpersonal and Representational Levels, the left-to-right sequencing of elements is determined by notational conventions alone (for example, a predicate is notated to the left of its arguments). It is only at the Morphosyntactic Level that real precedence relations are determined, dictating the linear order in which elements will actually be expressed in the Articulation Component. At the Phonological Level, the succession of elements in speech (for example, of Phonological Phrases inside an Intonational Phrase) is entirely dependent on the sequence of Clauses, Phrases, Words, Stems, Roots, and Affixes established at the Morphosyntactic Level. Linearization, then, is a matter for the Morphosyntactic Level: linear order is applied to the expression of an input that has been fully structured in terms of hierarchy but not in terms of the temporal order in which the units of the expression will be pronounced. Given the dominant role of hierarchy in the overall architecture and the distinctive role of the Morphosyntactic Level, the question arises to what extent it too is structured hierarchically, for example by means of constituent structure. The modularity assumption that underlies the recognition of four distinct levels of organization suggests, however, that hierarchical relations distinguished at the Interpersonal and Representational Levels should not simply be duplicated in morphosyntax, since that would lead to redundancy in the overall model.

Existing proposals for the ordering of elements at the Morphosyntactic Level (Hengeveld and Mackenzie 2008: Chapter 4; Hengeveld 2013; Mackenzie 2014, 2019) emphasize the role of templates, i.e. earlier-to-later, 'left-to-right' sequences of 'absolute' positions. In morphosyntactic encoding, elements that originate high in the layered structures of the Interpersonal and Representational Levels as operators or modifiers have prior access to those absolute positions. Absolute positions are perceptually prominent (occupying initial, final, medial, or second place in the sequence) and this equips them to function as icons of relatively broad scope. In this way, scope is manifested at the Morphosyntactic Level in the shape of linear relations in a one-dimensional sequence. Each of these absolute positions may be additionally associated with 'relative' positions, preceding or following the former according to availability. The result, for each template, is a 'flat' morphosyntactic structure in which hierarchical semantico-pragmatic relations are signaled by the sequencing of elements along the single dimension available for the placement of morphosyntactic units. That said, it should be emphasized that flatness applies within templates but that templates may

themselves be (hierarchically) embedded within each other. It is in this sense that the FDG Morphosyntactic Level prioritizes linearity without disregarding hierarchy.

3.2 The hierarchy versus linearity controversy in linguistics

The extent to which (morpho)syntax should reflect semantic and pragmatic hierarchization in the form of branching structures or should eschew hierarchy in favor of an emphasis on linearity (leaving hierarchical relations to other modules) has been central to the recent and ongoing 'hierarchy *vs* linearity' debate across the study of syntax in contemporary linguistics, psycholinguistics and artificial intelligence, and FDG has not been immune to this controversy. As observed by Jackendoff (2007), the presence of abundantly branching, i.e. heavily hierarchical, constituent structure has been associated with those theories he calls "syntactocentric" (2007: 357) because of their assigning a central role in the overall architecture to syntax. Constituent structure has been an essential feature of grammatical analysis since at least the times of Bloomfield in America and Hjelmslev in Europe. An alternative form of sentence diagramming based on dependency was developed by Tesnière (1988) and others and is currently finding favor in language typology in the form of the Universal Dependencies Initiative[3], but Generative Grammar and such offshoots as Lexical Functional Grammar and Head-Driven Phrase Structure Grammar – still the internationally dominant approaches to syntax – have not deviated from the use of constituency structure, nor has the functionally oriented Role and Reference Grammar (Van Valin and LaPolla 1997). There are different varieties of generative syntax, but in the prominent Minimalist and Cartographic approaches, constituency is the outcome of the simplest of all possible operations, called Merge, which combines exactly two elements *a* and *b* to form an ordered set *g* {*a*, *b*}, in which *a* and *b* are linearly ordered immediate constituents of a more embracing unit *g*, which itself can be merged with a single sister to its left. The result is to impose binary right-branching on syntactic trees, institutionalizing what has been the norm in Generative Grammar since the eighties (Kayne 1984).[4] In such syntactocentric approaches, categories that FDG assigns to the Interpersonal and Representational Levels are treated as syntactic; hence the proposals to recognize such syntactic phrases as IllocP, TopicP, FocusP, TenseP, AspectP, etc., which results, especially in Cartographic analyses, in extensive syntactic hierarchization (see, for example, Cinque 1999).[5]

In response to this trend Culicover and Jackendoff (2005), while retaining many of the general assumptions and aims of Generative Grammar, have proposed a "Simpler Syntax", so called because it is characterized by a minimum of hierarchy, with "relatively flat" (2005: 108), multiple-branching structures. Their overall theory is akin to FDG in assuming distinct modules for semantics, syntax and phonology (to the limited extent that pragmatics is considered, it is subsumed under 'semantics'), and as such is now more frequently known as the Parallel Architecture. One motivation for the development of such initiatives is growing awareness of what, since Hale (1989), have become known as non-configurational languages (where 'configuration' is understood very differently than in FDG). Such languages typically have 'free' (i.e. pragmatically determined) word order, permit syntactic discontinuity and leave anaphoric arguments unexpressed. These phenomena can be handled in a constituent structure grammar (Legate 2003), but only at the cost of an extensive apparatus of movement and deletion rules. A flat, multiply-branching structure lends itself more readily to accounting for the phenomenology of non-configurational languages. Varaschin and Culicover (2024) lay out suggestions for further development and testing of a theory in which syntactic structures are essentially flat, even for a language like English, in which, for lack of multiple morphological

[3] www.universaldependencies.org

[4] Whereas this position is defended in Cartography (cf. Cinque 2023), a dissenting view has arisen within Minimalism (Hornstein, Nunes, and Grohmann 2005: 218; Nevins in Chabot 2024: 5), namely that syntax lacks linear order, which only arises in PF (Phonological Form). For a retrospective view of what is still an unresolved debate in Generative Grammar, see Kayne (2024).

[5] For an approach that hierarchizes not only syntax and semantics, but also verbal interaction and emotions, see Wiltschko (2024).

markers, constituent order has often been seen as playing a relatively prominent role, with syntactic discontinuity being rare.

3.3. The hierarchy versus linearity controversy in psycholinguistics

As mentioned in Section 2, FDG is committed to maximizing its 'psychological adequacy' in the sense of aligning, as closely as is feasible for a theory of grammar, with the results of research into language processing, as regards both production and comprehension. Several essential FDG concepts come directly from the psycholinguist's vocabulary, more specifically from Levelt (1989). In his "blueprint for the speaker" he includes a conceptualizer (compare FDG's Conceptual Component), a formulator (compare FDG's Formulation), a grammatical encoder (compare FDG's Morphosyntactic Encoding), a phonological encoder (compare FDG's Phonological Encoding) and an articulator (compare FDG's Articulation Component). There are many differences of detail, primarily the fact that Levelt's operations are hypothesized to take place in real time (i.e. online rather than offline, to use the terms found in Lewis and Phillips 2015); yet the inspirational role of his work is clear. For psycholinguists working on language production, Levelt's architecture is still very much the "consensus model" (Wagner 2016) or the "modal model" (Slevc 2023). One unshakeable pillar of the consensus is a strict division between 'content' (taken to be non-linear) and 'structure' (linear), analogous to what applies to Formulation and Encoding in FDG. It is assumed that content and structure are processed simultaneously, with the former always having a head start on the latter; this is also reflected in the FDG architecture, specifically in the Depth First Principle (Hengeveld and Mackenzie 2008: 23-25), which ensures that Encoding is triggered as soon as possible, without waiting for Formulation to complete its work.

