Interfaces, mismatches, and the architecture of Functional Discourse Grammar

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Abstract: This chapter describes and delimits the nature of interfaces in FDG. The different interface conditions across languages are defined in terms of well-established typological hierarchies: for each language, a basic setting on these hierarchies predicts the overall working of the interfaces. In addition, the Fund states numerous language-specific settings, such as its alignment system, the permissibility of zero anaphora, the presence of cliticization, etc. It is also argued that within the Fund there are compartments corresponding to each of the Levels in the grammar: for every lexical item and for every construction, its interpersonal, representational, morphosyntactic, and phonological aspects are stored separately. Although the overall model is strongly top-down, some bottom-up processes are proposed, but these are restricted to the Fund and the Contextual Component. On this foundation, the chapter discusses mismatches across FDG's four levels of organization and shows that all possible mismatches may occur. Some mismatches follow from well-established typological hierarchies while others are the result of basic choices a language makes among various typological options. Bottom-up processes in the Fund are needed in order to account for certain types of mismatches, especially, but not exclusively, those involving feedback from the Phonological Level to higher levels.

Keywords: bottom-up, Fund, interface, mismatch, typological hierarchy

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1 Introduction

A distinctive property of Functional Discourse Grammar (FDG) is that in its architecture four different hierarchically ordered levels apply in a top-down fashion: the Interpersonal (pragmatic), Representational (semantic), Morphosyntactic, and Phonological Levels. In so doing, FDG takes "the functional approach to language to its logical extreme: within the top-down organization of the grammar, pragmatics governs semantics, pragmatics and semantics govern morphosyntax, and pragmatics, semantics, and morphosyntax govern phonology" (Hengeveld and Mackenzie 2008: 13). The mapping across the various levels is regulated by the operations of Formulation and Encoding, which thus act as interfaces across these levels. Often the mapping process is one-to-one, as when one Subact of Reference at the Interpersonal Level corresponds to one Individual at the Representational Level, to one Noun Phrase at the Morphosyntactic Level, and to one Phonological Phrase at the Phonological Level. In other cases, however, the mapping is less straightforward. These cases may be called "mismatches", as there is no one-to-one relationship between layers at the various levels. Mismatches are of general interest, as they create a lack of transparency in grammar (Leufkens 2013, 2015; Hengeveld and Leufkens 2018).

In the central Section 3 of this chapter we use the FDG model to provide a systematic inventory of mismatches, applying the top-down approach that is an important characteristic of FDG. But before that, in Section 2, we will need to specify the place, role, and organization of interfaces in FDG. In this section we will also suggest a number of adaptations of the FDG model in general. In Section 4 we will present our conclusions, relating our discussion of mismatches in Section 3 to the place of interfaces in FDG as discussed in Section 2.

2 Interfaces in FDG

2.1 Introduction

In FDG, given that it contains four levels of linguistic organization in its grammatical component, interfaces should play an important role (Contreras García 2013, 2015; García Velasco 2017), though so far most attention has gone into elaborating the internal structure of the levels themselves. The prime candidates for interface status in the model are what are called "operations" in Hengeveld and Mackenzie (2008: 13), represented as ovals in Figure 1. A distinction is made between operations of Formulation, Encoding and Articulation, which play a crucial role in the

top-down architecture of FDG. Another type of operation, Contextualization, connecting the Contextual and Grammatical Components, was added in Hengeveld and Mackenzie (2014). From here on we will use the term "interface" to refer to a mechanism of the grammar that executes a set of operations. We reconsider three aspects of the model as summarized above: the number and nature of interfaces (Section 2.2), the internal organization of the interfaces (Section 2.3), and the top-down organization of the model (Section 2.4).

2.2 Number and nature of interfaces

In this section we reconsider the place of Formulation within FDG. Formulation, in the architecture presented in Hengeveld and Mackenzie (2008: 13) as shown in Figure 1, is actually not an interface between levels, as is the case for all other interfaces, but between a component and a level. Formulation connects the Conceptual Component on the one hand to the Interpersonal and Representational Levels within the Grammatical Component on the other. In the current representation it thus connects units of unlike rank.

At the same time, Formulation in Figure 1 maps onto two distinct levels: the Interpersonal and the Representational Levels. As a result, an interface between these two levels is missing, the idea being that Formulation produces both the Interpersonal and Representational Levels in a coordinated manner. However, given that mismatches may occur between the Interpersonal and Representational Levels as well, as will be shown below, an interface between these two has to be added.

In Figure 2, we adapt Figure 1 in six different ways:

(i)   We incorporate *Contextualization* as an interface between the Contextual and Grammatical Components, as proposed in Hengeveld and Mackenzie (2014), and note that the model proposed there is actually somewhat more complex than is represented in Figure 2, as the Contextualizer forms a complex interface between the different levels within the grammar and corresponding levels, called "strata", within the Contextual Component. This is represented in Figure 3, adapted from Hengeveld and Mackenzie (2014) to the modified architecture given in Figure 2.

(ii)   We add a *Conceptual Level* (following Connolly 2013, see also Connolly 2017), produced by an interface called *Conceptualization* within the Conceptual Component. The Conceptual Level corresponds to the preverbal message. We will not develop this part of the theory any further here, but present it for the sake of architectural completeness. We will also remain agnostic as to the elements that form the input for Conceptualization.
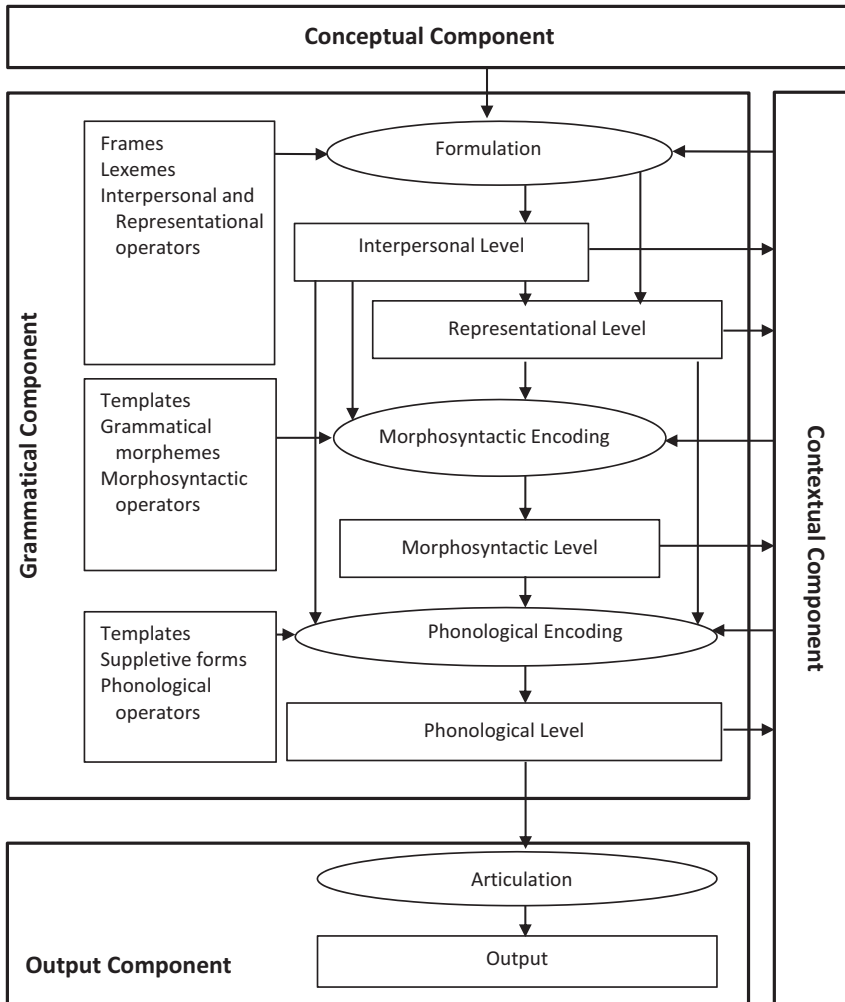
Figure 1: General layout of FDG (Hengeveld and Mackenzie 2008: 13).

(iii) Following O'Neill (2012: 122–125), we distinguish between *Interpersonal Formulation* and *Representational Formulation*, which both have the Conceptual Level as their input. As mentioned above, this will allow us to take care of mismatches between the Interpersonal and Representational Levels, to be discussed later in this chapter.

(iv) The Conceptual Level also maps onto the interpersonal and representational parts of the fund, linking conceptual representations to actual lexemes, following Hengeveld and Mackenzie (2016: 1141–1146), who argue that lexemes
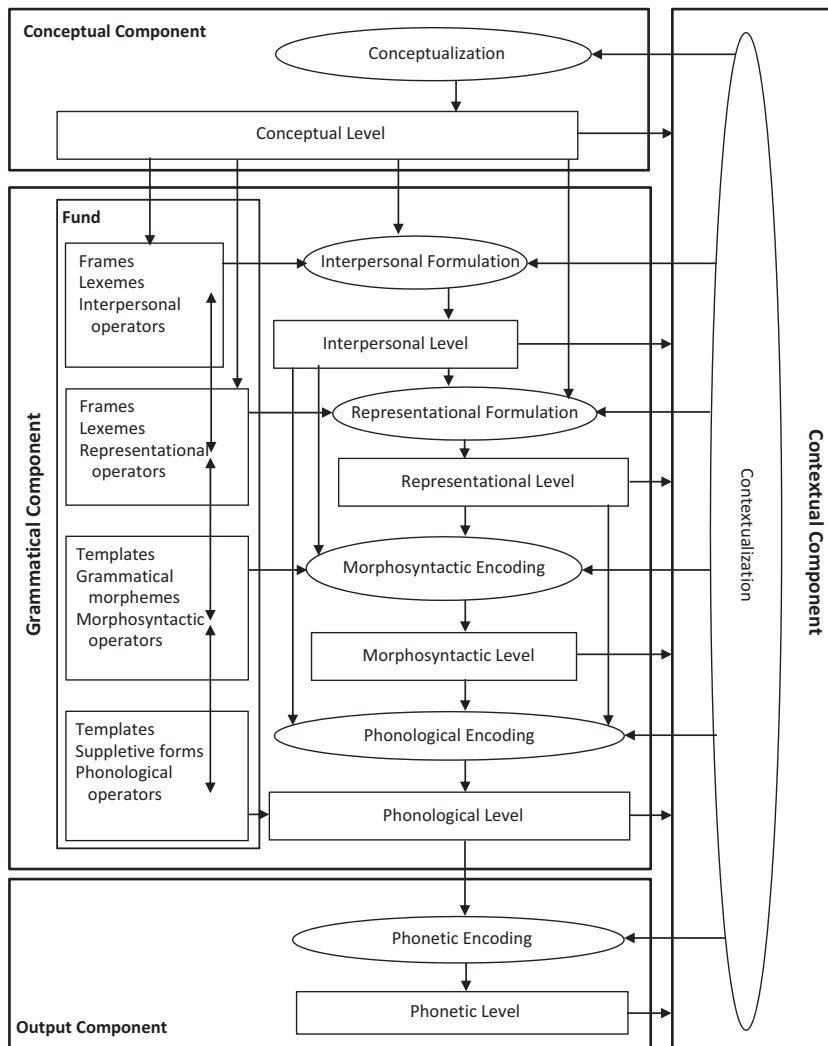
Figure 2: General layout of FDG – revised.

do not have abstract conceptual representations, but rather that "there is an abstract conceptual representation . . ., which leads the language user to the use of a lexeme that adequately captures the concept that he/she has in mind" (Hengeveld and Mackenzie 2016: 1142).

