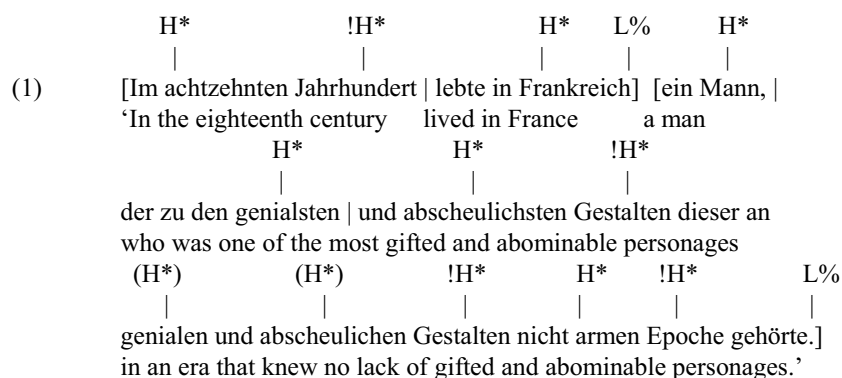KLAUS VON HEUSINGER

DISCOURSE STRUCTURE AND INTONATIONAL PHRASING[*]

1. INTRODUCTION

Theories that relate discourse structure and intonational structure often concentrate on the discourse functions of pitch accents and boundary tones. Intonational phrasing, however, is less prominently investigated. This paper focuses on intonational phrasing and its contribution to the construction of a discourse representation. I argue that intonational phrasing determines minimal discourse units which serve as the building blocks in a discourse representation. Even though minimal discourse units often correspond to syntactic constituents, sometimes they cross constituent boundaries. The problem can be illustrated by the very first sentence from the novel *Das Parfum* by Patrick Süskind, in (1).

```
                  H*            !H*          H*     L%      H*
                  |             |            |      |       |
(1)      [Im achtzehnten Jahrhundert | lebte in Frankreich]  [ein Mann, |
         'In the eighteenth century     lived in France        a man
                  H*            H*           !H*
                  |             |            |
         der zu den genialsten | und abscheulichsten Gestalten dieser an
         who was one of the most gifted and abominable personages
           (H*)         (H*)         !H*        H*     !H*          L%
           |            |            |          |      |            |
         genialen und abscheulichen Gestalten nicht armen Epoche gehörte.]
         in an era that knew no lack of gifted and abominable personages.'
```

We analyzed a read version of the novel with respect to intonational clues. The novel was professionally read by the artist Gert Westphal in 1995. The text was analyzed and intonationally segmented by Braunschweiler et al. (1988ff) in a project on spoken text in Konstanz. Parts of the text were then labeled for the following intonational properties: pitch accents (H*, L* or bitonal versions of it), boundary tones (H%, L%), and intonational phrasing (intonational phrases "[...]", and intermediate phrases: "|...|"). We checked part of the labeling with Jennifer Fitzpatrick.[1]

(1) is phrased into two intonational phrases, and both further into intermediate phrases. The length of the different phrases differs quite remarkably. For example, the second intonational phrase consists of the three intermediate phrases | *ein Mann* | *der zu den genialsten* | *und abscheulichsten Gestalten dieser an genialen und*

abscheulichen Gestalten nicht armen Epoche gehörte |. At first glance, it is not straightforward to assign well-formed syntactic constituents to these intonational units, e.g. | *der zu den genialsten* |. Intonational phrasing depends on different parameters, including Selkirk's (1984) "sense unit". For Selkirk, an intonational phrase must be a sense unit. However, she does not give a definition of sense unit. The paper presents a new approach that defines sense units in terms of discourse structure. A sense unit corresponds to a discourse unit that establishes a certain discourse relation to the already established discourse universe.

The paper is organized as follows: In section 2, I discuss different elements of discourse representation in terms of Discourse Representation Theory (DRT) and extend the formalism to segmented DRT, which is an attempt to integrate discourse relations into DRT. In section 3, I discuss the different elements of the intonational structure and their function with respect to the discourse structure. While pitch accents and boundary tones have received various functions, the discourse function of intonational phrasing has rarely been investigated. In section 4, I discuss the different parameters that determine the intonational phrasing. Besides metrical, phonological and syntactic parameters, semantics plays an important role. This function has been termed differently: Halliday (1967) introduced the term *informational unit*, while Selkirk (1984) uses *sense unit*. However, there is no semantic account of these terms. I argue that the semantics of intonational phrasing can be best accounted for in terms of *discourse units*. Discourse units are defined by their function to serve as arguments in discourse relations.

In section 5, I describe different discourse relations, in particular I introduce new discourse relations that are relations between subclausal units. While discourse relations are defined between propositions, I show that there are also discourse relations between smaller units. Section 6 gives a short summary. Throughout this paper, I try to illustrate the arguments with examples from the novel *Das Parfum. Die Geschichte eines Mörders* ('Perfume: The Story of a Murderer.') by Patrick Süskind.[2]. Examples from the novel are quoted by chapter and sentence, e.g. 13-022. The intonational phrasing always relates to the German text, even though the English translation is often used for the discourse representation. The translation itself is from the English version of the novel.

2. DISCOURSE STRUCTURE

Discourse structure is a cover term for different properties of a coherent text or discourse. In the following I focus on (i) reference and anaphora, (ii) information structure (topic-comment, or focus-background), and (iii) discourse relations between different discourse units. There are different families of theories treating discourse structure, each of which focuses on a different aspect. Discourse Representation Theory (Kamp 1981, Kamp & Reyle 1993) concentrates on representing the conditions for anaphoric reference. The discourse is incrementally (re)constructed. There is in principle no difference between parts of sentences and whole sentences since the construction algorithm does not recognize a special category of sentences (even though such a category is determined by the syntactic categories of the input). A second family of approaches (Klein & von Stutterheim 1987, Hobbs 1990, van Kuppevelt 1995, Roberts 1996, Büring 1997, 2003) understands a discourse structure as

representing the relations between propositions. Here the structure is represented as a tree of propositions. Such theories focus on the relation between sentences (or clauses), rather than on the relation between parts of sentences (or clauses). Neither view – except for Roberts (1996) and Büring (1997) – integrates aspects of information structure (topic-comment, or focus-background) in the analyses. These concepts are often used in the description of an additional level of sentence structure. Only the Prague School (Sgall & Hajičová & Benešová 1973) integrates information structure into the analysis of texts and discourses (see von Heusinger 2004 for a discussion of different approaches to information structure).