The insight that has come to dominate the psycholinguistic study of language production and comprehension is the central role of incrementality, the notion that the elements that compose a clause or larger unit are produced and comprehended in linear temporal succession.[6] This is linked to the insight that speakers often start to produce the first of those component elements without having a complete plan for the rest of the utterance. Incrementality has been interpreted as reflecting the fluency of speech (Brown-Schmidt and Konopka 2015), as offering a solution to the need to respond quickly in conversation and as meeting the desideratum of not overburdening working memory; it has also been seen as following from the different degrees of accessibility of the components of a pre-verbal message. Much of the discussion among psycholinguists has concerned the nature of the units that are produced incrementally and the related question of how far ahead speakers plan their utterance. Is the utterance produced word by word, or are longer units (for example, phrases) involved (cf. Christiansen and Chater 2016: 51-52)? In a language like English, is the lexical verb – typically in medial position – identified before the speaker starts a clause (cf. Altmann and Kamide 1999; Ferreira 2000)? How does the choice of a lexical verb dictate the encoding of any following arguments? How are instances of discontinuity (or long-distance dependency) handled in an incremental view, for example in German clauses, where a separable particle, destined to appear at the end of a finite main clause, is held in a memory buffer while the rest of the utterance proceeds (Auer 2009)? To what extent do language-specific constituent order constraints impact incremental production (Norcliffe et al. 2015)? The approach assumes that speakers make flexible use of their grammatical knowledge, finding appropriate formulations and encodings that are conditioned by the units they have already uttered; it also provides a natural explanation for the frequent occurrence of rephrasing and repair, as speakers find ways of escaping from syntactic and lexical dead ends of their own making.

3.4 Promotion of linearity in grammatical architectures

[6] Note that Minimalist tree construction with Merge, starting with the bottom right of the tree and working upwards and leftwards is strongly anti-incrementalist; see Nordström (2017) for a critique and Chesi (2015) for an alternative.

There have been various initiatives in recent decades to reflect the linearity of language production in grammatical architectures (Mackenzie 2010: 269-273). One early initiative is Kathol's (2000) Linear Syntax: while the syntax in this approach prioritizes hierarchical combinatorics, certain word order properties of German, Swedish and Yiddish are treated as a linear left-to-right sequence of topological positions, such that each "topo" class has to be ordered before the next such class; the resultant trees thus display both hierarchy and linearity. Dynamic Syntax (Cann, Kempson, and Marten 2005; Howes and Gibson 2021) goes much further in offering "a grammar formalism which directly reflects the time-linearity and context-dependent growth of information governing natural language parsing" (Cann, Kempson, and Marten 2005: 3). This approach uses formal semantics to unveil patterns of language use by tracking the dynamics of how an interpretation is built up in real time. Another relevant proposal is O'Grady's (2022) Natural Syntax, in which syntactic trees are built up in a rightward direction as provisional and evanescent structures (in the style of Hopper 2015). O'Grady's work has considered an extensive range of issues from English syntax, arguing in each case that the phenomena in question can and should be understood as resulting from considerations of efficient processing. Perhaps unsurprisingly, this focus on the incremental nature of language production and on spontaneous spoken language data has led certain grammarians, such as Haselow (2017), to forsake 'offline' grammar in favor of an account of 'online' production processes. An ambitious proposal in this area is Gibbon and Griffiths (2017), whose Multilinear Grammar involves a set of linear, incremental mini-grammars each modeling different aspects of real-time processing in parallel. The architecture distinguishes various 'ranks' (somewhat akin to FDG's levels and layers), each with its own unique structures.

3.5 Linearity and predictive processing

Speakers do not produce their utterances in a vacuum; rather, they do this in a manner that will maximize their chances of being understood in the way that they desire. Comprehenders, relying on their experience, use forward-looking guesswork as they process an incoming utterance, and speakers can assist them in this process. This aspect has come to the fore in recent years in tandem with a more general emphasis throughout the cognitive sciences on predictive processing. According to this approach, the human mind simplifies and streamlines the task of processing incoming information – be it visual, aural, tactile, or whatever – by attending only to the unexpected aspects of that information, since the rest has already been predicted in a top-down manner. Here too, then, it is the temporal dimension that is highlighted: in language processing, the mind is rushing ahead, predicting what is coming down the line. To gain insight into this cognitive faculty, Ferreira and Qiu (2021) conducted various experiments that use the tracking of eye movements ('saccades') or fMRI data to observe how experimental subjects' attention jumps ahead as they process incoming speech or writing. The use of written data, especially with sparse use of punctuation, is particularly revealing in this kind of research, for example with an experimental stimulus like *While the mother bathed the baby was crying*. Here, in what has become known as a 'garden path' example, subjects are not likely to predict a verb phrase after *the baby*, which many will have initially analyzed as the Undergoer/Object of *bathed*. Instead, they are more likely to predict a noun phrase Subject of a following clause, as in *While the mother bathed the baby the dog was barking.* In order to process the example correctly, however, they have to backtrack and re-analyze the example, now shown with punctuation as *While the mother bathed, the baby was crying*, and the extra processing time involved can be measured. It is worth noting that a prediction never offers certainty. In fact the communicative value of a linguistic unit lies in its ability to be unpredictable, calculated as the negative log probability (technically, the 'surprisal') of a unit given the units that have preceded.

Evidence has been accumulating in the psycho- and neurolinguistic literature (Pickering and Gambi 2018; Martin, Branzi, and Bar 2018) that not only language comprehension but also language production involves the prediction of both upcoming content (semantics) and structures (syntax); incrementality, in other words, operates not just word-for-word but leaps ahead along the linear path, activating what is likely to come later. In fact, the processes of production and comprehension appear

to be mutually supportive, notably in the sense that prediction in comprehension recruits the production system (MacDonald 2013; Lelonkiewicz, Rabagliati, and Pickering 2016). Martin, Branzi, and Bar (2018), for example, have provided evidence that language comprehension involves a silent simulation of production: in other words, the listener simulates the speaker's production effort and predicts the upcoming units and their meaning, in the same way as the speaker looks forward to pronouncing those units. This is shown by experimentally taxing the language production system in a manner that prevents the subjects from carrying out that "subvocal rehearsal of the verbal input" (2018: 1) and then showing with neurolinguistic methods that prediction is hindered.

A review of relevant research into the role of prediction in language processing is found in Huettig (2015). His careful analysis leads him to stress the variability observed by researchers with regard to the role of "working memory, cognitive efficiency, age, and literacy" (2015: 131) in the sense that prediction is best developed in proficient, experienced users. Rather than seeing prediction as an essential property of cognitive operations, Huettig suggests that prediction is a skill that comes into operation "when cognitive systems have plenty of resources available" (2015: 131). He has teamed up with the chief proponents of the above-mentioned Parallel Architecture (Huettig, Audring, and Jackendoff 2022), locating prediction within their linguistic model as the "pre-activation of linguistic representations, before incoming bottom-up input has had a chance to activate them" (2022: 2), a formulation that given the similarity with the flat structures of the Parallel Architecture can also be understood in FDG terms. In both models, it is true that "language processing is constantly accessing words, multi-word units, and abstract schemas" (2022: 12), giving equal weight to semantic, morphosyntactic and phonological representations (and in FDG also pragmatic representations). This provides a grammatical framework for the formulation of relevant hypotheses about the influence of predictive skills on not just the processing of language but also the extent to which language structures find their functional justification in those skills.