(v)   We add connections between the different sets of primitives, covering lexical correspondences across sets of primitives (cf. Culicover and Jackendoff 2005; Sadock 2012; Contreras García 2012, this volume; O'Neill 2012).

Figure 3: Contextualization.

The pragmatic, semantic, morphosyntactic, and phonological aspects of a lexical or grammatical element in the Fund are stored in the four corresponding subcomponents of the Fund, but connected across these subcomponents through vertical connections. This leads to a further adaptation of the general architecture of FDG. In Hengeveld and Mackenzie (2008) we took it that lexical and grammatical material would be inserted in its phonological form at all levels. We now take the position that the various aspects of lexical and grammatical elements are spread out over the corresponding subcomponents of the Fund, such that the phonological aspects only become visible at the Phonological Level and its corresponding fundal subcomponent. This adds to the alignment of FDG with prominent psycho- and neurolinguistic models (Levelt, Roelofs, and Meyer 1999; Hagoort 2013; Roelofs and Ferreira 2019), which consistently have found evidence for distinct processing of the conceptual-semantic, morphosyntactic and phonological-phonetic properties of lexical items and have distinguished them in their models of lexical access. The psycholinguistic evidence is chiefly drawn from behavioural phenomena such as speech errors, self-correction arising from self-monitoring, and priming effects. The neurolin-

guistic research, using various forms of electrophysiological and hemody-
namic neuro-imaging, has provided evidence of distinct brain localizations
for semantic, morphosyntactic, and phonological properties of lexical units,
based on experiments with subjects' reactions to ambiguities and anoma-
lies as well as observations of impairments in aphasia patients.

(vi) Partly following O'Neill (2012), Seinhorst (2014), and Seinhorst and Leufkens
(this volume), we replace the operation of Articulation in the Output Com-
ponent by an operation of Phonetic Encoding, which produces a Phonetic
Level. Note that there have been proposals to furthermore distinguish
between an underlying phonological sublevel and a surface phonological
sublevel within the Grammatical Component (O'Neill 2012, Seinhorst 2014),
and an auditory-phonetic sublevel and an articulatory-phonetic sublevel
within the Output Component (Seinhorst 2014) that we do not take over
here (see Seinhorst and Leufkens this volume for discussion).

The resulting adapted model in Figure 2[1] contains many different connections,
indicated by arrows. These arrows represent different things:

– Vertical single-headed arrows indicate actual operations as executed by the rel-
evant interfaces of conceptualization, formulation, encoding, and articulation;
– Horizontal single-headed arrows indicate feeding relationships: the differ-
ent subcomponents of the Fund feed their corresponding operations by pro-
viding the basic building blocks needed by those operations, and, similarly,
the different subcomponents of the Contextual Component feed their corre-
sponding operations by providing the contextual conditions and restrictions
relevant for those operations;
– Vertical double-headed arrows provide the connections between the prag-
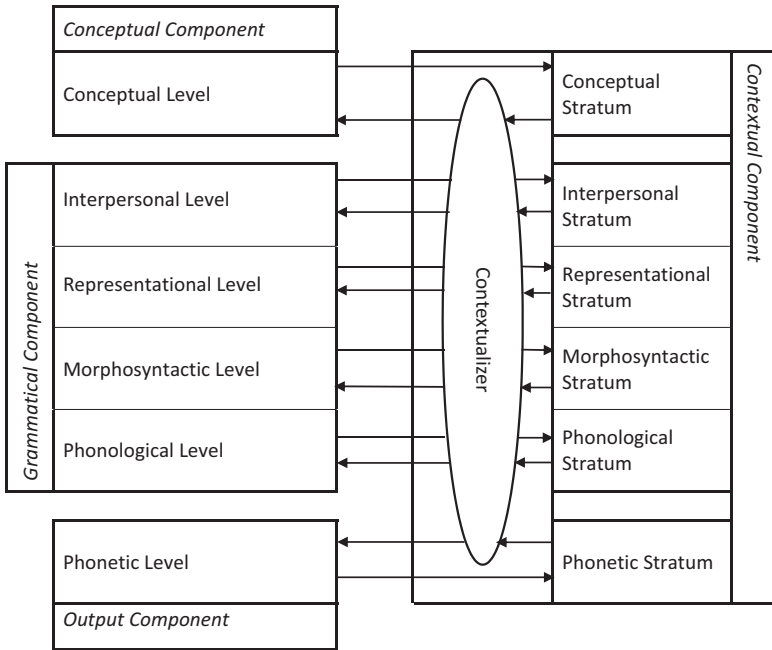matic, semantic, morphosyntactic, and phonological aspects of a lexical or
grammatical element within the Fund.

2.3 The internal organization of interfaces

In Hengeveld and Mackenzie (2008) we take the position that Formulation,
Encoding, and Articulation, which we here interpret as FDG's interfaces, contain
operations, i.e. sets of rules, but that position needs to be modified in two differ-
ent respects.

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1 We only represent the spoken modality in Figure 2, but the model could be applied to written
and signed modalities as well.

First of all, given the typological orientation of FDG, the model should capture the fact that differences between the sets of expression possibilities of different languages are not random, but in many cases vary systematically. The parameters along which possible sets of rules are constrained can to a large extent be captured by typological hierarchies. What we suggest, then, is that interfaces contain rules, but that the domain of application of these rules is defined as a number of settings along typological hierarchies. Of course, not all typological properties of a language are governed by hierarchies. For instance, the fact that a language has accusative or ergative alignment cannot be predicted from any other property of the language. Thus, apart from typological hierarchies, basic typological settings are needed as well. These basic typological settings are reflected in the sets of primitives available in the Fund of a language.

Secondly, neither rules nor typological hierarchies and settings can handle irregular forms. Forms and structures that cannot be handled productively by regular rules have to be taken care of by the Fund, which links irregular paradigms to lexemes or frames through the connections between its subcomponents. Rules apply in the regular cases after the Fund has been checked for the presence of irregular forms. This principle is called "lexical priority" in Dik (1997, 1: 345), but given the broad conception we have of the Fund as containing not only lexemes, but also frames, templates, grammatical morphemes, etc., this should rather be called "fundal priority".

We thus distinguish between rules, typological constraints, and the principle of fundal priority. The three can be illustrated using the following Spanish example.

(1) *El   indulto le   fue   denegado al   reo   por el   juez.*
     the   pardon   him   was   denied   to.the accused   by   the judge
     'The pardon was denied the accused by the judge.'

At least three typological domains are relevant for the analysis of this sentence: they concern constituent order, alignment, and passivization. As regards constituent order and alignment, there are no known typological hierarchies that predict what kind of constituent order the clauses of a language will have, just as there are no typological hierarchies that predict the alignment type of a language. In these cases there are basic typological settings for the language (for Spanish, SVO and Accusative), and the interface which takes care of morphosyntactic encoding will simply select the relevant templates from the Fund, which encode these basic settings implicitly.

As regards passivization, it has been claimed that in accusative languages the semantic function hierarchy in (2) is relevant:

(2) A ⊃ U ⊃ Rec ⊃ Ben ⊃ Other

Languages allow subject assignment to portions of this hierarchy, in such a way that when a constituent with a certain semantic function on this hierarchy can be assigned the subject function, then constituents with all semantic functions to the left of it will also allow subject assignment. Some English speakers, for instance, allow subject assignment up to the Beneficiary function, but not beyond that point (i.e. all speakers reject subject assignment to Instruments). In Spanish the possibilities are much more limited:

(3) *El   juez   le   denegó   el   indulto   al   reo.*
     the   judge   him   denied   the   pardon   to.the accused
     'The judge denied the accused the pardon.'

(4) *El   indulto   le   fue   denegado   al   reo   por   el   juez.*
     the   pardon   him   was   denied   to.the accused by   the   judge

(5) **El   reo   fue   denegado   el   indulto   por   el   juez.*
     the   accused   was   denied   the   pardon   by   the   judge
     'The accused was denied the pardon by the judge.'

(6) **María   fue   comprado   un   libro   por   Pedro.*
     María   was   bought   a   book   by   Pedro
     'María was bought a book by Pedro.'

(7) **El   destornillador   fue   arreglado   el   coche   por   Pedro.*
     the   screwdriver   was   fixed   the   car   by   Pedro
     'The screwdriver was fixed the car by Pedro.'

Thus, the morphosyntactic encoder for Spanish has to indicate that for Spanish the cut-off point on the hierarchy in (2) is between the Undergoer and the Recipient.[2]

Once this setting has been established, the morphosyntactic rules that regulate passive expressions in Spanish can apply to the relevant cases. These rules have to assign such subject properties as position and agreement to the constituent that has been selected as the subject. They also have to make sure that non-subjects are expressed according to their semantic functions, as in the case

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2 As reflected in the translations, in English the cut-off point is between the Beneficiary and Other semantic functions.

of *por el juez* in (4) and (5) and *por Pedro* in (6) and (7). Finally, they have to make sure that the predicate is expressed as a combination of the auxiliary *ser* and the past participle.