2.1 Reference and anaphora in discourse

The initial problem that motivated discourse representation theories is the interpretation of nominal and temporal anaphora in discourse. The phenomenon of cross-sentential anaphora forces semantics to extend its limits from the sentence to the discourse. The key idea in the approach to semantics of discourse, exemplified in Heim (1982) and Kamp (1981), is that each new sentence or phrase is interpreted as an addition or 'update' of the context in which it is used. This update often involves connections between elements from the sentence or phrase and elements from the context. Anaphoric relations and definite expressions are captured by links between objects in this representation. In order to derive the truth condition of the sentence, the representation is embedded into a model. The best way to get acquainted with DRSs is to look at the example (2).

(2)   Im achtzehnten Jahrhundert lebte in Frankreich ein Mann.
        'In the eighteen century France there lived a man.'

(2a)
$$\begin{array}{|c|}\hline t, u, x \\ \hline 18\text{th cent}(t) \\ \text{France}(u) \\ \text{Man}(x) \\ \text{live}(x,u,t) \\ \hline \end{array}$$
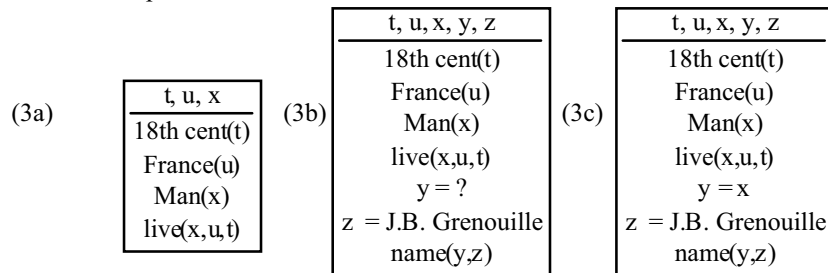
(2b) $\{t,u,x \mid 18^{th} \text{ cent}(t) \text{ \& France}(u) \text{ \& Man}(x) \text{ \& live}(x,u,t)\}$

The box in (2a) graphically describes a discourse representation structure (DRS) with two parts. One part is called the *universe* of the DRS, the other its *condition set*. A DRS is an ordered pair consisting of its universe and condition set, which can also be represented as in (2b) in set notation – this set describes all possible instances for the discourse referents such that the conditions hold of them. The DRS in (2a) or (2b) has three discourse referents *t, u, x* in its universe and the conditions that the discourse referent *t* is a time point in the 18th century, the discourse referent *u* a location in France, the discourse referent *u* a man, and that the predicate *live* holds of *x* at the location *u* and at the time *t*. For getting the truth condition, we have to map the DRS onto a model by an embedding function *f* that maps the discourse referents onto elements of the domain of M such that the elements are in the

extension of the predicates that are ascribed to the discourse referents. For example, the DRS (2a) or (2b) is true just in case that $f(t)$ is in the 18th century, $f(u)$ is in France, $f(x)$ is a man and $f(x)$ lives in $f(u)$ at $f(t)$.
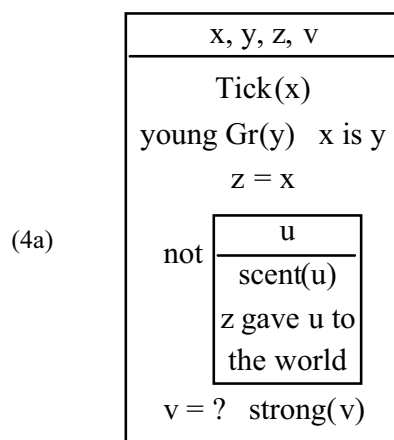
The sequence or conjunction of two sentences as in (3) receives a DRS incrementally. We start with the already established DRS for the first conjunct in (2a), and build the new DRS (3b) by inserting the new discourse referents for the pronoun *er* and the NP *Jean-Baptiste Grenouille*, and a condition for the predicate *hieß*. The anaphoric link of the pronoun is graphically represented as $y = ?$, indicating that the reference of the pronoun is still unresolved. The discourse referent which stands for an anaphoric expression must be identified with another *accessible* discourse referent in the universe. In the given context, y is identified with x, as in (3c). This mini-discourse is true if there is an embedding function f onto a model such that $f(t)$ is in the 18th century, $f(u)$ is in France, $f(x)$ is a man, $f(x)$ lives in $f(u)$ at $f(t)$, $f(y) = f(x)$, $f(z)$ is Jean-Baptiste Grenouille, and $f(y)$ was named $f(z)$.

(3)   Im achtzehnten Jahrhundert lebte in Frankreich ein Mann. Er hieß Jean-Baptiste Grenouille.
         'In the eighteen century France there lived a man. His name was Jean-Baptiste Grenouille.'

| (3a)	t, u, x	(3b)	t, u, x, y, z	(3c)	t, u, x, y, z
	18th cent(t)		18th cent(t)		18th cent(t)
	France(u)		France(u)		France(u)
	Man(x)		Man(x)		Man(x)
	live(x,u,t)		live(x,u,t)		live(x,u,t)
			$y = ?$		$y = x$
			$z = $ J.B. Grenouille		$z = $ J.B. Grenouille
			name(y,z)		name(y,z)

The new discourse referent introduced by the pronoun must be linked with an already established and accessible discourse referent. DRT defines accessibility in terms of structural relations, i.e. the discourse referent must be in the same (or in a higher) DRS. With this concept of accessibility, the contrast between (4) and (5) can be described by the difference in the set of discourse referents that are accessible for the discourse referent v of the pronoun *er* in (4) and (5). The construction rule for the negation in (4) creates an embedded discourse universe with the discourse referent u and the conditions *scent(u)* and *x gave u to the world.* The anaphoric pronoun *er* in the third (hypothetical) sentence cannot find a suitable discourse referent since it has no access to the embedded discourse universe with the only fitting discourse referent u. In (5a), however, the pronoun *er* in the second sentence is represented by the discourse referent v and the condition $v = ?$. This referent can be linked to the accessible discourse referent x, licensing the anaphoric link.