3.6 Deriving hierarchy from linearity: chunking

The linear dimension of linguistic expressions has thus stimulated psycholinguistic research into both incrementality (the timecourse of the piecemeal build-up of utterances) and prediction (the anticipation of temporally later elements of an utterance). The fact that these processes take place extremely rapidly, with minimal time to prepare responses in conversation, has inspired Christiansen and Chater (2016) to propose that in comprehension the incrementally constructed stream is compressed by being organized (or 'recoded') into chunks which are then passed to 'higher' levels of interpretation; similarly, in production, the cognitive material to be communicated is organized in formulation and encoding into chunks, with chunks from the ongoing conversation being particularly useful to get the utterance going (Dąbrowska 2014). This so-called Chunk-and-Pass strategy can be seen as the basis for the hierarchical organization of meaningful units. These chunks can also be anticipated on the basis of prior experience; as Christiansen and Chater (2016: 4) put it, "[a]nticipation allows faster, and hence more effective, recoding when oncoming information creates considerable time urgency". Brennan and Hale (2019) have found neurolinguistic evidence for the role of such hierarchical organization of the speech flow, finding that "predictions based on hierarchical structure correlate with the human brain response above-and-beyond predictions based only on sequential information"; for further evidence, see Pallier, Devauchelle, and Dehane (2011) and Ding et al. (2017).

It should be borne in mind that, when it comes to the grouping of items into higher-order units, psycho- and neurolinguists prefer to speak of 'chunks' rather than of phrases or clauses in order to do justice to 'messy' data that has been created on the fly (cf. also the earlier proposals of the linguists Sinclair and Mauranen 2006). For all the similarity between the approaches of functional linguists and experimental psychologists and neurologists, the grammarian's desire to establish a complete and correct analysis of an utterance is somewhat at variance with a growing interest among the experimentalists in processing that is 'good enough'. This notion has arisen in recent work and reflects the fact that communicators in actual interaction generally do not demand that utterances should be

complete and correct; it is enough that they are understood or at least understood well enough. In Goldberg and Ferreira's (2022: 300) words, "[good enough] production occurs when a language user accesses a nonoptimal albeit semantically relevant lexical or grammatical construction to express their intended message because a more-optimal construction is inaccessible at the moment of speaking (or signing)". They go on to say that "communication is reasonably successful despite imperfect encoding or retrieval from memory because neither production nor comprehension is brittle" (2022: 300); by 'brittle', they mean that verbal processes do not fail catastrophically in the event of some relatively minor deviation from lexical or grammatical norms.

3.7 Linearity and LLMs

This section cannot end without mention of non-human language processors that have recently achieved extensive social exposure, Large Language Models (LLMs). The algorithms that underlie LLMs have been trained on immense banks of unanalyzed human-generated linguistic material, the original goal of the training being to enable the program, having arrived at a particular word in its production of an utterance, to predict and produce the next word in sequence (a linguistic instantiation of a 'Markov chain'; Mitchell 2024). The prediction is probabilistic, being guided by drawing stochastically weighted generalizations from the training material. In their more recent manifestations, LLMs go well beyond their original from-word-to-word goal, but the emphasis on linearity, i.e. the sequencing of words, constructions, and whatever units have been inferred from the training data, persists. Rather naturally, questions have risen among linguists and psycholinguists of the extent to which LLMs process language like humans and, more importantly for our concerns, the extent to which humans process language like LLMs, i.e. with a strong emphasis on linear precedence and prediction (i.e. the question "How hierarchical is language use?", posed by Frank, Bod, and Christiansen 2012). As Blank (2023) points out, there are two ways to approach these questions: the study of LLMs, to the extent that they are analogous to neuronal structures, could give insight into how the brain works when processing language; alternatively, it could illumine how the mind works, in which case LLMs call into question many of the mentalistic suppositions of linguists (Piantadosi 2024). Of interest from a functional perspective is the conclusion of Mahowald et al. (2024: 517) that "[a]lthough LLMs are close to mastering formal competence, they still fail at functional competence tasks, which often require drawing on non-linguistic [cognitive] capacities". While this judgment motivates current work on the further sophistication of LLMs (e.g. Zada et al. 2024), the fact remains that they have already overcome many of the limitations of finite-state Markov processes (morphosyntactic linearity) that have been alleged since Chomsky (1956), who argued for the necessity of phrase structure (morphosyntactic hierarchy).

Determining the ideal balance between hierarchy and linearity in FDG is thus a debate that cannot be divorced from a lasting concern with this question in formal and functional linguistics, in psycholinguistics and in artificial intelligence. The following section focuses more narrowly on this question, specifying how FDG combines hierarchy and linearity in its approach to linearization.

4 Linearization in Functional Discourse Grammar

4.1 Introduction

The approach to linearization in FDG, originally proposed in Hengeveld and Mackenzie (2008: Chapter 4) and further developed in the present volume, distinguishes itself from other approaches in that it is both dynamic and top-down in nature. The approach involves a number of ordered steps, which apply equally at the layers of the Clause, Phrase, and Word:

(i) Hierarchical ordering
(ii) Non-hierarchical ordering
(iii) Dummy-insertion

(iv) Agreement

In languages that do not use dummies and/or agreement, steps (iii) and (iv) are irrelevant. The first two steps distinguish between the ordering of interpersonal and representational elements that are in a hierarchical relationship and those that are in a configurational, i.e. non-hierarchical relationship. These can be distinguished as in (11) and (12): units between round brackets are in a hierarchical relationship, those in square brackets are in a configurational relationship (see Section 2.3).

(11) (hierarchical)
[configurational]
(hierarchical)
[configurational]
$(M_1: (A_1: [(F_1) (P_1)_S (P_2)_A (C_1: [(T_1) \ldots\ldots\ldots (R_1)] (C_1))] (A_1)) (M_1))$

(12) (hierarchical)
[configurational]
$(p_1: (ep_1: (e_1: (f^e_1: [(f_1) (v_1) \ldots.. (v_n)] (f^e_1)) (e_1)) (ep_1)) (p_1))$

Both hierarchical and configurational ordering make use of dynamically constructed morphosyntactic templates, which we discuss in Section 4.2. The processes of hierarchical and configurational ordering are then discussed in Sections 4.3 and 4.4. Section 4.5 is dedicated to the placement of constituents that play a role at both the Interpersonal and Representational Levels. In Sections 4.6 and 4.7 we then briefly discuss dummy insertion and agreement. Section 4.8 places the description of the ordering process in FDG in a wider context.

4.2 Templates

The linearization procedures in FDG make use of dynamically constructed templates at the Morphosyntactic Level. These templates start out, on a language-specific basis, from a number of absolute positions. Potentially relevant from a crosslinguistic perspective are the initial (P^I), second (P^2), middle (P^M) and final (P^F) positions. Every language uses a selection of these positions, which furthermore may differ across the layers of the Clause, the Phrase, and the Word. The absolute positions are the starting points for the dynamic construction of templates, since, as soon as an absolute position is occupied by a constituent of the relevant rank, the template is expanded with further relative positions, which may or may not be occupied by other constituents in the following steps. The initial and second positions may be expanded to the right, the final position to the left, and the middle position to the left and to the right. This is shown in (13):[7]

(13)

P^I	P^{I+1}	P^{I+2}	etc.					
	P^2	P^{2+1}	P^{2+2}	etc.				
	etc.	P^{M-2}	P^{M-1}	P^M	P^{M+1}	P^{M+2}	etc.	
					etc.	P^{F-2}	P^{F-1}	P^F

4.3 Hierarchical ordering

The first step in the ordering process concerns the placement of operators, modifiers and functions with higher scope before the placement of such elements with lower scope. As an example, let us consider example (14), represented in (15):

[7] Note that, as a result of this approach, the same surface position may correspond to different positions in a template. For instance, a constituent in surface second position may correspond to P^{I+1}, P^2, P^M or P^F, or a position relative to P^M or P^F.