When a verb is regularly formed, the rules of verb inflection may apply straightforwardly, and produce *arregla-do* from *arreglar*, as in (7). However, in the case of the irregular form *fue* of the auxiliary *ser* in (4)–(7) no such rule can be applied, and the Fund has to kick in. Checking the paradigm of *ser* through the connections in the Fund, the irregular form will be selected ready-made from the paradigm stored in the morphosyntactic part of the Fund. The rule of fundal priority ensures that the inappropriate selection of the regular form is avoided.

2.4 Top-down architecture and feedback

There is a small range of phenomena, to be discussed in more detail later in this chapter, that are problematic for a strictly top-down model of grammar. For instance, in some languages phonotactic constraints co-determine syntactic placement. A case in point is Tagalog. In this language nouns and adjectives within noun phrases are joined together, irrespective of order, through a linker that has two allomorphs: *-ng* and *na*. The allomorph *-ng* occurs when the preceding word either ends in a vowel or in an alveolar nasal or glottal stop. In the latter case, the word-final alveolar nasal or glottal stop is deleted. The allomorph *na* occurs in all other cases. Since the order of head and modifier is rather free, pairs like the one in (8)–(9) may be found (Shih and Zuraw 2017: 322), in which the form of the linker varies depending on the order chosen:

(8) *áso-ng   ulól*
    dog-LK   mad
    'mad dog'

(9) *ulól   na   áso*
    mad   LK   dog
    'mad dog'

In the default order in Tagalog, the adjective precedes the noun, but the opposite order is possible too, and may be triggered by various factors, several of which are phonological in nature. For instance, as shown by Shih and Zuraw (2017: 325), in order to avoid a sequence of two nasals, there is a preference for placing the noun before the adjective, as in (10), which is preferred over (11), which would represent the default order:

(10) *pelúka-ng   itim*
     wig-LK   black
     'black wig'

(11) *itim   na   pelúka*
     black   LK   wig
     'black wig'

It is clear that in cases like these, the morphosyntactic encoder needs to have access to information from the Phonological Level, which has, however, not been reached yet at this point.

We therefore tentatively propose to relax the top-down restriction in FDG in such a way that this restriction applies to grammatical processes, but not to the Fund. Through the Fund, with its connecting compartments, information can be retrieved bottom-up. In the example mentioned above, the phonological shape of the adjective can be consulted by the morphosyntactic encoder in order for the latter to decide on its placement. Our proposal is to allow look-ahead operations, but to limit them to those that are mediated through the Fund, where pragmatic, semantic, morphosyntactic, and phonological aspects of one and the same lexeme or frame are connected and accessible. By taking this approach, bottom-up processes are allowed but at the same time restricted in a principled way.[3]

In a similar vein, information can be passed on bottom-up in the Contextual Component from lower strata to higher strata. As shown in Mackenzie (2012), the Contextual Component is a bridge between the encoding activities of the speaker and the decoding activities of the addressee. The former process is top-down, the latter is bottom-up. Since speakers and addressees switch roles all the time, decoding processes may influence encoding processes over time. For instance, a frequent phonetic realization that deviates from the underlying phonological representation may become the norm over time, in which case the Phonetic Level influences the Phonological Level from a diachronic perspective. One such case is discussed in Seinhorst and Leufkens (this volume), referring to Kohler (1998), and concerns the pronunciation of German *haben* 'have', which they present as having undergone reduction over time from /haː.bən/ to /haːb.n̩/ > /haːb.m̩/ > /haːm.m̩/ > /haːm/. Since this means that phonetic reduction is grammaticalized

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3 Note that this goes against the proposal of Hengeveld and Smit (2009), who permit certain bottom-up processes in the grammar itself.

into a phonological rule, Seinhorst and Leufkens (this volume) represent this as a bottom-up process within the grammar itself.

We have a somewhat different take on this process, giving a central role to the Contextual Component. The Morphosyntactic Level (ML) is responsible for ordering the verb /ha:b/ and its infinitive suffix (or agreement suffix). In the initial phase of the phonological change described by Seinhorst and Leufkens (Stage 1), this sequence is sent on to the Phonological Level, where the suffix is given the form /ən/, stored in the Fund, resulting in the Phonological Word /ˈha:bən/ (with resyllabification as /ha:/ + /bən/). This then passes to the Articulator, where phonetic processes of reduction, assimilation and degemination take place (not phonological processes, as is suggested by Seinhorst and Leufkens' use of slashes, see above), ultimately resulting in the phonetic realization [ha:m], which as a consequence of those phonetic processes displays a mismatch between phonology and phonetics (notably, one syllable rather than two). The Contextual Component (CxtC) stores the form [ha:m] at the Output Stratum (as it stores all phonetic forms), and when, over time, this grows into an established pronunciation of *haben*, the form [ha:m] becomes available as an option for the application of fundal priority in the phonological form /ha:m/ (Stage 2). As this becomes entrenched through repeated application (Stage 3) and removes the /-ən/ syllable, the ML sequence /ha:b/ + infinitive/agreement affix comes to be mapped onto the ready-made Phonological Word /ha:m/. The resultant form then is realized without any mismatches between the Phonological Level (PL) and the Phonetic Level (PhonL) as [ha:m]. The process can be visualized in bottom-up fashion as in Figure 4.

Stage 3
Fund   ML   /ha:b/-<inf>
/ha:m/ (fundal pr.)   PL   /ha:m/
                            PhonL   [ha:m] ➔ CxtC
          entrenchment
Stage 2
Fund   ML   /ha:b/-<inf>
/-ən/, /ha:m/ (fundal pr.) PL   /ha:m/
                            PhonL   [ha:m] ➔ CxtC
          influence
Stage 1
Fund   ML   /ha:b/-<inf>
/-ən/   PL   /ha:bən/
                            PhonL   [ha:m] ➔ CxtC
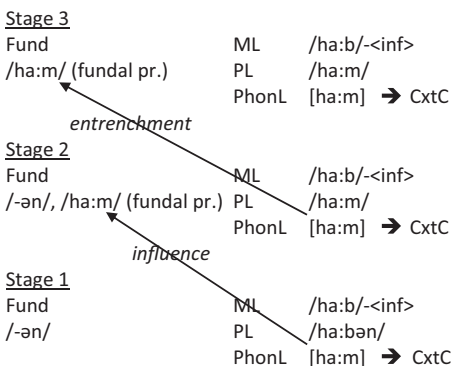
Figure 4: Bottom-up influence of the Contextual Component (CxtC).

With this adapted architecture in mind, we will now turn to the treatment of mismatches in FDG.

3 Mismatches

3.1 Introduction

When there are straightforward, i.e. transparent (see Hengeveld and Leufkens 2018), mappings between levels, interfaces are not stretched in any way. This happens, for instance, when a single Subact of Reference at IL maps onto a single Individual at RL, which is expressed by a single Noun Phrase at ML and a single Phonological Phrase at PL. Interfaces have a more challenging task in the case of mismatches. In this section we will discuss different types of mismatches and the way these can be handled in the architecture sketched in Section 2.

3.2 Mismatches between IL and RL

3.2.1 Introduction

The communicative intention captured by the Conceptual Level gives rise to two levels in Formulation, the Interpersonal and the Representational Levels (IL and RL). In FDG, these are seen as each having their own status within Formulation, with IL covering all aspects of Formulation that concern the rhetorical and pragmatic aspects of the grammar of the Linguistic Expression under analysis, and RL dealing with all the semantic aspects. One and the same morphosyntactic unit generally conveys both interpersonal and representational meaning: for example, a Noun Phrase like *those men* in English is definite and potentially focused (interpersonal meanings) and also plural and distal (representational meanings), so that it is to be expected that there will be correspondences between IL units and RL units, in which case the interface between IL and RL merely serves to confirm the one-to-one relationship. In other cases, however, we can observe a lack of correspondence (a mismatch) between IL and RL, and it is to an overview of such mismatches that this section is devoted.

It is worth noting that the existence of mismatches between IL and RL helps to justify the distinction between them that is characteristic of the FDG architecture. In pre-FDG work (Hengeveld 1997), it was proposed, in the tradition of Functional Grammar (Dik 1997), that there was a single underlying structure in which interpersonal layers were situated higher in the hierarchy than representational ones. Comparable proposals have been made in generative syntax, especially in the cartographic variant (Rizzi and Cinque 2016), in which it has been proposed to introduce, at relatively high positions in the syntactic tree, "projections" (i.e. syntactic phrases) with clearly IL-like names such as Topic, Focus and (illocu-

tionary) Force. However, in FDG, the two types of meaning are clearly separated, but linked by an interface that specifies correspondences, mismatches, and complementarities between the two Levels. The default setting of the interface is one-to-one correspondence (in more mathematical terms, a bijective function). The major default relations between the IL and the RL pertain to:

- Subacts of Reference (R_1) at IL, each of which generally corresponds to a single (α_1) at RL, where α is a variable over the various RL layers (p_1, ep_1, e_1, f_1, x_1, l_1, ...);
- Subacts of Ascription ($T_{1)}$ at IL, each of which generally corresponds to a single Property (f_1) or to a semantic operator at RL;
- Communicated Contents (C_1) at IL, each of which generally corresponds to a single (p_1) at RL.

The focus of this section will be on mismatches. Mismatches between IL and RL can be divided into four types (cf. also Leufkens 2015):

1. null-to-nonnull (where there is no unit at IL corresponding to one or more units at RL)
2. nonnull-to-null (where there is no unit at RL corresponding to one or more units at IL)
3. one-to-many (where one unit at IL corresponds to more than one unit at RL)
4. many-to-one (where one unit at RL corresponds to more than one unit at IL)

The section will deal with the following mismatches:

Subacts of Reference (R_1)
- null-to-nonnull: no (R_1) corresponding to one (α_1), exemplified by zero anaphora
- many-to-one: {(R_1), (R_2), ...}, corresponding to one (α_1), exemplified by cross-reference

Subacts of Ascription (T_1)
- null-to-nonnull: no (T_1) corresponding to one (f_1), exemplified by gapping
- many-to-one: {(T_1), (T_2), ...}, corresponding to one (f_1), exemplified by certain infinitive + finite sequences in Spanish and other languages

Communicated Contents (C_1)
- one-to-many: one (C_1), corresponding to {(p_1), (p_2), ...}, exemplified by certain conditional adverbial constructions
- many-to-one: {(C_1), (C_2), ...}, corresponding to one (p_1), exemplified by certain temporal adverbial constructions

The preceding overview displays three of the four types of mismatch. The question arises whether there are nonnull-to-null mismatches between IL and RL, i.e. cases where some unit at IL has no equivalent at RL. There are indeed such cases, e.g. Expressives (like *Ouch!*), Interactives (like *Congratulations!*) and Vocatives (like *Hey John!*), but here the RL is not involved at all, and such expressions are dealt with by the interface with PL (cf. Hengeveld and Mackenzie 2008: 77).