(4) So ein Zeck war das Kind Grenouille. An die Welt gab es nichts ab
(...) nicht einmal **einen Duft**$_1$. (04-061) #**Er**$_1$ war stark.

'The young Grenouille was such a tick. He gave the world nothing (...)
not even his own scent. #It was strong.'

(4a)

$$
\begin{array}{|c|}
\hline
x, y, z, v \\
\hline
\text{Tick}(x) \\
\text{young Gr}(y) \quad x \text{ is } y \\
z = x \\
\text{not} \quad \boxed{\begin{array}{c} u \\ \hline \text{scent}(u) \\ z \text{ gave } u \text{ to} \\ \text{the world} \end{array}} \\
v = ? \quad \text{strong}(v) \\
\hline
\end{array}
$$

(5) Ein anderes Parfum aus seinem Arsenal war **ein mitleiderregender
Duft**$_1$, der sich bei Frauen mittleren und höheren Alters bewährte.
Er$_1$ roch nach dünner Milch und sauberem weichem Holz. (38-015)

'Another perfume in his arsenal was a scent for arousing sympathy
that proved effective with middle-aged and elderly women. It smelled
of watery milk and fresh soft wood.'

(5a)

$$
\begin{array}{|c|}
\hline
x, y, v \\
\hline
\text{scent for arousing sympathy} \\
\text{that proved effective with} \\
\text{middle–aged and elderly women}(x) \\
\text{Another perfume in} \\
\text{his arsenal}(y) \\
x \text{ is } y \\
v = x \\
v \text{ smelled of watery} \\
\text{milk and fresh soft wood} \\
\hline
\end{array}
$$
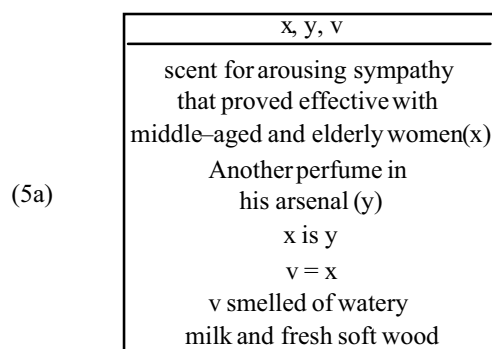
2.2 Information structure and discourse structure

Information structure is generally understood as an additional linguistic level to
describe sentence structure. Information structure often does not map syntactic
structure, and this was the main reason for introducing this level of description in the

19th century. It subsequently received different terms, such as *theme-rheme, topic-comment, focus-background* (see Sgall et al. 1973 for an overview). The theoretical basis for this additional structure varies according to the background theory of the researcher. But in most approaches information structure is defined by the contribution of the informational units to the sentence meaning.

This is illustrated by the next two examples. In (6) the time of the reported event is fronted – since the time was already introduced, one can also say that this phrase is discourse-linked or backgrounded. In (7), however, the exclamation *gut* 'good' is fronted for focusing, while the given reference of the pronoun is backgrounded.

(6)   Zu der Zeit, von der wir reden, herrschte in den Städten ein für uns moderne Menschen kaum vorstellbarer Gestank.
'In the period of which we speak, there reigned in the cities a stench barely conceivable to us modern men and women.'

(7)   Gut schaut er aus.
'He looks good.'

In general, theories assume that one unit is linked to the established discourse, while the other is said to express the new information in the sentence. Because of space limitations, I cannot present a full survey of the different approaches and a general criticism (see von Heusinger 2004). I only want to stress the point that information structure is often understood as a sentence structure and not as part of a discourse structure. Therefore, it is not included in discourse representation theories.

2.3 Sentence and discourse relation

A discourse consists of sentences that are related to each other by relations, such as causation, explanation, coherence, elaboration, continuation. This can be illustrated in the following two discourse segments. In (8) the question is followed by a continuation, which in itself consists of a causation and a conjunction. This is best represented in an annotated tree, as in (8a). Similarly, the sentence (9) can be split into its clauses, which can then be represented in a tree, as in (9a).

(8)   "Was ist das?" sagte Terrier und beugte sich über den Korb und
         schnupperte daran, denn er vermutete Eßbares. (02-002)
         '"What's that?" asked Terrier, bending down over the basket and
         sniffing at it, in the hope that it was something edible.'

(8a)

```
                        Continuation
                       /         \
                      /           \
   What's that?  asked Terrier      Causation
                                   /        \
                                  /          \
                             Conjunction   in the hope that
                            /        \      it was something
                    bending down   sniffing     edible.
                       over         at it
                    the basket
```
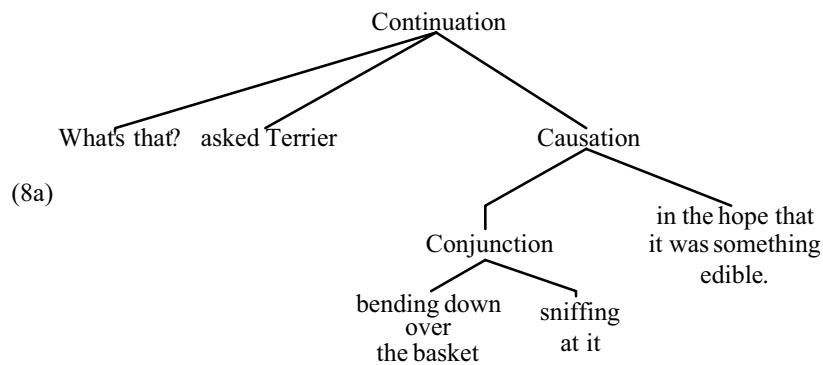
(9)   Technische Einzelheiten waren ihm sehr zuwider, denn Einzelheiten
         bedeuteten immer Schwierigkeiten, und Schwierigkeiten bedeuteten
         eine Störung seiner Gemütsruhe, und das konnte er gar nicht
         vertragen. (02-015)
         'He despised technical details, because details meant difficulties, and
         difficulties meant ruffling his composure, and he simply would not put
         up with that.'