(14) *Unfortunately*^{C} *the dog must*^{p} *have*^{ep} *bitten its owner again*^{e}.

(15) (A_I: [(F_I: DECL (F_I)) (P_I)$_S$ (P_J)$_A$ (C_I: [(T_I) (+id, +s R_I) (+id, +s R_J) (T_J)] (C_I): unfortunately (C_I))] (A_I))
(infer p_i: (past ep_i: (e_i: ($f^c{}_i$: [(f_i: bite (f_i)) (1 x_i: dog (x_i))$_A$ (1 x_j:–its owner–(x_j))$_U$] ($f^c{}_i$)) (e_i): again (e_i)) (ep_i)) (p_i))

In this example, *unfortunately* is a modifier that expresses speaker attitude at the layer of the Communicated Content, *must* is an operator that expresses inferential evidentiality at the layer of the Propositional Content, *have* is an operator that expresses tense at the layer of the Episode, and *again* is a modifier that expresses event quantification at the layer of the State of Affairs.

The process of hierarchical ordering has to start with the highest modifier or operator, which in (14) is *unfortunately*. The position available for this modifier is the absolute position P^I. As a result of placement of the modifier in this position, a new position P^{I+1} is created:

	P^I	P^{I+1}
(16)	Unfortunately	…

The next highest element in (14) is *must*. The fact that it is preceded by the subject *the dog*, which cannot be assigned a position yet in this phase, shows that it cannot be in a position relative to P^I, so it has to go to the absolute medial position P^M. Placement of the auxiliary in this position triggers the creation of new relative positions to the left and right of P^M:

	P^I	P^{I+1}	P^{M-1}	P^M	P^{M+1}
(17)	Unfortunately	…	…	must	…

The next hierarchically lower element to be assigned a position is *have*, which can go straightforwardly to the relative position created to the right of P^M, thereby causing the creation of a further relative position:

	P^I	P^{I+1}	P^{M-1}	P^M	P^{M+1}	P^{M+2}
(18)	Unfortunately	…	…	must	have	…

The final hierarchical element to be assigned a position is *again*. Since it is preceded by the predicate *bitten* and the argument *its owner*, which are configurational and will therefore be placed in the second phase, *again* cannot be in a position relative to P^M, but must be in the absolute position P^F. Its placement triggers the creation of a new relative position with respect to P^F:

	P^I	P^{I+1}	P^{M-1}	P^M	P^{M+1}	P^{M+2}	P^{F-1}	P^F
(19)	Unfortunately	…	…	must	have	…	…	again

This completes the hierarchical ordering phase at the Clause layer for this example.

The same principles can be applied to phrases and words. Starting with phrases, consider the example in (20), its underlying representation in (21), and its ordering in (22):

(20) *poor*^{R} *sick*^{x} *former*^{f} *president*

(21) (R_I: [(T_I) (T_J) (T_K)] (R_I): poor (R_I))
(x_i: (f_i: president (f_i): (f_j: former (f_j)) (f_i)) (x_i): (f_k: sick (f_k)) (x_i))

	P^I	P^{I+1}	P^{I+2}	P^{I+3}
(22)	poor	sick	former	…

The adjective *poor* is an expression of sympathy by the speaker and pertains to the Referential Subact at the Interpersonal Level. It is therefore assigned a position first and goes to P^{I}. The difference between the adjectives *sick* and *former* is that the latter expresses reference modification (Bolinger 1967: 14f) and applies at the layer of the Lexical Property, while the former expresses referent modification (Bolinger 1967: 20f) and applies at the layer of the Individual. *Sick* therefore has to be assigned a position first, and goes to P^{I+1}, followed by *former*, which goes to P^{I+2}. The head *president* will be assigned a position later on, in configurational ordering. Note that the only absolute position required to account for the placement of modifiers in the example is P^{I}.

Moving to the ordering of morphemes within words, now consider the following example from Turkish (Lewis 2000: 153) in (23), its underlying representation in (24), and its ordering in (25). We will ignore the epenthetic *-y* in our analysis, as this is an element that will be inserted at the Phonological Level:

(23) *Anla-y-abil*^{fc}*-ecek*^{ep}*-miş*^{C}*-ø*.
understand-EP-ABIL-FUT-RPRT-3.SG
'It seems he will be able to understand.'

(24) $(A_I$: $[(F_I$: DECL $(F_I))$ $(P_I)_S$ $(P_J)_A$ (Rep C_I: $[(T_I)]$ $(C_I))]$ $(A_I))$
$(p_i$: (fut ep_i: $(e_i$: (dyn.poss $f^c{}_i$: $[(f_i$: anla $(f_i))$ $(x_i)_A]$ $(f^c{}_i))$ $(e_i))$ $(ep_i))$ $(p_i))$

(25)

P^{F-3}	P^{F-2}	P^{F-1}	P^{F}
…	-abil	-ecek	-miş

The suffix *-miş* is the suffix expressing the hierarchically highest operator: it expresses reportative evidentiality at the layer of the Communicated Content. It is the first operator to be assigned a position and goes to P^{F}. The next lower operator is the one for future, expressed by *-ecek*, which goes to P^{F-1}. The expression of the next lower and last operator to be assigned a position is the suffix *-abil*, which expresses dynamic possibility (i.e. ability) and goes to P^{F-2}, leaving P^{F-3} available for the stem *anla-*, which will be assigned its position in configurational ordering. Note that for this word template P^{F} is the only absolute position required.

4.4 Configurational ordering

Configurational ordering is based on alignment considerations: elements that are in a non-hierarchical, configurational relationship, such as a predicate-argument relation, are assigned a position based on their pragmatic, semantic and/or morphosyntactic properties, depending on the language under consideration. This is the second step in the ordering process. An example of a language for which both semantic and syntactic functions play a role in the clausal ordering system is Turkish (Kornfilt 1997: 90, see also Hengeveld and Mackenzie 2008: 336):

(26) *Hasan-Ø* *kitab-ı* *Ali-ye* *ver-di-Ø.*
Hasan-NOM book-ACC Ali-DAT give-PST-3.SG
'Hasan gave the book to Ali.'

In Turkish, Subjects have to go the P^{I} or follow hierarchical constituents that are already in P^{I}. The placement of the Undergoer and Recipient arguments is, however, not attributable to syntactic factors, as Turkish, unlike English, does not have a syntactic Object function. In neutral contexts the Recipient then precedes the predicate, and is itself preceded by the Undergoer.

Returning now to our clausal example (14), its underlying representation in (15), and its hierarchical ordering in (16)-(19) in the previous section, there are three elements that are in a configurational relationship: the predicate *bitten*, the Subject *the dog*, and the Object *its owner*. We

start with the predicate as the central element, and can place it in position P^{M+2}, which became available after inserting the auxiliary *have* in P^{M+1}. It cannot be in the other position theoretically available, P^{F-1}, because this would leave no room for the Object. The result is shown in (27):

	P^{I}	P^{I+1}	P^{M-1}	P^{M}	P^{M+1}	P^{M+2}	P^{M+3}	P^{F-1}	P^{F}
(27)	Unfortunately	…	…	must	have	bitten	…	…	again

Insertion of the predicate results in the creation of a new relative position P^{M+3}. There are two potential positions now for the Object *its owner*: P^{M+3} or P^{F-1}. The predicate *bitten* and the object *its owner* cannot be separated, which may be taken to indicate that the right choice is P^{M+3}:

	P^{I}	P^{I+1}	P^{M-1}	P^{M}	P^{M+1}	P^{M+2}	P^{M+3}	P^{F-1}	P^{F}
(28)	Unfortunately	…	…	must	have	bitten	its owner	…	again

The last constituent to be placed is the Subject *the dog*. Subjects in English go to P^{I}, or, when this position is occupied, to the first available position to the right of P^{I} (see Hengeveld 2012 and Keizer 2015).[8] In this case the first available relative position is P^{I+1}:

	P^{I}	P^{I+1}	P^{I+2}	P^{M-1}	P^{M}	P^{M+1}	P^{M+2}	P^{M+3}	P^{F-1}	P^{F}
(29)	Unfortunately	the dog	…	…	must	have	bitten	its owner	…	again

Configurational ordering is also relevant at the Phrase and Word layers: in phrases, for instance, in the case of noun phrases with a relational head; in words, for instance, in the case of verbal words with noun incorporation. In the example of a phrase in (22) and a word in (25), however, there is only one element to be put into place during configurational ordering (the head noun in [22] and the verb stem in [25]), so these simply go to the only position available.