The six types of mismatch will be treated in the following subsections.

3.2.2 Zero anaphora

A major difference between IL and RL is that the former is a record of the activity carried out by the language user, specifically the Discourse Acts (A_1, A_2, . . .) that s/he performs and the Subacts that make up the Communicated Content, while the latter is a non-actional description of semantic content. This entails that the IL will show only those Acts and Subacts that are actually carried out, in the sense of having an explicit reflection at the Morphosyntactic and Phonological Levels. As a consequence, instances of zero anaphora will be analyzed as involving a null-to-nonnull mismatch between the IL and the RL, cf. (12):

(12) *She came into the room and left the door open.*

In the clause *left the door open* there is no expression of the Actor. Nevertheless, the clause will be understood as having the same Subject as the preceding clause, and this fact will be shown at RL; the fact that the speaker has not used any linguistic material to express this Actor will be analyzed as the absence of any Subact of Reference corresponding to that Actor at IL. Compare (13) and (14):

(13) (R_I) (T_I) (T_J) (R_J)   (T_K) (R_K)   (T_L)
      She   *came* *into* *the room* *and* *left* *the door* *open.*

(14) (R_I) (T_I) (T_J) (R_J)   (R_K) (T_K) (R_L)   (T_L)
      She   *came* *into* *the room* *and* *she* *left* *the door* *open.*

Zero anaphora is characteristic of languages with "low referential density" in the sense made familiar by Bickel (2003). Bickel shows how an elicited monologue in Belhare, a Sino-Tibetan language spoken in the Himalayan foothills of Eastern Nepal, displays very little use of Subacts of Reference. Here is a gloss provided by Bickel (2003: 709) of a passage from that monologue:

> First, . . . uh . . . picked mangos and took down in a big bag. Then put into a basket. Moved over by pulling from over there, and then came on a rickshaw, uh.. on a bike, on a bike and then . . . .

As Bickel (2003: 710) comments about this passage, "Identifying who did what in the story is mostly the listener's task". In FDG this strategy will be reflected in the relative non-use of Subacts of Reference, while at RL the Belhare verb for 'put, direct', *leŋs*, will have argument positions for Actor, Undergoer and Locative, although only the last of these is explicitly mentioned. Bickel (2003: 733) speculates that users of languages structured like Belhare "pay relatively more attention to the event than to the participants"; however, from an FDG perspective, it is more a question of communicative strategy, since the participants are fully present at the RL.

According to current typological insights, the degree of referential density of a language cannot be predicted from other features. This means that zero anaphora has to be captured by basic settings that specify correspondences between representational and interpersonal frames. In a language not allowing zero anaphora a two-place predication frame, for instance, at RL has to correspond to a content frame with two Subacts of Reference at IL:

(15) $[\quad (T_1) \quad (R_1) \quad (R_2) \quad]$
    $[\quad (f_1) \quad (x_1) \quad (x_2) \quad]$

while in languages allowing zero anaphora, depending on their degree of referential density, the correspondences would be as in (16) and (17):

(16) $[\quad (T_1) \quad (R_1) \qquad \quad]$
    $[\quad (f_1) \quad (x_1) \quad (x_2) \quad]$

(17) $[\quad (T_1) \qquad \qquad \quad]$
    $[\quad (f_1) \quad (x_1) \quad (x_2) \quad]$

Note that in order to establish these relationships, a certain amount of bottom-up consultation through the Fund is required.

3.2.3 Cross-reference

A form of mismatch in which the Speaker at IL performs two Subacts of Reference that both correspond to a single unit at RL is cross-reference, a term introduced

in Functional Grammar by Dik (1997). Dik (1997, 2: 403) discusses how a Theme – Clause – Tail sequence as in French (18), modified here, can lead through "demarking" to a single-clause expression of the type shown in (19):

(18) *Jean, il   le   lui   a   donné   à   Pierre,*
     Jean 3SG.M.NOM 3SG.M.ACC 3SG.DAT AUX.3SG give.PTCP to Pierre
     ton   livre.
     2SG.POSS book
     'John, he gave it to Peter, your book.'

(19) *Jean   il=le=lui=a=donné   à   Pierre*
     Jean   3SG.M.NOM=3SG.M.ACC=3SG.DAT=AUX.3SG=give.PTCP to Pierre
     ton   livre.
     2SG.POSS book.
     'John gave Peter your book.'

In the structure shown in (19), which informally represents the procliticization of the pronouns and the auxiliary verb, the erstwhile pronouns *il, le* and *lui* have come to act as "cross-referencing elements rather than as independent pronouns" (Dik 1997, 2: 404).

Agreement is in FDG a purely morphosyntactic operation, and as such does not involve the interface between IL/RL and ML (see 3.3). Cross-reference, by contrast, involves an appositional relationship in the sense that both the noun/adposition phrases (in (19), *Jean*, *à Pierre* and *ton livre*) and the markers on the verb reflect Subacts of Reference. The latter are identified in Hengeveld (2012) as "appositional referential markers", the underlying insight being that in each case the speaker is performing two Subacts at IL corresponding to a single unit at RL. The referential status of the markers is clear from the fact that they can occur in combination with the verb without the appositional element, in which case the entities being referred to can be retrieved from the Contextual Component. Consider the following example from Chickasaw (Hengeveld 2012: 476, data from Munro and Gordon 1982: 110):

(20) *Aboha   anõ'k-akõ   Dan   ib-aa-binni'li-li-tok.*
     house   in-CONTR.NONSBJ   Dan   COM-LOC-sit-1.SG.A-PST
     'I sat with Dan in the house.'

As Hengeveld (2012: 476) observes, the "Comitative, the Locative, and the Actor argument are all cross-referenced on the verb. Information on the semantic functions of these arguments can in most cases only be unequivocally retrieved on

the basis of the referential affixes on the verb themselves". The sentence *Ib-aa-binni'li-li-tok* would also be grammatical in the sense of "I sat with someone there". In other words, the Speaker's strategy here involves, for each of the three arguments/modifiers at RL, the performance of two Subacts of Reference, dividing the single unit of semantic information over the two.

Contrast this with "unique referential markers", as found in Canela-Krahô (Hengeveld 2012: 471, data from Popjes and Popjes 1986: 139), where there is a one-to-one correspondence between Subacts and semantic units:

(21) *Hũmre te po curan.*
man PST deer kill
'The man killed the deer.'

(22) *Cu-te po curan.*
3-PST deer kill
'He killed the deer.'

(23) *Cu-te ih-curan.*
3-PST 3-kill
'He killed it.'

Here in each case there is a single expression of the Actor (*hũmre*, *cu-* and *cu-* respectively) and single expression of the Undergoer (*po*, *po* and *ih-*). There is thus no agreement, but also no cross-reference, and the IL and RL align perfectly.

It seems that cross-reference, too, cannot be predicted from other typological properties of the language. This means that cross-reference has to be captured by basic settings that specify the correspondences between content frames and representational frames. In this case, the question is whether at IL one or more Subacts of Reference will be executed in connection with one argument or adjunct at RL. For instance, in order to produce (20), the following correspondence should be allowed:

(24) [(T_1) (R_1) (R_2) (R_3) (R_4) (R_5)]
[(f_1) (x_1) (x_2) (x_3)]

In (24) (R_1), (R_2), and (R_4) correspond to the referential markers on the verb, while (R_3) and (R_5) correspond to the lexical realizations of the locative and comitative constituents.

3.2.4 Gapping

The term "gapping" owes its origins to transformational grammar: the formal-syntactic viewpoint was that an element is introduced into the tree only to be deleted at a later stage, creating a gap, hence the name (Jackendoff 1971). Gapping can be subsumed under the more general heading of ellipsis (Haspelmath 2007) and from an FDG standpoint involves the non-performance of a Subact of Ascription in a non-initial coordinated clause (Mackenzie 2018). Consider example (25), in which the second coordinated clause corresponds to two Subacts of Reference only (*he* and *lemonade*), without any Subact of Ascription:

(25) *I had coffee*$_{Foc}$, *and he lemonade*$_{Foc}$.

Gapping is subject to various preconditions at the Interpersonal Level. The most fundamental of these, as in (25), is that the "gapped" or non-performed Subact of Ascription, if it had been performed, would have corresponded to a non-topical element in the initial coordinated clause which remains cognitively available for the interpretation of the non-initial clause. In addition there is typically a contrast between the two clauses, as again in (25): where this contrast has phonological consequences, the pragmatic function Contr(ast) will apply to the respective Subacts (in (25), to *I* and *coffee* in the first clause and to *he* and *lemonade* in the second).

Gapping is a phenomenon of formal written usage in English (Miller and Weinert 1998: 82) and is absent from those authors' corpus of spoken English. It is also entirely absent from various other languages, including the SVO languages Mandarin Chinese and Thai, and is not normally applied in Maltese (Borg and Azzopardi-Alexander 1997: 83, cited in Haspelmath 2007: 42):

(26) *Jien ħadt   kafè   u   hu   ħa   luminata.*
      1SG   took.1SG   coffee and   3SG.M took.3SG.M lemonade
      'I had coffee, and he (had) lemonade.'

Gapping is never obligatory in coordinated constructions,[4] and should be seen as deriving from a strategic choice available for formal communication in particular languages in order to bring out a contrast by using a marked construction.

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4 Cf. Spanish 'subdeletion' as in *María leyó más libros que Juan (*leyó) revistas* ('Mary read more books than John (read) magazines'; Reglero 2006).