(9a)

```
                        Causation
                       /        \
                      /          \
              He despised      Elaboration
              technical       /         \
              details,       /           \
                     because          Elaboration
                     details         /         \
                     meant          /           \
                  difficulties  and difficulties meant   and he simply would
                               ruffling his composure    not put up with that.
```
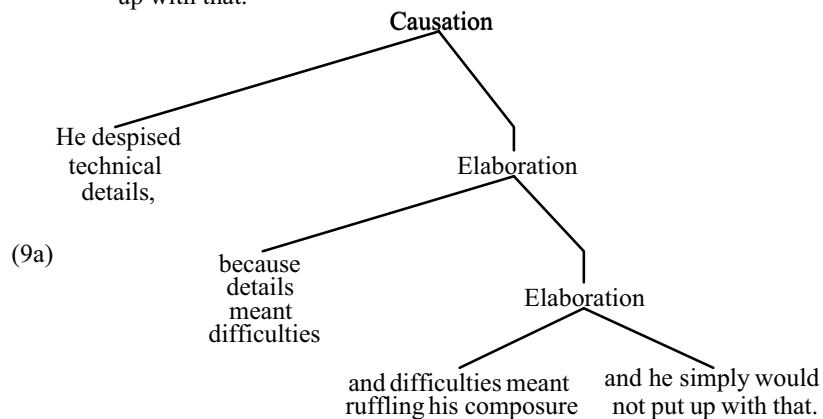
Recent approaches to discourse structure (Hobbs 1990, van Kuppevelt 1995,
Roberts 1996, Büring 1997, 2003) use anotated trees that relate propositions to
each other. However, such approaches do not relate the internal structure to the
propositions nor do they assume smaller discourse units than propositions.

Only Asher (1993, 2004) combines insights from DRT and discourse relation in his theory of *segmented* DRT (= SDRT), which is not confined to the incremental composition of DRSs, but also captures discourse relations between the sentences in the discourse. He revises the classical DRT of Kamp (1981) and Kamp & Reyle (1993). The classical version describes the dynamic meaning of words or phrases with respect to a discourse structure. There is, however, no means to compare the dynamic potential of a full sentence with the discourse so far established. Asher (1993, 256) notes that

> the notion of semantic updating in the original DRT fragment of Kamp (1981) (...) is extremely simple, except for the procedures for resolving pronouns and temporal elements, which the original theory did not spell out. To build a DRS for the discourse as a whole and thus to determine its truth conditions, one simply adds the DRS constructed for each constituent sentence to what one already had. (...) This procedure is hopelessly inadequate, if one wants to build a theory of discourse structure and discourse segmentation.

In SDRT, each sentence S_i is first represented as a particular segmented DRS for that sentence. The segmented DRS can then interact with the already established DRS reconstructing a discourse relation *R*, such as **Caus**ation, **Cont**inuation, **Conj**unction, **Elab**oration, etc. as informally sketched in (8b) and (8c) for the tree structure (8a). First the clause receives its DRS, which can then be related to the already established DRS, and then the representation can be integrated into the already established representation. In (8b), the already established DRS contains among other elements the discourse referents for the basket and for Terrier. The first two sentences from the tree (8a) are translated into DRSs which establish the discourse relation of **Cont**inuation, while the rest remains in the tree. In (8c) these two DRSs are integrated into the main DRS and the other three clauses are translated into segmented DRSs which again establish certain discourse relations with the main DRS: The sentence in (8) is represented as the DRS in (8b) with the box for the discourse information. The relation between the sentences (or propositions) are **Cont**. The remaining structure is given in (8b) and the DRSs for that structure is given in (8c):
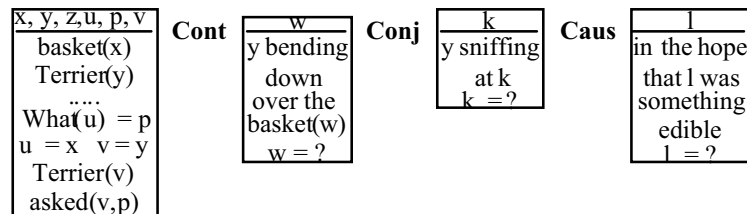
(8)   "Was ist das?" sagte Terrier und beugte sich über den Korb und
        schnupperte daran, denn er vermutete Eßbares. (02-002)

(8b)
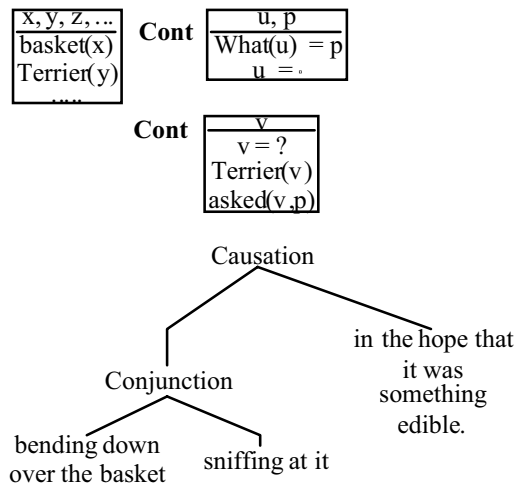
(8c)

To summarize this very short presentation of DRT, the discourse structure of DRT provides not only a new structure but also introduces new semantic objects: discourse referents, conditions, and discourse domains ("boxes"). DRT explains semantic categories such as definiteness and anaphora in terms of interaction between these representations. Furthermore, the extension to SDRT allows us to express discourse relations between whole propositions, as well. These new tools, objects, and representations form the basis for a new semantic analysis of information structure. In the next section, this approach is sketched briefly.