4.5 Ordering across levels: Pragmatic functions

Many constituents in a configurational relationship have both interpersonal and representational properties. This is the case because Subacts at the Interpersonal Level correspond to entities at the Representational Level. When certain Subacts carry a pragmatic function, this triggers priority in the assignment of positions. This can be illustrated with examples (30)-(31), taken from Hengeveld (2013: 19-20), and represented in (32):

(30) *Perhaps*^{P} *I will*^{ep} *accept that.*
(31) *That*^{Contr} *perhaps*^{P} *I will*^{ep} *accept.*

(32) $(A_I: [(F_I: \text{DECL } (F_I))\ (P_I)_S\ (P_J)_A\ (C_I: [(T_I)\ (R_I)\ (+\text{id}, +\text{s } R_J)_{\{Contr\}}]\ (C_I))]\ (A_I))$
$(p_i: (\text{fut } ep_i: (e_i: (f^e_i: [(f_i: \text{accept } (f_i))\ (x_i)_A\ (\text{dist v})_U]\ (f^e_i))\ (e_i))\ (ep_i))\ (p_i): \text{perhaps } (p_i))$

The difference between (30) and (31) is that in (31) *that* carries the pragmatic function Contrast, while it does not in (30). In (30), placement proceeds as in the earlier example:

	P^{I}	P^{I+1}	P^{M-2}	P^{M-1}	P^{M}	P^{M+1}	P^{M+2}	P^{M+3}
(33)	Perhaps	…	…	I	will	accept	that	…

As the hierarchically highest element, *perhaps* is placed in P^{I}, after which *will* is placed in P^{M}. The predicate and Object are placed relative to P^{M}, and so is the Subject.

[8] For an alternative view, see Hengeveld and Mackenzie 2008: 349; Giomi, this volume.

In (31), however, *that* precedes *perhaps*, and thus has to be assigned a position earlier in the process. This earlier assignment is licensed by the fact that *that* carries the Contrast function at the Interpersonal Level, which is hierarchically higher than the Representational Level. This is shown in (34):

	P^{I}	P^{I+1}	P^{I+2}	P^{M-2}	P^{M-1}	P^{M}	P^{M+1}	P^{M+2}
(34)	That	perhaps	…	…	I	will	accept	…

After placement of *that* in P^{I}, *perhaps* is located in the first position relative to P^{I}. The remaining steps are identical to those represented in (33).

A similar example at the Phrase layer, adapted from Hengeveld and Mackenzie (2008: 388), comes from French:

(35) *une* *voiture* *superbe*
INDF car magnificent
'a magnificent car'

(36) *une* *superbe* *voiture*
INDF magnificent car
'a MAGNIFICENT car'

In French, in neutral contexts the adjective *superbe* 'magnificent' follows the head noun, as illustrated in (35) and shown in the following template:

	P^{I}	P^{M}	P^{F}
(37)	une	voiture	superbe

But if it receives special emphasis at the Interpersonal Level, as in (36), it is located in a position relative to P^{I}, as shown in (38):

	P^{I}	P^{I+1}	P^{M}
(38)	une	superbe	voiture

We have not come across examples in which interpersonal factors influence the order of morphemes within words. This is arguably because, even in highly polysynthetic languages, pragmatically highlighted units are rarely available for incorporation and other compounding processes (see Olthof and Hengeveld 2021: 140-142); and, even when this happens, pragmatic saliency of bound morphemes is more likely to be expressed prosodically, rather than positionally.

4.6 Dummy insertion

The third step in the ordering process in FDG concerns the insertion of dummies. Dummies are morphosyntactic elements that do not have an interpersonal or representational counterpart and therefore occur for purely morphosyntactic reasons. An example from English is:

(39) *It is raining.*

The dummy *it* in (39) does not refer to any argument, as *rain* is a zero-place predicate. It is just there because the grammar of English requires the subject position P^{I} to be filled.

The following example is from Muna (Austronesian, van den Berg 1989: 103, see also Hengeveld and Mackenzie 2008: 394):

(40) *O dahu no-kotou.*

ART dog 3.SG.RLS-bark
'A dog barks.'

In Muna, when a noun phrase is not otherwise identifiable as such, the article *o* is inserted in the prenominal slot within the Noun Phrase.

Since dummies do not correspond to any interpersonal or representational element, they are inserted after all meaningful material has been assigned a position. If in the resulting configuration obligatory positions remain unoccupied, the relevant dummy is inserted in that position.

The dummy in (39) is inserted in the ordering process pertaining to the Clause layer, while the one in (40) forms part of a phrase. Dummies within words are rare but not unattested. For examples see Hengeveld and Mackenzie (2008: 412-413).

4.7 Agreement

The very last step to be taken in the ordering process~~,~~ is the expression of agreement, which is treated as a copying process in FDG. After all elements have found a position at a specific layer, the agreement operation copies the relevant features from one unit to the other. Agreement may be found at the Clause layer ([41], from French), Phrase layer ([42], from Spanish), and Word layer ([43], from Bininj Kun-Wok [Gunwinyguan], Evans 2003: 452).

(41) *Nous travaill-**ons**.*
1.PL work-PRS.1.PL
'We are working.'

(42) *un-**a** casa viej-**a***
INDF-F.SG house(F) old-F.SG
'an old house'

(43) ***Nga**-murrng-bimbom na-mekke.*
1>3-bone-paint.PST.PFV M-DEM
'I painted those bones.'

Given that agreement is dealt with as a copying procedure in FDG, and that this copying takes place only after the remaining ordering steps in creating morphosyntactic units have been completed, the prediction is that agreement morphemes will always be peripheral to the hosts to which they are copied. See Hengeveld (2012), which also shows that agreement should be clearly distinguished from cross-reference.

4.8 The FDG approach in a broader context

The discussion of the approach to linearization in FDG in this chapter shows that Morphosyntactic Encoding is organized in a top-down manner. This is consistent with the overall architecture of FDG. This approach is particularly reflected in the process of hierarchical ordering, in which hierarchically higher elements are assigned a position before hierarchically lower elements. This approach has four important properties.

First, unlike most other approaches, FDG does not start out by assigning positions to what would be the core elements in those approaches: the predicate and its arguments. In FDG these have to be accommodated after all other meaningful material has been linearized. This means that, in contrast to the classical typology of constituent orders in terms of S, O and V, this approach creates room for a different type of typology in terms of the absolute positions that are taken as the starting points for hierarchical ordering in languages. Some examples may show the relevance of such an approach. The following example is from Hidatsa (Siouan, Matthews 1965: 115):

(44) *Wíra i apaari ki*^{fc} *stao*^{ep} *ski*^{p}.

tree it grow INGR REM.PST CERT
'The tree must have begun to grow a long time ago.'