Given FDG's ban on deletion, gapping cannot be an operation of omission or suppression internal to ML. Otherwise ML would randomly delete any parallel material, which may lead to ungrammatical results, as in (27) and (28), and may even have a comical zeugmatic effect (28):

(27) *John heard no one object, and Bill ~~heard no one~~ say anything.*

(28) *She called Mary a taxi and ~~she called Mary~~ an idiot.*

Rather, ML has to create a clause for which the Subact of Ascription has not been made available. However, to encode the remaining elements of the non-initial clause, the ML is dependent upon a complete RL analysis. This is visible in the following examples of gapping from German:

(29) *Er   unterstütz-te mich,   und ich   ihn.*
      3SG.M.NOM support-PST   1SG.ACC and 1SG.NOM 3SG.M.ACC
      'He supported me, and I him.'

(30) *Er   half   mir,   und ich   ihm.*
      3SG.M.NOM help.PST 1SG.DAT and 1SG.NOM 3SG.M.DAT
      'He helped me, and I him.'

In the second coordinated clause, the case-marking of the second argument is dependent upon the selection of the verb: *unterstützen* 'support' requires accusative marking and *helfen* 'help' requires dative marking. It is therefore necessary for the verb to be present in the Configurational Property to ensure correct case-marking of its arguments. The fact that this verb must be identical to the verb in the initial clause suggests that the Contextual Component, which retains a full copy of the RL of that clause, may play a role here, influencing the process of formulation to ensure semantic parallelism between the clauses.

It seems that the extent to which languages allow gapping cannot be predicted from a typological perspective, so it has to be specified as a basic setting within the grammar, which concerns the matching between a content frame at IL and a representational frame at RL, as illustrated in the following representation of sentences like (30):

(31) [(T_1) (R_1) (R_2) (R_3) (R_4)]
      [(f_1) (x_1) (x_2) (f_1) (x_2) $(x_1)_U$]

Only the first instance of (f_1) in (31) corresponds to a Subact of Ascription; the second one does not, and therefore is not expressed overtly, though it is present in the semantic representation. In languages like Maltese, as illustrated in (26), there would be a Subact of Ascription corresponding to the second instance of (f_1).

There are certain morphosyntactic restrictions on gapping in languages like German. Consider for instance the following example (Hella Olbertz, p.c.):

(32) *Er   schlägt   mich   und   ich   *(schlage)   ihn.*
     He   strikes   me   and   I   strike   him
     'He strikes me and I him.'

When two verb forms are not formed in a parallel way because they form part of an irregular paradigm (note the umlaut in the 3rd person form *schlägt*), gapping is not allowed. Since this restriction is based on formal properties of the constituent only, there is a phonological restriction on a pragmatically and semantically motivated operation. This means that in this case we need a bottom-up verification process, which checks within the Fund whether or not the verb form to be gapped corresponds in its basic form with the first occurrence of that same verb. The vertical connections within the Fund proposed in Section 2.4 allow for this.

3.2.5 Verb doubling

Whereas gapping involves a null-to-nonnull relation between IL and RL, we will now consider an example of a many-to-one (strictly speaking a two-to-one) relation between IL and RL. The construction in question occurs in various languages in different but similar guises. In Spanish, Portuguese and Catalan, it involves an infinitive form of a zero- or one-place intransitive verb followed by a finite form of the same verb, which may be negated. Hengeveld and Mackenzie (2008: 348) analyzed the Spanish construction – we now believe erroneously – as involving a dummy predicate at ML. Consider the following examples from Spanish:

(33) a *Llov-er   lluev-e.*　　　　　　b *Llov-er   no   lluev-e.*
       rain-INF   rain-IND.PRS.3SG　　　　rain-INF   NEG   rain-IND.PRS.3SG
       'It does rain to a certain extent.'　　'It doesn't really rain.'

(34) a *Ayud-ar   ayud-a.*　　　　　　b *Ayud-ar   no   ayud-a.*
       help-INF   help-IND.PRS.3SG　　　　help-INF   NEG   help-IND.PRS.3SG
       'It does help to a certain extent.'　　'It doesn't really help.'

The construction is typical of the informal spoken language, but it can be found in written form in certain informal settings on the internet, such as web fora and blogs. It is pronounced in a single Intonational Phrase and in writing usually occurs without a comma after the infinitive; these formal properties signal the presence of a single Discourse Act.

These constructions, we argue, contain two Subacts of Ascription at IL, with distinct pragmatic functions, Topic and Focus respectively. The Subact corresponding to the infinitive is Topic, evoking a contextually available event (e.g. rain), and the Subact corresponding to the finite verb is Focus, offering new information about that Topic, namely that the event happens or does not happen. At RL, however, there is only one State of Affairs, the one denoted by the finite verb. This means that a sentence like (33a) has the following representation, in which the mismatch is visible in the presence of two Subacts of Ascription and a single Lexical Property.:

(35) $[\quad (T_1)_{Top} \qquad (T_2)_{Foc} \quad]$
  $[\qquad\qquad (f_1) \qquad\qquad]$

The extent to which languages allow this kind of construction seems again to be largely a basic setting, rather than being predictable from other features of the language.

3.2.6 Asyndetic conditionals

Another case of a mismatch between IL and RL concerns cases in which one Communicated Content at IL corresponds to two Propositional Contents at IL. This is the case of asyndetic conditionals of the type found in informal usage in certain varieties of English (cf. also Jackendoff and Audring 2020: 247–248), as illustrated in (36):

(36) *He's home he's having dinner.*

This sentence corresponds to the more explicit (37):

(37) *If he is home he is having dinner.*

In (37), the conditional is at RL a subordinate Propositional Content that is a modifier within the main Propositional Content:

(38) $[\qquad\qquad\qquad\qquad (C_I) \qquad\qquad\qquad\qquad]$
  $[\ (p_j: - \text{he is having dinner} - (p_j): (p_i: - \text{he is home} - (p_i))_{Cond}\ (p_j))\ ]$

Thus the Communicated Content at IL corresponds to a single Propositional Content (p_j) at RL, which itself contains another Propositional Content (p_i). The propositional nature of (p_i) and (p_j) follows from the fact that the conditional can be paraphrased as in (39):

(39)   *If **it is true that** he is home then he is having dinner.*

while the main clause may contain a propositional modifier, as in (40):

(40)   *If he is home he is **probably** having dinner.*

The interpretation of the asyndetic (36) is identical to the syndetic one in (37). However, in this case the two Propositional Contents are simply juxtaposed, and the conditional relation is not expressed but implied. In this case the representation would therefore be as in (41):

(41)   [(C_I)   ]
       [(p_i: – he is home – (p_i)) (p_j: – he is having dinner – (p_j))]

As shown in (41), one Communicated Content is now mapped onto two Propositional Contents.

The circumstances under which a language can use constructions like (36) have to be specified as a basic setting concerning the possible mappings between content frames at IL and representational frames at RL.

3.2.7 Temporal adverbial clauses

Mackenzie (2019: 311–314) discusses the following construction:

(42)   *After Mary introduced herself to the audience, she turned to a man she had met before.*

He argues that in this case we have two Communicated Contents corresponding to a single Propositional Content. An argument in favour of analyzing (42) as based on two C's is that both the subordinate clause and the main clause may be modified separately by a reportative modifier:

(43)   *After Mary **reportedly** introduced herself to the audience, she turned to a man she had met before.*

(44) *After Mary introduced herself to the audience, she **reportedly** turned to a man she had met before.*

An argument in favour of analyzing (45) as containing just one (p) is that propositional verbs have scope over both clauses:

(45) *I **believe** that after Mary introduced herself to the audience, she turned to a man she had met before.*

Here we thus have the opposite situation to the one sketched in the previous section, where the relationship was one-to-many. Here we have a case in which the relationship is many-to-one, as schematically represented in (46):

(46) $[(C_I)$ $(C_J)]$
      $[(p_i: –$ After Mary introduced   she turned to a man she
      herself to the audience,   had met before $– (p_i))]$

For a full representation of this sentence, see Mackenzie (2019: 311–314).

3.3 Mismatches between IL/RL and ML

3.3.1 Introduction

Mismatches between IL/RL and ML are the ones that have received most attention in the literature. In the FDG model it is here that the relation between (interpersonal and representational) meaning and (morphosyntactic) form becomes relevant, a relation that has also been central in the discussion of transparency in language. In this section we limit ourselves to mismatches that originate in the interface between IL/RL and ML, which is called *Morphosyntactic Encoding*. It is important to note that mismatches may also originate outside that interface. As discussed in Hengeveld and Leufkens (2018), several non-transparent features of language originate within ML itself. For instance, it is within ML that dummy insertion is taken care of, where the insertion of a dummy creates a discrepancy between IL/RL and ML, as the dummy does not have an IL/RL counterpart. As this type of discrepancy does not arise in an interface, it will not play a role in this section.

Mismatches that do arise in the interface between IL/RL and ML can be organized into three different pairs, the members of which will be discussed one by one in the following subsections:

(i) a In languages that display grammatical relations (at ML), there is *neutralization* of pragmatic (IL) and semantic (RL) functions. Thus there is a reduction of the distinctions available at IL and RL to a smaller number of distinctions at ML. For instance, in English Actor and Undergoer arguments of intransitive predicates (RL) are both treated in the same way as Subjects at ML. This is thus an instance of a many-to-one mismatch.

  b The opposite situation occurs when a language displays *suppletion*, which may be lexical or syntactic. In the case of lexical suppletion, a single meaning is realized in different forms. In the case of syntactic suppletion the same unit, e.g. a Communicated Content, may be realized differently depending on whether it is realized as a main or as a subordinate clause. Both are instances of one-to-many mismatches.

(ii) a *Incorporation* and *compounding* lead to a situation in which two or more meaning units are realized as a single morphosyntactic unit, as in the case of *truck driver* or *bookcase*. Again this is a case of a many-to-one mismatch.

  b The opposite situation occurs in *idiom formation*, where a single meaning unit at IL and RL corresponds to a series of morphosyntactic units, e.g. when the idiomatic Verb *kick_the_bucket* at RL corresponds to a sequence of (Vp) and (Np) at ML. This is a one-to-many mismatch.