3. INTONATIONAL STRUCTURE

Intonation contours are represented by phonologists as a sequence of abstract tones consisting of pitch accents and two types of boundary tones. Pierrehumbert & Hirschberg (1990, 308) assign discourse functions to the particular tones: "Pitch accents convey information about the status of discourse referents (...). Phrase accents [= boundary tones of intermediate phrases] convey information about the relatedness of intermediate phrases (...). Boundary tones convey information about

the directionality of interpretation for the current intonational phrase (...)." The status of discourse referents can be accounted for in terms of given vs. new; the boundary tones of intonational phrases indicate how the proposition expressed by the whole phrase is integrated into the discourse. Similarly, boundary tones of intermediate (or phonological) phrases that correspond to a full proposition indicate the way these propositions are interpreted with respect to the linguistic context, as illustrated in (10) and (11). While in (10), the L-boundary tone indicates that the two clauses have no relation to each other, the H-boundary tone in (11) indicates that the first clause is related to the second, suggesting a discourse relation of causation.

$$
\begin{array}{cc}
\text{L} & \text{L L\%} \\
| & | \quad | \\
\end{array}
$$

(10)   [(George ate chicken soup) | (and got sick)]

$$
\begin{array}{cc}
\text{H} & \text{L L\%} \\
| & | \quad | \\
\end{array}
$$

(11)   [(George ate chicken soup) | (and got sick)]

However, in this view there is no way of treating phrases that correspond to units below the clause level, such as the modification *im achtzehnten Jahrhundert* ('in the eighteenth century'), the unsaturated phrase *lebte in Frankreich* ('lived in France') or the first part of the complex noun *der zu den genialsten* ('one of the most gifted') in example (1), repeated as (12).

(12)   [Im achtzehnten Jahrhundert | lebte in Frankreich] [ein Mann, | der zu den genialsten | und abscheulichsten Gestalten dieser an genialen und abscheulichen Gestalten nicht armen Epoche gehörte.]

All these phrases can constitute intermediate phrases in German. Even though English and many other languages mark their intermediate phrases by boundary tones, in German there is no evidence for boundary tones for intermediate phrases (Féry 1993, 59-79). Evidence for intermediate phrases in German must be taken from other criteria. I argue on the basis of discourse structure and discourse relations that intonational phrasing (intonational and intermediate phrases) can sufficiently be defined by its function in building a discourse structure. Before I give a characterization of intonational phrasing for intonational phrases and intermediate phrases, I first present some approaches to the functions of pitch accents and boundary tones.

3.1 Pitch accents and reference

Each intonational unit (intermediate phrase or intonational phrase) must have at least one pitch accent. Pitch accents are associated with prosodically prominent expressions in that phrase. Often they are associated with focus and thus indicate new (or not-given) information. Pitch accents themselves are often said to express the discourse status of their associated expressions (Hobbs 1990, Gussenhoven

1984, Ladd 1996). This can be illustrated by (13) and (14). (13) is the first sentence of the novel and introduces the time, the place and the person by phrases marked with a H* pitch accent. (14) is the first sentence of the second chapter. The wet nurse *Jeanne Bussie* was already introduced in the first chapter; so the L* indicates that she is discourse-old.

```
              H*            !H*                H*  L%        H*
              |             |                  |   |         |
(13)     [Im achtzehnten Jahrhundert | lebte in Frankreich]  [ein Mann,
         In the eighteenth century     lived in France        a man
```

```
              L*  H%   H*      L*              LH*  H%
              |   |    |       |                |   |
(14)     [Einige Wochen später]  [stand die Amme | Jeanne Bussie] ...(02-001)
         Few    weeks later     stood the wet nurse Jeanne Bussie
```

The pitch accent can also indicate contrast between two referents or unexpected relations between two referents, as illustrated in the often quoted example (15) and a sentence from our novel (16):

(15)   First HE called HIM a Republican and then HE offended HIM.

(16)   Grenouille folgte ihm, mit bänglich pochendem Herzen, denn er ahnte, daß nicht ER DEM DUFT folgte, sondern daß DER DUFT IHN gefangengenommen hatte und nun unwiderstehlich zu sich zog. (08-036)
         "Grenouille followed it, his fearful heart pounding, for he suspected that it was not he who followed the scent, but the scent that had captured him and was drawing him irresistibly to it."

3.2 Tune representing information structure

Steedman (1991, 2000) intertpretes Halliday's thematic structure (see section 4.2) in terms of combinatory categorial grammar (CCG). This can be illustrated with the following example which receives the informational structure in *theme-rheme.* Both thematic units are further divided into given material and new material; the latter is associated with a pitch accent.

(17)   Q: I know that Mary's FIRST degree is in PHYSICS.
            But what is the subject of her DOCTORATE?

```
                   L+H*LH%              H* LL%
A:       [Mary's DOCTORATE  |  is in CHEMISTRY]
            Given     New        Given New
                   Theme              Rheme
```

The basic informational units are the theme and the utterance. All other parts are defined with respect to these basic elements. For example, the rheme is a function

that takes the theme as an argument to yield the utterance. Steedman now defines the syntactic function of the pitch accent L+H* as a theme that lacks a boundary tone, i.e. as a function that needs a boundary tone to yield a theme. Analogously, the pitch accent H* indicates a function that needs a boundary tone in order to yield a rheme. Thus in the description of tones, Steedman assumes the boundary tones and the whole tune as the primary units, while the pitch accents define the informational status as theme or rheme (cf. Hayes & Lahiri 1991 for a similar approach with respect to sentence type).