At the Clause layer, the only starting point for hierarchical ordering in this language is P^F. In Leti (Austronesian, van Engelenhoven 2004: 239), both P^I and P^F are used as starting points for hierarchical ordering:

(45) *Rèkna*^{C} *side*^{e} *[la=Agustus tujublas]*^{ep} *ra-sèka=e=lo* *Servaru*^{ep}.
let's_say usually DIR=August 17 3.PL-dance=EXCT=LOC Serwaru.EXCT
'Let's say they usually do a specific war dance in Serwaru on 17 August.'

And in Lillooet (Salishan, van Eijk 1997: 208) P^2 is the starting point for hierarchical ordering, as the relevant expressions are second position clitics:

(46) *Kaxim=a*^{A}*=k*^{w}*úʔ*^{C}*=tuʔ*^{ep}.
disappear.PST.3.SG=EMPH=RPRT=PST
'He disappeared, I heard.'

Second, since the starting point of hierarchical ordering may be any absolute position available in the language, including P^F, the system presented here predicts that language production will often require substantial look-ahead in ordering constituents. This is consistent with the psycholinguistic evidence presented in Section 3, which shows that not only in comprehension but also in production look-ahead may be involved. An example such as (44), for instance, illustrates a system in which the right-to-left ordering of grammatical elements starting in P^F has to be stored until configurational ordering has been completed before the morphemes can actually be pronounced in the right location.

Third, the approach presented here entails that constituent ordering, especially the part that is hierarchy-driven, is to a great extent iconic. Given the fact that elements with higher scope are assigned a position before elements with lower scope, and arguments bearing pragmatic functions before those that do not, the result is that constituent order iconically reflects the scope relations obtaining at the Interpersonal and Representational Levels, and between these levels.

Fourth, unlike most other frameworks, FDG employs a single set of ordering principles that apply at all layers of morphosyntactic organization. This allows for a systematic and parsimonious treatment of these principles, and implies that there is no separation between syntax and morphology: morphology is treated as the syntax of words.

In the next and final section of this chapter, we will show how the remaining chapters in this volume relate to the issues addressed in this introduction.

5 This volume

All chapters in this volume develop further the process of linearization in Functional Discourse Grammar. The first two chapters present theoretical advances in the FDG approach to linearization; the remaining chapters apply the linearization principles to language-specific studies.

In the first chapter, **Kees Hengeveld** and **Evelien Keizer** propose a number of changes to the linearization process in FDG. They first introduce a Sentence layer at the Morphosyntactic Level (between the layers of the Linguistic Expression and the Clause), allowing the theory to account for the placement of pragmatically marked constituents. They then propose additional linearization principles in order to constrain the model and to counteract overgeneralization. These new principles take into account the configurational nature of the Discourse Act and the precedence of predicates over arguments and operators over modifiers, while retaining the fundamental pragmatic and semantic hierarchy in FDG. They demonstrate the need for and power of these changes with examples

from four syntactically different languages: English (a verb-medial language), Dutch (a verb-second language), Turkish (a verb-final language), and Tagalog (a verb-initial language).

Riccardo Giomi, in the next chapter, focuses on the actual mapping of the information from the formulation levels onto morphosyntactic constituents. This problem requires a discussion of FDG's stance on constituency and a constituent's relation to a syntactic field (an absolute position with all its relative positions). He proposes, and ranks according to importance, three principles for determining whether two or more morphosyntactic units form a single constituent: positional economy, domain integrity and maximal flatness. These principles are then applied to linearization in languages which differ significantly as regards their word-order typology: Tahitian (verb-initial), Dutch (verb-second), English, Italian (both verb-medial) and Tamil (verb-final).

The next three chapters focus on linearization at the Clause layer or above. All three demonstrate how word order is often decided by the interplay of factors on different levels and layers.

Abigail Carretero and **Ventura Salazar-Garcia** analyze the semantically complex and syntactically irregular negative word *tampoco* 'either/neither' in modern Mexican Spanish. The analysis shows that *tampoco* has three functions: evaluative, adversative and additive. Focusing primarily on the syntactically mobile additive use, they argue that the syntactic placement of this negative marker correlates with the layer *tampoco* scopes over (i.e. the Propositional Content, Episode, State of Affairs and Configurational Property); the syntactic position changes, however, in the presence of certain pragmatic functions or operators such as Contrast, Focus or Emphasis. They end with a general discussion of negative concord in Spanish.

In a corpus study, **Ozan Mustafa** explores the factors that influence the syntactic position of semi-fixed constructions with epistemic or evidential meaning in English, such as (*not*) *as far as I know* and (*not*) *to my knowledge*. Placement, he demonstrates, is influenced by a number of factors, such as the construction's pragmatic scope (or targeting), discourse-organizational function, general function (response, modifier, ECC) and the presence of the negator (*not*).

In his chapter, **Matthias Mittendorfer** looks at the interplay between pragmatic function and prosody in triggering either left or right dislocation at and outside the Sentence layer. Using data from the British English ICE corpus, he argues that dislocated phrases are multi-relational with host-oriented and discourse-oriented functions, and their linearization and prosody can be accounted for by the principle of task urgency.

The last two chapters of this edited volume address linearization issues at the Phrase layer. In particular both papers discuss the placement of modifiers in the noun phrase.

In their chapter, **Daniel García Velasco** and **Elnora ten Wolde** account for adjectival word order patterns in English (as a language with a pre-head modifier preference) and Spanish (with a post-head modifier preference). They argue that adjectival word order restrictions stem from the interplay between typological word order principles (e.g. iconicity, domain integrity) and demonstrate how they can be accounted for with the linearization hierarchy discussed in Hengeveld and Keizer (this issue) and a specific adjectival one that they propose.

In the final chapter, **Nathalia Pereira de Souza-Martins** and **Roberto Gomes Camacho**, based on corpus data of spoken Brazilian Portuguese, discuss the factors (semantic, pragmatic, morphosyntactic and phonological) that affect the placement of post-nominal classifying and qualifying modifiers, e.g. *um portão eletrônico cinza*, 'a grey electronic gate', literally "a gate electronic grey". They demonstrate that, prototypically, Brazilian Portuguese favours the expected head + classifier + qualifier order in noun phrase linearization. This canonical order can be overridden, with the qualifier being placed closer to the head, by information from the Interpersonal Level (pragmatic emphasis), the Morphosyntactic Level (morphosyntactic weight) and the Phonological Level (phonological complexity), thereby licensing structures such as, e.g. *um cateter normal de diagnóstica* 'a normal diagnostic catheter', literally "a catheter common of diagnosis".

Abbreviations not included in the Leipzig Glossing Rules

ABIL ability
CERT certain
DIR direction
EMPH emphasis
EP epenthesis
EXCT exact ascription
INGR ingressive
PST past
REM remote
RLS realis
RPRT reportative

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References

Altmann, Gerry T.M. & Yuki Kamide. 1999. Incremental interpretation at verbs: Restricting the domain of subsequent reference. *Cognition* 73(3). 247–264.

Auer, Peter. 2009. On-line syntax: Thoughts on the temporality of spoken language. *Language Sciences* 31. 1–13.

Berg, René van den. 1989. *A grammar of the Muna language* (Verhandelingen van het Koninklijk Instituut voor Taal-, Land- en Volkenkunde 139). Dordrecht: Foris.

Blank, Idan A. 2023. What are large language models supposed to model? *Trends in Cognitive Sciences* 27(11). 987–989.