(iii) a *Fusion* leads to a situation in which two or more meaning units fuse into a single morphosyntactic unit, as when a stem and an affix fuse into a single morphosyntactic unit, e.g. *went* as the past tense of *go*. This is a case of a many-to-one mismatch.

  b The opposite of fusion is *discontinuity*, where a single meaning unit is distributed over different positions. Circumfixes are a clear example of this situation.

Note that we only have instances here in which there is a one-to-many or a many-to-one mismatch. Null-to-nonnull mismatches do exist, but do not arise in the interface. Above we mentioned the case of dummy insertion, which introduces an element in morphosyntax (nonnull) that does not correspond to any semantic or pragmatic material (null). The opposite case, nonnull-to-null, is not something we would expect in FDG, as deletion, just like other transformations, is not allowed in this theory.

3.3.2 Neutralization

Neutralization of semantic functions is illustrated in the following examples from English:

(47) *I ran.* (A)

(48) *I'm good.* (U)

(49) *I'm feeling lazy.* (L)

All three sentences have a single argument. In (47) this argument is an Actor, in (48) an Undergoer, and in (49) a Locative. Experiencers are treated as a subtype of Locative in FDG, see Hengeveld and Mackenzie (2008: 194–206). Despite these different semantic functions, the arguments behave the same way in all three sentences: they do not carry a case marker, occupy the preverbal position, and trigger verbal agreement. The neutralizing effect becomes particularly visible when these examples are compared to parallel ones in Chickasaw, a language without neutralization (Munro and Gordon 1982: 81, 81, 83):

(50) *Malili-li.* (A)
       run-1.SG.A
       'I ran.'

(51) *Sa-chokma.* (U)
       1.SG.U-good
       'I'm good.'

(52) *An-takho'bi.* (L)
       1.SG.L-lazy
       'I'm lazy.'

We can thus say that in Chickasaw there is a transparent relation between RL and ML in this respect, and there is no mismatch, while in English there is: three different semantic functions are mapped onto a single morphosyntactic function, usually called Subject.

A proportion of the languages that show neutralization in intransitive predications also show neutralization between intransitive and transitive predications. When there is neutralization of the A argument in transitive predications and the only argument in intransitive predications, the alignment system is accusative.

When there is neutralization of the U argument in transitive predications and the only argument in intransitive predications, the alignment system is ergative. In accusative languages the nominative arguments may be called the Subject, and in ergative languages the absolutive arguments may be called the Subject. Neutralization shows up especially clearly in passivization in accusative languages and anti-passivization in ergative languages. Thus, in the examples (53)–(54) the A (53) and U (54) arguments in the accusative language English show the same formal behaviour, and in (55) and (56) the U (55) and A (56) arguments show the same formal behaviour in the ergative language Basque (Hualde and Urbina 2003: 431).

(53) *The man read a book.*   (A-Subject)

(54) *The book* (U) *was read by the man* (A).   (U-Subject)

(55) *Gutun   hau   zuk   idatzia   da.*   (U-Subject)
      letter   this.ABS you.ERG write.PFV.DET   AUX.3.SG
      'You have written this letter.'

(56) *Ni   gutun   asko   idatzia   naiz.*   (A-Subject)
      I.ABS   letter   a.lot.ABS write.PFV.DET   AUX.1.SG
      'I have written a lot of letters.'

A proportion of the preceding group of languages also show neutralization of U arguments in transitive predications and L arguments in ditransitive predications, as shown in the following examples from Kham (Watters 2002: 67, 68):

(57) *Ŋa:-Ø   no:-lai   ŋa-Ø-r̃:h-ke.*
      I-NOM   he-OBJ   1.SG.SBJ-3.SG.OBJ-see-PFV
      'I saw him.'

(58) *Ŋa-lai   bəhtanji   y-ã:-ke-o.*
      I-OBJ   potato   give-1.SG.OBJ-PFV-3.SG.SBJ
      'He gave me a potato.'

These neutralized arguments in this case are called Objects.

    In the case of Kham this is the only way of marking U and L arguments, and the alignment type is called secundative. In other languages, the alignment type is indirective, as for instance in German (Haspelmath 2008: 78):

(59) *Sankt Georg-Ø* (A) *tötete den   Drach-en* (U).
      St.   George-NOM killed DEF.ACC dragon-ACC
      'St. George killed the dragon.'

(60) *Sankt Martin* (A) *gab   dem   Bettler* (L) *seinen   Mantel* (U).
      St.   Martin   gave DEF.DAT beggar   his.ACC cloak
      'St. Martin gave the beggar his cloak.'

In yet other languages there is variable assignment of the Object function, called dative shift. This is illustrated here for English:

(61) *Peter* (A) *gave some flowers* (U) *to Sheila* (L).

(62) *Peter* (A) *gave Sheila* (L) *some flowers* (U).

In ergative languages the arrangement of the U and L arguments works out differently. As the U argument already aligns with the only argument of intransitive predications, and is thus the absolutive Subject, this Subject function extends to the ditransitive U in indirective alignment, and the ditransitive L in secundative alignment. The Object function is thus not needed for ergative languages (see Hengeveld and Mackenzie 2008: 329).

In order to account for these phenomena, the interface needs to contain at least the following basic settings and constraints. First of all, the position of the language with respect to the Syntactic Function Hierarchy in (63) should be specified.

(63)   Syntactic Function Hierarchy
        Subject   >   Object
     1. +   +
     2. +   −
     3. −   −

If a language has a syntactic function Object, it also has the syntactic function Subject; a language may have the Subject function only, but the hierarchy also predicts a language type that does not have any syntactic functions at all, in which case there is no mismatch. Chickasaw above is a case in point.

If a language does have syntactic functions, the interface has to know whether the language is ergative or accusative, and whether it is indirective or secundative, which are basic settings.

The next step is for the question to become relevant which arguments, in the case of variable assignment, can become subject or object, in terms of their semantic functions. The Semantic Function Hierarchy takes different forms for accusative and ergative languages:

(64)   Semantic Function Hierarchy – Subject assignment (accusative)

	A	>	U	>	L	>	Other
1.	+		+		+		+
2.	+		+		+		−
3.	+		+		−		−
4.	+		−		−		−

(65)   Semantic Function Hierarchy – Subject assignment (ergative)

	U	>	A	>	L	>	Other
1.	+		+		+		+
2.	+		+		+		−
3.	+		+		−		−
4.	+		−		−		−

(66)   Semantic Function Hierarchy – Object assignment (accusative)

	A	>	U	>	L	>	Other
1.			+		+		+
2.			+		+		−
3.			+		−		−

3.3.3 Suppletion

In the preceding section we illustrated a situation in which several types of semantic unit map onto a single morphosyntactic unit, i.e. Subject or Object. In this section we will focus on a process that is quite the opposite, that is, one in which a single semantic unit maps onto several morphosyntactic units. This happens when a semantic unit assumes different forms depending on the specific morphosyntactic configuration in which it occurs. This phenomenon is called suppletion when applied to lexical stems, but we will also apply it to larger morphosyntactic units.

Lexical suppletion may be illustrated with the following examples from Wambon (de Vries 1989: 23), a language in which several verbs have various manifestations, depending on the TMA category that has to be expressed. For instance, the meaning 'eat' is expressed in Wambon as either *en-*, *ande-* or *na-*.

Ande- is used with past and future tenses and with the plural imperative, *na-* is used with the singular imperative, and *en-* is used elsewhere. Some examples are given in (67)–(68) (de Vries 1989: 24, 32):

(67) *Ande-t-ep-mbo.*
 eat-PST-1.SG-PST
 'I ate.'

(68) *E-nok-si-t.*
 eat-NEG-INT.NEG-3.SG
 'He does not want to eat.'

As noted in Section 2.3, forms and structures that cannot be handled productively by regular rules have to be taken care of by the Fund through the rule of fundal priority. The various forms in a paradigm have to be listed in the set of primitives that feeds the ML and the conditions on their insertion have to be implemented through language-specific rules. This example demonstrates the importance of a distributed approach to the lexicon in FDG.

Syntactic suppletion is a term that we propose here, in parallel with its lexical counterpart, for the phenomenon in which a complex semantic unit has different morphosyntactic manifestations. Consider the following examples from Dutch:

(69) *Ik betreur* [*dat gisteren gezegd te hebben*].
 I regret DEM yesterday said to have
 'I regret saying that yesterday.'

(70) *Ik betreur* [*dat ik dat gisteren heb gezegd*].
 I regret SUB I DEM yesterday have said
 'I regret that I said that yesterday.'

(71) *De jongen* [*die dat gisteren heeft gezegd*] *is mijn broer.*
 the boy who DEM yesterday has said is my brother
 'The boy who said that yesterday is my brother.'

(72) **De* [*dat gisteren gezegd hebbende*] *jongen is mijn broer.*
 the DEM yesterday said having boy is my brother
 'The boy saying that yesterday is my brother.'

In FDG both the complements of commentative verbs and relative clauses are treated semantically as Episodes, as they may contain absolute temporal

expressions, such as *gisteren* 'yesterday'. Yet the way in which these Episodes are expressed in Dutch is different, as (under similar conditions of coreference), the relative clause has to be finite, as shown in (71)–(72), while the complement clause of the commentative predicate may be realized non-finitely, as shown in (69)–(70). This means that in Dutch the expression of an Episode depends on the question whether it occupies an argument or a modifier position.

In other languages such discrepancies do not occur. Consider the following examples from Maltese (Borg and Azzopardi-Alexander 1997: 30, 35):

(73) [*Li* *l-ġimgħa* *d-dieħla* *se* *tkun* *vaganza*] *hija*
    SUB DEF-week DEF-entering.F.SG FUT COP.3.F.SG holiday 3F.SG
    stqarrija *sorprendenti.*
    statement surprising
    'It is a surprising statement that next week will be a holiday.'

(74) *Rajt* *il-qattus* [*li* *t-tfal* *xtraw* *il-bieraħ*].
    saw.1SG DEF-cat SUB DEF-children bought.3PL DEF-yesterday
    'I saw the cat that the children bought yesterday.'

The complement clause in (73) and the relative clause in (74) are both finite and identical to main clauses, except that the coreferential element in the relative clause is not expressed, but this depends on independent factors that we looked at in Section 3.2.