(18)   Categorial functions of tones for English (Steedman 1991)
 a   LH%   boundary tone   simple argument
 b   LL%   boundary tone   simple argument
 c   L+H*   pitch accent   function from boundary tone into theme
 d   H*   pitch accent   function from boundary tones into rheme
 e   L+H*LH%   contour   simple argument: theme
 f   H* LL%   contour   function from themes into utterance

Steedman uses the terms *theme* and *rheme* as well as *given* and *new*. The first pair can be defined with respect to the sentence under analysis. Yet the second pair can only be defined by the discourse in which the sentence is embedded.

Even though the tones and their functions are different for German, the following example from our novel may illustrate Steedman's analysis. The first phrase ends with a H% boundary tone representing the theme (with the global contour of L*H%, cf. (18e)), while the second intonational phrase ends with L% expressing the rheme (with the global contour ...H*L%, cf. (18f)).

                                        L*H%
                                         | |
(19)   [Zu der Zeit, von der wir reden,]   [herrschte in den Städten
          'In the period of which we speak,   there reigned in the cities

                   H*L   H*   !H*   L%
                    | | | |
          ein für uns moderne Menschen | kaum vorstellbarer Gestank.]
          to us modern men and women a stench barely conceivable'

However, not all sentences can be divided into one theme and one rheme, as in (20):

                        L* H% H*   L*   LH* H%
                         | | | | | |
(20a)   [Einige Wochen später]   [stand die Amme | Jeanne Bussie]
          'Few   weeks later   stood the wet nurse Jeanne Bussie

                        H*   H%
                         | |
 b   [mit einem   Henkelkorb in der Hand]
          with   a   market basket in the hand

```
                        L*                      H* H%
                         |                      |   |
c       [vor der Pforte des Klosters von Saint-Merri]
        at   the gate  of the cloister  of  Saint-Merri

                  H*     !H*              !H*   L%
                   |       |               |     |
d       [und sagte dem öffnenden Pater Terrier,]
        and said    to the opening Father Terrier'
```

The first four intonational phrases end with an H% boundary tone, and only the last phrase with an L% boundary tone. This is difficult to explain in terms of a view of information structure that is sentence bound. In such a view we must assume several themes before we get to the rheme, and the final sentence. The example suggests that the boundary tones indicate the relation of the phrase to the already established discourse on the one hand, and to the subsequent discourse on the other.

3.3 Tones representing different discourse functions

Pierrehumbert & Hirschberg (1990) give a list of functions of pitch accents and boundary tones. The latter indicate whether the phrase to which the boundary tone is associated should be interpreted with respect to the preceding discourse or to the following discourse. Pierrehumbert & Hirschberg (1990, 304) illustrate this point in the following contrast between (21) and (22). The low boundary tone L% in (21a) indicates that this sentence as a unit is related to the discourse on its own, while the high boundary tone H% in (22a) indicates that it is to be interpreted with respect to the following sentence forming a large unit which then can be inserted into or related to the discourse. This difference influences the choice of the antecedent of the pronoun *it* in (21b) and (22b). In (21) it refers to the following proposition *I spent two hours figuring out how to use the jack*, while in (22) it refers back to the *new car manual*.

```
                                        L L%
(21a)    My new car manual is almost unreadable.
                        L H%
b        It's quite annoying.
                                               L L%
c        I spent two hours figuring out how to use the jack.

                        L H%
(22a)    My new car manual is almost unreadable.
                        L H%
b        It's quite annoying.
                                               L L%
c        I spent two hours figuring out how to use the jack.
```

Pierrehumbert & Hirschberg (1990, 308) assign the following discourse functions to the particular tones:

> Pitch accents convey information about the status of discourse referents, modifiers, predicates, and relationships specified by accented lexical items. Phrase accents convey information about the relatedness of intermediate phrases–in particular, whether (the propositional content of) one intermediate phrase is to form part of a larger interpretative unit with another. Boundary tones convey information about the directionality of interpretation for the current intonational phrase–whether it is "forward-looking" or not.

In explaining the function of intonational phrasing (intonational and intermediate phrases), they refer to the "propositional content" of the corresponding phrase. This can also be illustrated by the following fragment from our novel. The low boundary tones in (23a) and (23b) indicate that the content of the utterance can be added to the discourse without relating it to subsequent utterances. However, the high boundary tone in (23c) indicates that the utterance ("But I've put a stop to that") must be related to the next utterance (23d) ("Now you can feed him yourselves").

<div style="text-align:center">

H*   L%
| |

</div>

(23a)   [Weil er sich an mir vollgefressen hat.]
      'Because he himself on me stuffed   has

<div style="text-align:center">

H*   L%   H*   L%
| | | |

</div>

b   [Weil er mich leergepumpt hat] [bis auf die Knochen.]
      Because he's pumped me dry   down to the bones.

<div style="text-align:center">

H* H%
| |

</div>

c   [Aber damit ist jetzt Schluß.]
      But with that is now end

<div style="text-align:center">

H*   !H*   L%
| | |

</div>

d   [Jetzt könnt Ihr ihn selber weiterfüttern]
      Now can   you him yourselves feed.'

However, not all intonational phrases can be associated with a propositional content, some intonational units might only refer to modifications such as *im achtzehnten Jahrhundert* ('in the eighteenth century') or the unsaturated phrase *lebte in Frankreich* ('lived in France') of example (1), repeated as (12). Thus, the functions of boundary tones must be redefined with respect to these "sub-propositional" units. Intonational phrasing doesn't always correspond to propositions or to simple discourse referents. Therefore, we need a more fine-grained discourse structure that allows to construct corresponding discourse segments.