Bolinger, Dwight. 1967. Adjectives in English: Attribution and predication. *Lingua* 18(1). 1–34.

Brennan, Jonathan R. & John T. Hale. 2019. Hierarchical structure guides rapid linguistic predictions during naturalistic listening. *PLoS ONE* 14(1). e0207741.

Broccias, Cristiano. 2019. Cognitive grammar. In András Kertész, Edith Moravcsik & Csilla Rákosi (eds.), *Current approaches to syntax: A comparative handbook*, 23–48. Berlin: De Gruyter Mouton.

Brown-Schmidt, Sarah & Agnieszka E. Konopka. 2015. Processes of incremental message planning during conversation. *Psychonomic Bulletin Review* 22(3). 833–843.

Cann, Ronnie, Ruth Kempson & Lutz Marten. 2005. *The dynamics of language: An introduction*. Amsterdam: Elsevier.

Chabot, Alex, Rita Manzini, Andrew Nevins, Heather Newell, Ian Roberts & Shanti Ulfsbjorninn. 2024. The Romance inter-Views: Modularity. *Isogloss* 10(1). 1–9.

Chesi, Cristiano. 2015. On directionality of phrase structure building. *Journal of Psycholinguistic Research* 44(1). 65–89.

Chomsky, Noam. 1956. Three models for the description of language. *IRE Transactions on Information Theory* 2(3). 113–124.

Christiansen, Morten H. & Nick Chater. 2016. The Now-or-Never bottleneck: A fundamental constraint on language. *Behavioral and Brain Sciences* 39. 1–19.

Cinque, Guglielmo. 1999. *Adverbs and functional heads: A cross-linguistic perspective*. New York: Oxford University Press.

Cinque, Guglielmo. 2023. *On linearization*: *Toward a restrictive theory*. Cambridge, MA: MIT Press.

Culicover, Peter W. & Ray Jackendoff. 2005. *Simpler syntax*. Oxford: Oxford University Press.

Dąbrowska, Ewa. 2014. Recycling utterances: A speaker's guide to sentence processing. *Cognitive Linguistics* 25(4). 617–653.
Dik, Simon C. 1997. *The theory of Functional Grammar. Part 1: The structure of the clause*, 2nd, revised edn. Edited by Kees Hengeveld. Berlin: Mouton De Gruyter.
Ding, Nai, Lucia Melloni, Xing Tian & David Poeppel. 2017. Rule-based and word-level statistics-based processing of language: Insights from neuroscience. *Language, Cognition and Neuroscience* 32(5). 570–575.
Dryer, Matthew S. 2009. The Branching Direction Theory of word order correlations revisited. In Sergio Scalise, Elisabetta Magni & Antonietta Bisetto (eds.), *Universals of language today*, 185–207. Dordrecht: Springer.
Engelenhoven, Aone van. 2004. *Leti: A language of Southwest Maluku*. Leiden: KITLV Press.
Evans, Nicholas. 2003. *Bininj Gun-Wok: A pan-dialectical grammar of Mayali, Kunwinjku and Kune* (Pacific Linguistics 541). Canberra: Pacific Linguistics, Research School of Pacific and Asian Studies, The Australian National University.
Eijk, Jan van. 1997. *The Lillooet language: Phonology, morphology, syntax.* Vancouver: UBC Press.
Ferreira, Fernanda. 2000. Syntax in language production: An approach using tree-adjoining grammars. In Linda Wheeldon (ed.), *Aspects of language production*, 291–330. Cambridge, MA: MIT Press.
Ferreira, Fernanda & Zhuang Qiu (2021). Predicting syntactic structure. *Brain Research* 147632. Accessible at https://psycnet.apa.org/record/2021-84340-001.
Frank, Stefan L. & Rens Bod. 2011. Insensitivity of the human sentence-processing system to hierarchical structure. *Psychological Science* 22(6). 829–834.
Frank, Stefan L., Rens Bod & Morten H. Christiansen. 2012. How hierarchical is language use? *Proceedings of the Royal Society B – Biological Sciences* 279. 4522–4531.
Giomi, Riccardo. This volume. Constituency and linearization in Functional Discourse Grammar.
Goldberg, Adele E. & Fernanda Ferreira (2022). Good-enough language production. *Trends in Cognitive Sciences* 26(4). 300–311.
Gibbon, Dafydd & Sascha Griffiths. 2017. Multilinear Grammar: Ranks and interpretations. *Open Linguistics* 3. 265–307.
Guerrero Medina, Pilar & Carmen Portero Muñoz (eds.). 2018. Derivational morphology in Functional Discourse Grammar. [Special issue]. *Word Structure* 11(1).
Hale, Ken. 1989. On nonconfigurational structures. In Lázsló Marácz & Pieter Muysken (eds.), *Configurationality: The typology of asymmetries*, 293–300. Dordrecht: Foris.
Halliday, M.A.K. 1985. *An introduction to Functional Grammar.* London: Edward Arnold.
Halliday, M.A.K. & Christian M.I.M. Matthiessen. 2014. *An introduction to Functional Grammar*, 4th edn. London: Routledge.
Haselow, Alexander. 2017. *Spontaneous spoken English: An integrated approach to the emergent grammar of speech*. Cambridge: Cambridge University Press.
Hengeveld, Kees. 2012. Referential markers and agreement markers in Functional Discourse Grammar. *Language Sciences* 34(4). 468–479.
Hengeveld, Kees. 2013. A new approach to clausal constituent order. In J. Lachlan Mackenzie & Hella Olbertz (eds.), *Casebook in Functional Discourse Grammar* (Studies in Language Companion Series 137), 15–38. Amsterdam: John Benjamins.
Hengeveld, Kees & Evelien Keizer. This volume. General principles of linearization in Functional Discourse Grammar.
Hengeveld, Kees, Evelien Keizer & Riccardo Giomi (in prep.) *Layering in Functional Discourse Grammar: The hierarchical structure of the language system.* Oxford: Oxford University Press.
Hengeveld, Kees & J. Lachlan Mackenzie. 2008. *Functional Discourse Grammar: A typologically-based theory of language structure*. Oxford: Oxford University Press.
Hengeveld, Kees & Marize Mattos Dall'Aglio Hattnher. 2015. Four types of evidentiality in the native languages of Brazil. *Linguistics* 53(3). 479–524.