Hengeveld and Luberti (2020) investigate how syntactic suppletion fits into Hengeveld and Leufkens' (2018) transparency hierarchy, and show that languages behave systematically as regards the extent to which they allow the use of the same clause type in different functions. The distribution of this feature can thus be captured by a typological hierarchy (see Hengeveld and Luberti 2020: 14). The clause types themselves are captured by morphosyntactic templates.

3.3.4 Incorporation/compounding

In cases of incorporation and compounding two pragmatic/semantic units map onto one morphosyntactic unit. A full treatment of incorporation in relation to interfaces in FDG can be found in Olthof and Hengeveld (this volume). We focus here on compounding.

Hengeveld and Mackenzie (2016) distinguish between three types of compounds, illustrated in (75)–(77), in which the dollar sign is a variable for lexemes:

(75) $(f_i: [(f_j: (\$_i|drive) (f_j)) (x_i)_A (x_j: (f_k: (\$_j|truck_N (f_k)) (x_j))_U) (f_i))$ *truck driver*

(76) $(f_i: (f_j: (\$_i|case) (f_j): (f_k: (\$_j| book) (f_k)) (f_j)) (f_i))$ *bookcase*

(77) $(f_i: [(f_j: (\$_i|singer) (f_j)) (f_k: (\$_j| composer (\$_j)) (f_k))] (f_i))$ *singer-composer*

In (75) *truck* (x_j) is an argument of *drive* (f_j); in (76) *book* (f_k) modifies (:) *case* (f_j); in (77) *singer* (f_j) and *composer* (f_k) are juxtaposed. In all cases the combination of elements forms a complex Property f_i. The various lexical elements are expressed as a single Morphosyntactic Word at ML.

Compounding is not universal. For instance, Fortescue (2004: 1394) notes with respect to West-Greenlandic: "In stark contrast to its rich derivational potential the language does not allow nominal or verbal compounding at all". When languages do have compounding, the types of compounding they have do not seem to be predictable in implicational terms (Bauer 2011: 355). The compounding possibilities of the language concerned thus have to be specified in the Fund in terms of semantic frames such as the ones given in (75)–(77).

3.3.5 Idiom formation

The opposite of incorporation and compounding is idiom formation. Keizer (2016) distinguishes three types of idioms: (i) unmotivated, semantically non-decomposable idioms such as *to kick the bucket*; (ii) motivated, semantically non-decomposable idioms, such as *to smoke the peace pipe*; and (iii) motivated, semantically decomposable idioms, such as *to spill the beans*. Idioms of the first class are represented by Keizer as single but complex lexical items at IL and RL but as multiple morphosyntactic units at the Morphosyntactic Level. In this case there is thus a mismatch between IL/RL and ML. Thus, the analysis she proposes for (78) at IL, RL, and ML is given in (79):

(78) *He kicked the bucket.*

(79) IL: $(A_1: [(F_1: DECL (F_1)) (P_1)_S (P_2)_A (C_1: [(\mathbf{T_1})_{\mathbf{FOC}} (+ id R_1)] (C_1))] (A_1))$
      RL: $(p_1: (past\ ep_1: (e_1: (f_1: [\mathbf{(f_2: kick\_the\_bucket_V (f_2))} (1x_1)_U] (f_1)) (e_1))$
           $(ep_1)) (p_1))$
      ML: $(Cl_1: [(Np_1: (Nw_1: he (Nw_1))_{Subj} (Np_1)) \mathbf{(Vp_1: (Vw_1: kick\text{-}past (Vw_1)) (Vp_1))}$
           $\mathbf{(Np_2: [(Gw_1: the (Gw_1)) (Nw_2: bucket (Nw_2))] (Np_2))}] (Cl_1))$

The second and third classes are treated by Keizer as complex both at RL and ML, but as a single Subact and a fixed combination of Subacts at IL. These cases are therefore not of interest to us here.

Idioms such as *kick_the_bucket* must be listed as lexical entries in the Fund, with the pragmatic, semantic and morphosyntactic information being independently specified in the respective components of the Fund. Given the highly idiosyncratic nature of idioms, typological parametrization is not possible (see also Contreras García 2012, Jackendoff and Audring 2020).

3.3.6 Fusion

The notion of fusion applies to two different phenomena in language. On the one hand, it covers *cumulation*, which is the expression of more than one grammatical category in one morpheme. For instance, the morpheme *-é* in the Spanish example (80) expresses four grammatical categories at the same time:

(80) *compr-é*
    buy-IND.PAST.PF.1SG
    'I bought.'

Cumulation seems not to be predictable from a typological point of view. Virtually all languages in Leufkens (2015)'s study show cumulation of one type or another, and the author remarks that "the fusion feature 'Cumulation of TAME and/or case' also shows a scattered distribution" (Leufkens 2015: 138). It thus seems that for every language one has to stipulate the categories that are expressed cumulatively.

On the other hand, the notion of fusion also covers *stem alternation*, which occurs when the form of a lexical stem is affected by the expression of a grammatical category. Thus, *saw* in (81) expresses the lexical meaning *see* and the past tense simultaneously.

(81) *saw*
    see.PAST.SG

Hengeveld (2007) shows that stem alternation is not randomly distributed, but partly depends on the parts-of-speech system of a language. Most importantly, if languages do not make a distinction between verbs, nouns, adjectives, and adverbs, they have no stem alternation at all; if they do not make a distinction

between nouns, adjectives, and adverbs, they do not have stem alternation in nouns and adjectives; and if they do not make a distinction between adjectives and adverbs, they do not have stem alternation in adjectives. However, in all other circumstances languages may or may not have stem alternation in unpredictable ways, and where languages show stem alternation it is not predictable for which specific lexical items. Hence stem alternation has to be specified in the Fund.

3.3.7 Discontinuity

The opposite of fusion is discontinuity, which may manifest itself in the morphology and in the syntax of a language. A morphological example is given in (82), from Dutch, and a syntactic example in (83).

(82) ***ge**-wandel-**d***
      RES.PTCP-walk-RES.PTCP
      'walked' (participle)

(83) *I saw **a man** yesterday **that was carrying a huge suitcase.***

Discontinuity occurs when a single semantic unit is expressed in more than one morphosyntactic position. Thus, in (82) the two parts of the circumfix *ge-X-d* together express resultativity, and none of the two parts has a meaning by itself.[5] In (83), the single description of an Individual *a man that was carrying a huge suitcase* is expressed in two different syntactic positions.

In Hengeveld and Leufkens (2018) discontinuity is the only feature investigated that cannot be assigned a position in the transparency hierarchy without counterexamples. It thus seems that, again, the types of discontinuity have to be stipulated, in terms of the morphosyntactic templates listed in the Fund.

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5 Similarly, in languages with non-concatenative stems, the discontinuity is a property of both the stem and its inflection. In Arabic (Ryding 2005: 45–47), for example, a system of consonantal roots interlocks with patterns of vowels to yield words that may contain affixes and/or involve consonantal gemination. For example, the sequence kV_1tV_2b 'writing' is seen in *kitaab* 'book', *kutub* 'books', *kutub-an* 'books-ACC', *kaatib* 'writer', *kuttaab* 'writers', *katab-a* 'he wrote', *katab-at* 'she wrote', *na-ktub-u*, 'we write', etc. Here too, the root *k-t-b* has meaning, but neither the individual V_1 nor V_2 does.

4 Mismatches between IL/RL/ML and PL

4.1 Introduction

The mismatches pertaining to the interaction between the Phonological Levels and the higher levels involve (a) cases where phonological phrasing does not run parallel to morphosyntactic phrasing and (b) cases where phonological considerations have an impact upon the workings of the higher levels and in this way cause mismatches. These will be dealt with in turn.

4.2 Phonological versus morphosyntactic phrasing

There appear to be major differences across languages in the extent to which phonological structure reflects morphosyntactic structure. In particular, it has been argued (Lahiri and Plank 2010) that in Germanic languages rhythmic considerations predominate over the groupings that follow from morphosyntactic considerations, leading to rather radical differences between ML and PL. In Romance languages, by contrast, there is quite good alignment between ML and PL.

An example of the former situation discussed in Lahiri and Plank (2010: 376–377) is given in the famous slogan shown in (84):

(84) *Drink ‖ a pint | of   milk ‖ a   day.*
      /ˈdrɪŋkə   ˈpaɪntə(v) ˈmɪlkə   ˈdeɪ/

The syntactic structure in (84) involves a succession of Vp, Np and Np, the first Np containing an Adpp. In pronunciation, however, the divisions between the Phonological Phrases, each characterized by carrying stress, are radically at odds with the morphosyntactic analysis: the indefinite article of *a pint* is realized as a single Phonological Phrase with the verb, and the head noun *pint* of *a pint* is realized as a single Phonological Phrase with the preposition *of* from the Adpp *of milk*. In fact, the effect is so strong that a neologism *pinta* /ˈpaɪntə/ arose in UK advertising to mean 'pint of milk'.

By contrast, in French main clauses there is good alignment between syntactic and phonological phrases, as in the following advertising slogan:

(85) *Du pain,   du vin,   du Boursin.*
      /dyˈpɛ̃   dyˈvɛ̃   dybuʁˈsɛ̃/
      PARTV bread   PARTV wine   PARTV Boursin.cheese
      'Bread, wine, Boursin.'

The Intonational Phrase divides into three (rhyming) Phonological Phrases and each Phonological Phrase corresponds exactly to a Noun Phrase.

Languages can thus differ quite strikingly in the extent to which there are one-to-one or many-to-many mappings between morphosyntactic and phonological structure. In the case of a one-to-one mapping, information from ML can be fitted directly into a prosodic template at PL. In the case of a many-to-many mapping, the string of elements that is the output of ML acquires its phonological shape, including lexical stress where relevant, at PL, and this string is then fitted into a prosodic template based on phonological rather than syntactic considerations. In the case of (84), the unstressable indefinite article *a* as well as the unstressable preposition *of* form a unit with the stressed lexical unit that precedes them, thus following the trochaic pattern of the prosodic template. This is shown in (86).