Summarizing, pitch accents may indicate the discourse status of their respective discourse referents. They can also form the nucleus of an informational unit, as in Steedman's approach, which is, however, limited to the sentence. Pierrehumbert & Hirschberg define the function of boundary tones with respect to the relations between clauses. However, they can only deal with phrases that are associated with propositions. None of these approaches accounts for the discourse function of subclausal units. Before I develop such an approach in section 5, I give a sketch of the description of intonational phrasing in the next section.

4. INTONATIONAL PHRASING AND ITS FUNCTION

4.1 Phrasing

The term *intonational phrase* (IP) is usually applied to spans of the utterance which are delimited by boundary tones: "Like other researchers, we will take the melody for an intonational phrase to be the 'tune' whose internal makeup is to be described. As a rule of thumb, an intonational phrase boundary (transcribed here as %) can be taken to occur where there is a non-hesitation pause or where a pause could be felicitously inserted without perturbing the pitch contour" (Pierrehumbert 1980, 19). In (24) from Selkirk (1995, 566), there are three intonational phrases, such that the relative clause corresponds to one, while each part of the matrix sentence to the right and to the left constitutes one. In (25) from the novel *Das Parfum* (02-125), one intonational phrase marks the direct speech, while the two others are associated with the two conjuncts of the assertion. The second conjunct is further divided into two intermediate phrases.

(24)   H%   H%   L%
               | | |
          [Fred,]$_{IP}$ [who's a volunteer fireman,]$_{IP}$ [teaches third grade]$_{IP}$

(25) H* L%   L* H%   (L*)   H*   L%
      | | | | | | |
     ["Na?"]   [bellte Terrier] [und knipste ungeduldig | an seinen Fingernägeln.]
        '"Well?"   barked Terrier,   clicking his fingernails impatiently.'

The terms in which we can define an intonational phrase are not very clearly understood. There are phonetic, syntactic and semantic criteria for forming an intonational phrase:

(26)   Linguistic criteria for defining an intonational phrase (IP)
(i)   *Timing*: An IP can be preceded and followed by a pause.

(ii)   *Metrical*: The metrical structure provides an additional clue,
            viz., the presence of a most prominent accent.

(iii)   *Tonal*: The boundary of an IP is sometimes tonally marked
            by a boundary tone. Pitch range adjustment plays a
            role, as well.

(iv)   *Junctural*: The boundary of an IP can block certain junctural
            phenomena (cf. Nespor & Vogel (1986)).

(v)   *Syntactic-prosodic*: The boundaries of an IP correspond to
            those of some syntactic constituents.

(vi)   *Semantic*: The material in the IP must constitute an
            informational unit or *sense unit*.

The conflict between different criteria can be illustrated with the first sentence of
our novel (1), repeated as (27).

(27)   H*   !H*   H*   L%   H*
                | | | | |
            [Im achtzehnten Jahrhundert |$_{580}$ lebte in Frankreich]$_{300}$[ein Mann,|$_{590}$
            In the eighteenth century   lived in France   a man

The subscript indicates the duration of the pauses, which is shorter between the two
intonational phrases than inside either of them. We rather assume the boundary tone
as a robust criterion for an intonational phrase. Unfortunately, German does not
show boundary tones for intermediate phrases (Féry 1993, 59-79). They can,
however, be detected by other criteria such as pauses, lengthening of the final
syllable and a pitch accent for each intermediate phrase. I argue that the discourse
function of the intermediate phrase is one of the most reliable criteria.

There are very short and very long intonational phrases, which means that the
phrases do not depend on length. They rather depend on their appropriateness for
building a coherent discourse. A discourse is coherent if at least the following two
requirements are met: (i) anaphoric relations can be established; (ii) discourse
relations hold between the discourse units, as argued in section 4.4.

4.2 Halliday: information units and information structure

Halliday postulates an independent level for information structure and is the first
one to introduce the term "informational unit". He is in fact the first who uses the
term *information structure* and establishes it as an independent concept. His main
preoccupation was to account for the structure of intonation in English. Since phrasing
does not always correspond to syntactic constituent structure, Halliday (1967, 200)
postulates a different structural level as the correlate to phrasing (his "tonality"):

> Any text in spoken English is organized into what may be called 'information units'
> (...) this is not determined (...) by constituent structure. Rather could it be said that the
> distribution of information specifies a distinct structure on a different plane. (...)
> Information structure is realized phonologically by 'tonality', the distribution of the text
> into tone groups.

The utterance is divided into different tone groups, which are roughly equivalent to intermediate phrases. These phrases exhibit an internal structure. Analogously, Halliday assumes two structural aspects of information structure: the informational partition of the utterance, and the internal organization of each informational unit. He calls the former aspect the *thematic structure* (theme-rheme), and the latter aspect is treated under the title *givenness*. The thematic structure organizes the linear ordering of the informational units, which corresponds to the Praguian view of theme-rheme (or topic-comment, or topic-focus, see section 2.2). The theme refers to that informational unit that comprises the object the utterance is about, while the rheme refers to what is said about it. Halliday (1967, 212) assumes that the theme always precedes the rheme. Thus theme-rheme are closely connected with word order, *theme* being used as a name for the first noun group in the sentence, and theme for the following: "The theme is what is being talked about, the point of departure for the clause as a message; and the speaker has within certain limits the option of selecting any element in the clause as thematic."

The second aspect refers to the internal structure of an informational unit, where elements are marked with respect to their discourse anchoring. Halliday (1967, 202) writes: "At the same time the information unit is the point of origin for further options regarding the status of its components: for the selection of point of information focus which indicates what new information is being contributed." Halliday calls the center of informativeness of an information unit *information focus*. The information focus contains new material that is not already available in the discourse. The remainder of the intonational unit consists of given material, i.e. material that is available in the discourse or in the shared knowledge of the discourse participants. Halliday (1967, 202) illustrates the interaction of the two systems of organization with the following example (using bold type to indicate information focus; // to indicate phrasing). Sentence (28a) contrasts with (28b) only in the placement of the information focus in the second phrase. The phrasing, and thus the thematic structure, is the same. On the other hand, (28a) contrasts with (28c) in phrasing, but not in the placement of the information focus. However, since the information focus is defined with respect to the information unit, the effect of the information focus is different.