Hopper, Paul J. 1987. Emergent Grammar. *Berkeley Linguistics Society* 13. 139–157.
Hopper, Paul J. 1988. Emergent Grammar and the A Priori grammar postulate. In Deborah Tannen (ed.) *Linguistics in Context (Collected General Lectures from the 1985 LSA Institute)*. Georgetown: Linguistics Institute, Georgetown University.
Hopper, Paul J. 2015. An emergentist approach to grammar. In Brian MacWhinney & William O'Grady (eds.), *The handbook of language emergence*, 314–327. New York: Wiley.
Hornstein, Norbert, Jairo Nunes & Kleanthes K. Grohmann. 2005. *Understanding Minimalism*. Cambridge: Cambridge University Press.
Howes, Christine & Hannah Gibson. 2021. Dynamic Syntax. *Journal of Logic, Language and Information* 30. 263–276.
Huettig, Falk. 2015. Four central questions about prediction in language processing. *Brain Research* 1626. 118–135.
Huettig, Falk, Jenny Audring & Ray Jackendoff. 2022. A Parallel Architecture perspective on pre-activation and prediction in language processing. *Cognition* 224. 105050.
Jackendoff, Ray. 2007. Linguistics in cognitive science: The state of the art. *The Linguistic Review* 24. 347–401.
Jackendoff, Ray & Jenny Audring. 2020. *The texture of the lexicon: Relational Morphology and the Parallel Architecture*. Oxford: Oxford University Press.
Kathol, Andreas. 2000. *Linear syntax*. Oxford: Oxford University Press.
Kayne, Richard S. 1984. *Connectedness and binary branching*. Dordrecht: Foris.
Kayne, Richard S. 2024. Generative syntax over the years: On some changes and on some non-changes. Lingbuzz https://ling.auf.net/lingbuzz/007894.
Keizer, Evelien. 2015. *A Functional Discourse Grammar for English*. Oxford: Oxford University Press.
Kojadinović, Zlatan. 2022. Variation in the prosody of illocutionary adverbs. *Open Linguistics* 8(1). 593–617.
Kornfilt, Jaklin. 1997. *Turkish*. London: Routledge.
Kroon, Caroline. 1995. *Discourse particles in Latin*. Amsterdam: Gieben.
Legate, Julie Anne. 2003. The configurational structure of a nonconfigurational language. In Pierre Pica (ed.), *Linguistic variation yearbook*, vol. 1, 61–104. Amsterdam: Benjamins.
Lelonkiewicz, Jarosław R., Hugh Rabagliati & Martin J. Pickering. 2016. The role of language production in making predictions during comprehension. *Quarterly Journal of Experimental Psychology* 74(12). 2193–2209.
Levelt, Willem J.M. 1989. *Speaking*: *From intention to articulation*. Cambridge MA: MIT Press.
Lewis, Geoffrey. 2000. *Turkish grammar* (2nd edn). Oxford: Oxford University Press.
Lewis, Shevaun & Colin Phillips. 2015. Aligning grammatical theories and language processing models. *Journal of Psycholinguistic Research* 44. 27–46.
MacDonald, Mary Ellen C. 2013. How language production shapes language form and comprehension. *Frontiers in Psychology* 4. Article 226.
Mackenzie, J. Lachlan. 2010. More tiles on the roof: Further thoughts on incremental language production. In Kasper Boye & Elisabeth Engberg-Pedersen (eds.), *Language usage and language structure*, 263–293. Berlin: Mouton de Gruyter.
Mackenzie, J. Lachlan. 2014. Morphosyntax in Functional Discourse Grammar. In Andrew Carnie, Daniel Siddiqi & Yosuke Sato (eds.), *Routledge handbook of syntax*, 627–646. London: Routledge.
Mackenzie, J. Lachlan. 2019. The Functional Discourse Grammar approach to syntax. In András Kertész, Edith Moravcsik & Csilla Rákosi (eds.), *Current approaches to syntax – A comparative handbook,* 291–316. Berlin: de Gruyter Mouton.
Mackenzie, J. Lachlan & Evelien Keizer. 1991. On assigning pragmatic functions in FG. *Pragmatics* 1(2). 169–215.

Mahowald, Kyle, Anna A. Ivanova, Idan A. Blank, Nancy Kanwisher, Joshua B. Tenenbaum & Evelina Fedorenko. 2024. Dissociating language and thought in large language models. *Trends in Cognitive Sciences* 28(6). 517–540.

Martin, Clara D., Francesca M. Branzi & Moshe Bar. 2018. Prediction is production: The missing link between language production and comprehension. *Scientific Reports* 8. 1079.

Matthews, George Hubert. 1965. *Hidatsa syntax*. The Hague: Mouton.

Mitchell, Melanie. 2024. Large language models. In Michael C. Frank & Asifa Majid (eds.), *Open encyclopedia of cognitive science*. MIT Press (online). Accessible at https://doi.org/10.21428/e2759450.2bb20e3c

Mittendorfer, Matthias. This volume. Discourse functions, placement and prosody: An FDG analysis of left and right dislocation in British English.

Norcliffe, Elisabeth, Agnieszka E. Konopka, Penelope Brown & Stephen C. Levinson. 2015. Word order affects the time course of sentence formulation in Tzeltal. *Language, Cognition and Neuroscience* 30(9). 1187–1208.

Nordström, Jackie. 2017. Language without narrow syntax. *The Linguistic Review* 34(4). 687–740.

O'Grady, William. 2022. *Natural Syntax: An emergentist primer*, 3rd edn. https://www.researchgate.net/publication/362967378_natural_syntax_an_emergentist_primer_3rd_ed.

Olbertz, Hella & Sandra Gasparini Bastos. 2013. Objective and subjective deontic modal necessity in FDG: Evidence from Spanish auxiliary expressions. In J. Lachlan Mackenzie & Hella Olbertz (eds.), *Casebook in Functional Discourse Grammar,* 277–300. Amsterdam: John Benjamins.

Olthof, Marieke & Kees Hengeveld. 2021. Noun incorporation in Functional Discourse Grammar. In Lucía Contreras-García & Daniel García Velasco (eds.), *Interfaces in Functional Discourse Grammar: Theory and applications*, 127–173. Berlin: De Gruyter Mouton.

Pallier, Christophe, Anne-Dominique Devauchelle & Stanislas Dehaene. 2011. Cortical representation of the constituent structure of sentences. *Proceedings of the National Academy of Sciences of the USA* 108(6). 2522–2527.

Piantadosi, Steven T. 2024. Modern language models refute Chomsky's approach to language. In Ted Gibson & Moshe Poliak (eds.), *From fieldwork to linguistic theory: A tribute to Dan Everett*, 353–414. Berlin: Language Science Press.

Pickering, Martin J. & Chiara Gambi. 2018. Predicting while comprehending language: A theory and review. *Psychological Bulletin* 144(10). 1002-1044.

Pollard, Carl & Ivan A. Sag. 1994. *Head-Driven Phrase Structure Grammar*. Chicago: University of Chicago Press.

Sinclair, John & Anna Mauranen. 2006. *Linear Unit Grammar: Integrating speech and writing*. Amsterdam: John Benjamins.

Slevc, L. Robert. 2023. Grammatical encoding. In Robert Hartsuiker & Krystof Strijkers (eds.), *Language production,* 4–31. London: Routledge.

Smit, Niels. 2010. *FYI: Theory and typology of information packaging*. PhD Dissertation, University of Amsterdam.

Tesnière, Lucien. 1988. *Éléments de syntaxe structurale*. Paris: Klincksieck.

Unger, Andrea Christina. 2010. *A computational approach to the syntax of displacement and the semantics of scope*. Utrecht: LOT.

Van Valin, Robert D. Jr & Randy LaPolla. 1997. *Syntax: Structure, meaning and function*. Cambridge: Cambridge University Press.

Van Valin, Robert D. Jr. 2005. *Exploring the syntax-semantics interface*. Cambridge: Cambridge University Press

Varaschin, Giuseppe & Peter W. Culicover. 2024. Flat structure: A minimalist program for syntax. *The Linguistic Review* 41(3). 543–606.

Wagner, Michael. 2016. Information structure and production planning. In Caroline Féry & Shinichiro Ishihara (eds.), *The Oxford handbook of information structure*, 541–561. Oxford: Oxford University Press.

Wiltschko, Martina. 2024. *The grammar of interactional language*. Cambridge: Cambridge University Press.

Zada, Zaid, Ariel Goldstein, Sebastian Michelmann, Erez Simony, Amy Price, Liat Hasenfratz, Emily Barham, Asieh Zadbood, Werner Doyle, Daniel Friedman, Patricia Dugan, Lucia Melloni, Sasha Devore, Adeen Flinker, Orrin Devinsky, Samuel A. Nastase & Uri Hasson. 2024. A shared model-based linguistic space for transmitting our thoughts from brain to brain in natural conversations. *Neuron* 112(18). 3211–3222.