(86) (Cl$_i$:   [(Vp$_i$: –drink– (Vp$_i$)) (Np$_i$: [(Gw$_i$: a (Gw$_i$))
     (IP$_I$:   [(PP$_i$: – 'drɪŋkə – (PP$_i$))
               (Nw$_i$: pint (Nw$_i$)) (Adpp$_i$: [(Adpw$_i$: of (Adpw$_i$))
               (PP$_j$: – 'paɪntə(v) – (PP$_j$))
               (Np$_j$: milk (Np$_j$))] (Np$_i$)) (Adpp$_i$)) (Np$_k$: [(Gw$_j$: a (Gw$_j$))
               (PP$_k$: – 'mɪlkə – (PP$_k$))
               (Nw$_k$: day (Nw$_k$))] (Np$_k$))]   (Cl$_i$))
               (PP$_I$: – 'deɪ/ – (PP$_I$))]   (IP$_I$))

4.3 Bottom-up impact of phonology

Phonological considerations may in some cases determine the choices that have to be made at higher levels. Such cases of bottom-up processes are difficult to deal with in a strictly top-down architecture. In 2.4 we argued that FDG should allow bottom-up feedback processes, but should restrict these to the Fund and to the Contextual Component. We will make use in this section of this adaptation of the architecture of FDG. Note that Inkelas (2014: 281–315), who inventories these cases, after considering a wealth of earlier studies finds that in general the influence of phonology on morphology is "fairly limited" (2014: 314). However, a number of the cases she treats are relevant to our considerations here. In the following we will discuss examples where PL may have a bottom-up impact on IL, RL or ML. One may expect that the larger the distance between PL and a higher level, the less likely it is that this higher level will be sensitive to PL.

4.3.1 PL-IL: Norwegian imperatives

Inkelas (2014: 289) raises the problem of "ineffability", i.e. cases where some phonological constraint makes it impossible to express a regular meaning, giving (2014: 292) the example of Norwegian imperatives, which are identical to the infinitive, but without the final suffix *−e*. Where this leads to an unacceptable syllabic coda (specifically certain phonologically illicit syllable-final consonant clusters), the imperative form is blocked:

(87) INFINITIVE   IMPERATIVE
     å åpne   **åpn*   'open'
     å padle   **padl*   'paddle'
     å sykle   **sykl*   'bike'

According to Inkelas (2014: 292), ". . . some speakers repair the problem phonologically by devoicing the final sonorant (i.e. /n/ or /l/), while others simply recruit the infinitive form for use as the imperative. Still other speakers experience a genuine paradigm gap in these cases, and resort to periphrasis to express the intended meaning."[6] The third option is relevant to us here, as in this case the speaker feels forced to select a basic Illocution other than IMP at the Interpersonal Level. Thus, a choice at IL is co-determined by phonological considerations. Note that RL plays a role in this process as well, as the choice of a particular verb, such as *åpne* 'open' in (87), takes place at that level. This means there has to be feedback from RL to IL too. By allowing this feedback within the Fund, both the choice of the basic Illocution and the choice of the verb can be made sensitive to the phonological shape of the verb, which is stored in the compartment of the Fund corresponding to PL.

4.3.2 PL-RL: Comparative adjectives in English

The basic facts and a treatment of comparative adjectives in English in terms of FDG were proposed in Hengeveld and Mackenzie (2008: 454–455, see also Inkelas 2014: 290). They observe that there is an alternation between the syntactic option of creating an Adjp with *more* (*more delicious*) and the morphological operation

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6 This has been confirmed by speaker of Norwegian Hilde Hasselgård (p.c.), who recognizes the second and third options; in the third option, speakers will sense the phonological problem, she says, and use such circumlocutions as *Kan du åpne* . . . 'Can you open . . .' or *Du må åpne* . . . 'You must open . . .'.

of suffixing –*er* (*tastier*). Which form is chosen depends upon the phonological characteristics of the adjective: the suffix is required where the stem is mono-syllabic (*old*, *older*) and often preferred where the adjective is disyllabic with an unstressed second Syllable (*tasty*, *tastier*). Where the stem has three or more Syl-lables, the syntactic option has to be taken (*persistent*, *more persistent*).

Hengeveld and Mackenzie (2008: 455) take *more* to be lexical, because it can be modified (*much more persistent, enormously more persistent*) and propose the frame in (89) (here modified in the light of post-2008 developments in FDG) for the Configurational Property of, for example, (88):

(88)   *John is noticeably more intelligent than his brother.*

(89) $[(f^c_1: (f_1: \blacklozenge_{Adj} (f_1): (f_2: more_{Adv} (f_2): (f_3: \blacklozenge_{Adv} (f_3)) (f_2)) (f_1)) (x_1)_{Standard})) (f^c_1)) (x_2)_U]$

It is hypothesized by the authors that the same frame also underlies (90), so that at the Representational Level, both forms have the same analysis.

(90)   *John is noticeably bigger than his brother.*

As for the Morphosyntactic Level, Hengeveld and Mackenzie (2008: 455) propose that (90) is not only semantically parallel to (88) but also has the same general form as (88). In other words, what is found at ML is the ungrammatical *John is markedly more big than his brother*; it is left to PL, where it is possible to be sen-sitive to the monosyllabic property of *big*, to yield the grammatical form *bigger*.

There is, however, a problem with this analysis, which is that in (88) mod-ification of the degree expressed by *more* is indeed possible, but in (90), with the suffixal expression, it is not. One of the readings of (88) is that the property *intelligent* holds to a higher extent for John, and that this extent is noticeable. The reading in (90), however, is that John's being bigger than his brother is notice-able. Thus, in (90), *noticeably* modifies *bigger* as a whole, and not just the *-er* suffix. This is due to the fact that the comparative suffix is triggered by an opera-tor (Comp), a grammatical element that cannot be modified, so that (90) should have the representation in (91):

(91) $[(f^c_1: (Comp f_1: \blacklozenge_{Adj} (f_1): (f_2: \blacklozenge_{Adv} (f_2)) (f_1)) (x_1)_{Standard})) (f^c_1)) (x_2)_U]$

As a result, (88) and (90) have different semantic representations.

The second problem is that our earlier analysis requires a transformation at ML, in that first the Advw *more* is inserted, which subsequently is changed into the Aff *-er*. Such transformations are dispreferred in a functional approach.

The modifications of FDG proposed in Section 2 now allow us to propose a different solution, which makes use of bottom-up feedback provided through the Fund. In creating a comparative construction, there are two representational frames available for English, as given in (89) and (91). The choice of one or the other of these two frames is dependent on the phonological properties of the lexeme selected for the (f_1) slot in those frames. Through the Fund, the phonological properties of this lexeme are consulted, and the choice of one or the other frame is determined. The representations at ML and PL can from there on be formed regularly.

4.3.3 PL-ML: Affix metathesis in Witsuwit'en

In Section 2.4 we already discussed the case of Tagalog, where the order of head and modifier in noun phrases is in some cases determined by the phonological properties of the lexemes used in building up the noun phrase. A parallel case, but now in morphology, is that of affix metathesis in Witsuwit'en, an Athabaskan language (Inkelas 2014: 311–312). Cases like these are characterized by Inkelas as "not easy to find" (2014: 311). This is a rare instance of where affix order is determined by phonological rather than, as would be expected in FDG (and more generally in grammatical theory), semantic considerations. Witsuwit'en is a language in which negation scopes over aspect (referred to as "tense" by Inkelas) and accordingly the negative prefix *s-*[7] occurs further from the stem than aspect prefixes. However, this prefix is constrained at the Phonological Level to only occur as the coda of a syllable, and this requirement imposes positioning of the prefix after an aspect prefix to guarantee that this happens:

(92) *We#**c'-ə-s**-ɛ-xw-ʔɛnʔ*.
NEG#UNSP.OBJ-INSERT-NEG-PROG-PL.SUBJ-see
'You-guys don't see anything.'

(93) *We#**c'-ɛ-s**-Ø-ʔɛnʔ*.
NEG#UNSP.OBJ-PROG-NEG-SG.SUBJ-see
'He/she doesn't see anything.'

Each portion in bold print shows a syllable and how *s-* on both occasions occurs in the coda. Note that in (92), a meaningless schwa is inserted to create a syllable

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7 Negation is expressed by two prefixes: an initial *we#* and *s-*.

peak. It is perhaps significant that the prefix which can appear in different positions in the sequence is a prefix of negation. Hengeveld and Mackenzie (2018) point out that the unified cognitive operation of negation can correspond to an operator at many different layers of semantic (and indeed pragmatic) structure: the lower positioning of NEG in (93) may therefore not affect the interpretation of the clause as negative.

This is a case in which phonological considerations influence the ordering choices to be made at ML. This can be accounted for by bottom-up feedback through the Fund, by means of which the phonological features of the various suffixes can be consulted in determining morpheme order.

5 Conclusions

In this chapter we set out to revise FDG's architecture in order to be able to more accurately define and delimit the number and position of interfaces in the theory. Within interfaces we distinguished three types of units: parameters, rules, and exceptions. As a typologically-oriented theory of language structure, FDG prefers to define differences between interface conditions across languages in terms of typological hierarchies, such that for every language a basic setting on the many hierarchies will predict the working of the interfaces. Apart from these hierarchies a number of basic settings should be provided, potentially including questions such as whether the language allows zero anaphora or not, what its alignment system is, whether modifiers are allowed to fall outside the Intonational Phrase of the main clause, and whether cliticization is allowed or not. These basic settings are reflected in the Fund, where frames, templates, and contours capture the configurations permitted in a language. We have also argued that within the Fund, there should be compartments corresponding to the Levels in the grammar, such that for every lexical item and for every construction, the interpersonal, representational, morphosyntactic, and phonological aspects are stored separately. Finally, we argued that apart from top-down processes, some bottom-up processes should be allowed, though severely restricted in the sense that these processes can only take place in the Fund and in the Contextual Component, but not within the grammar as such.

We have used the resulting new architecture to systematically discuss mismatches between the four levels of organization in FDG. In doing so we have shown that indeed all the interfaces recognized are relevant, in the sense that at all these interfaces mismatches may occur. We have also demonstrated that some mismatches can be accounted for as following from typological settings, in some

cases derived from well-established typological hierarchies, and in some cases as basic choices a language makes among various typological options. Finally, we have shown that bottom-up processes in the Fund are needed in order to account for certain types of mismatches, especially, but not exclusively, those involving feedback from the Phonological Level to higher levels.

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