(28)a   //**Mary**//always goes to **town** on Sundays.//
b   //**Mary**//always goes to town on **Sundays.**//
c   //**Mary** always goes to //**town** on Sundays.//

Halliday does not connect the sentence perspective with the discourse perspective, even though he makes some vague comments on it:

> The difference can perhaps be best summarized by the observation that, while 'given'
> means 'what you were talking about' (or 'what I was talking about before'), 'theme'

> means 'what I am talking about' (or 'what I am talking about now'); and, as any student
> of rhetoric knows, the two do not necessarily coincide. (Halliday 1967, 212)

The main progress initiated by the work of Halliday is the assumption of an independent level of information structure. This structure is closely related to the discourse and assigns the features *given* or *new* to the expressions in a sentence. However, he does not provide a criterion for informational units in terms of discourse.
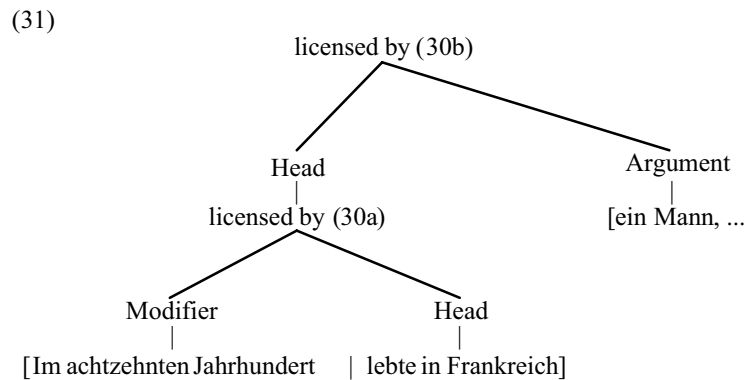
4.3 Selkirk: sense units and argument structure

Selkirk (1984) has argued that the intonational phrase (IP) constitutes a domain relevant to various aspects of the phonetic implementation of the sentence, including timing effects like constituent-final lengthening. Selkirk (1984, 286) employs the notions of *sense unit* since she argues that the intonational phrase cannot be defined by phonetics or by syntax alone, but it needs additional semantic constraints:

> Our position, then – again following Halliday 1967 – is that there are no strictly
> syntactic conditions on intonational phrasing. Any apparently syntactic conditions on
> where 'breaks' in intonational phrasing may occur are, we claim, ultimately to be
> attributed to the requirement that the elements of an intonational phrase must make a
> certain kind of semantic sense.

Selkirk (1984, 286ff) defines the correlation between intonational phrase and the sense unit in (29), and in (30) she determines the sense unit as a complex of constituents that stand either in a modifier-head or argument-head relation:

(29)   The Sense Unit Condition on intonational phrasing
         The immediate constituents of an intonational phrase must together
         form a sense unit.

(30)   Two constituents C_i, C_j form a sense unit if (a) or (b) is true of the
         semantic interpretation of the sentence:
         (a) C_i modifies C_j (a head)
         (b) C_i is an argument of C_j (a head)

This can be illustrated with (31). The first intermediate phrase *im achtzehnten Jahrhundert* modifies the head *lebte in Frankreich*, and the argument *ein Mann...*is an argument of the complex predicate *im achtzehnten Jahrhundert lebte in Frankreich*.

(31)

licensed by (30b)

Head   Argument
| |
licensed by (30a)   [ein Mann, ...

Modifier   Head
| |
[Im achtzehnten Jahrhundert | lebte in Frankreich]

Selkirk herself (1984, 295f) notes that the Sense Unit Condition is very closely related to argument structure, so it does not cover cases where material is preposed or in nonrestrictive modifiers such as nonrestrictive relative clauses. The latter is a typical instance of backgrounding, which expresses a discourse relation rather than an argument-head relation, as illustrated by (32):
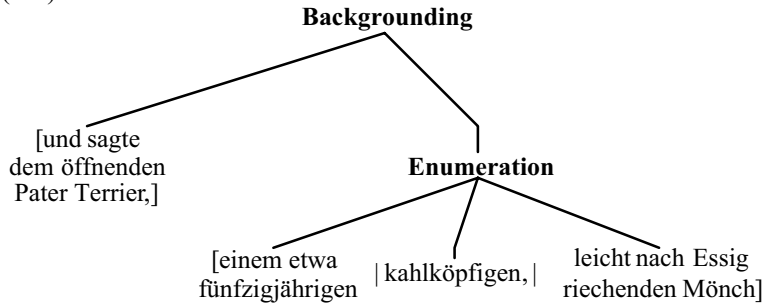
(32)   [und sagte dem öffnenden Pater Terrier,] [einem etwa fünfzigjährigen | kahlköpfigen, | leicht nach Essig riechenden Mönch:] ["Da!"]
'... and the minute they were opened by Father Terrier, a bald monk of about fifty, with a faint odour of vinegar about him, she said "There!"'

While the background information about the Father Terrier is "embedded" into an independent intonational phrase, this phrase itself is divided into three intermediate phrases that each give one characteristic property of the person. Thus, it is not the argument structure that triggers the intonational phrasing, but rather the discourse relation of backgrounding.

4.4 Intonational phrasing and discourse units

The discussion in the last two sections has shown that informational phrasing is partly determined by informational units. However, neither Halliday's concept of informational unit nor Selkirk's definition of sense unit succeeded in covering all cases. It already became clear that intonational phrasing must be described in terms of discourse units, which serve as arguments for discourse relations. This can be illustrated in the discourse tree (32a) for the sentence (32).

(32a)

Backgrounding

[und sagte
dem öffnenden
Pater Terrier,]

Enumeration

[einem etwa
fünfzigjährigen | kahlköpfigen, | leicht nach Essig
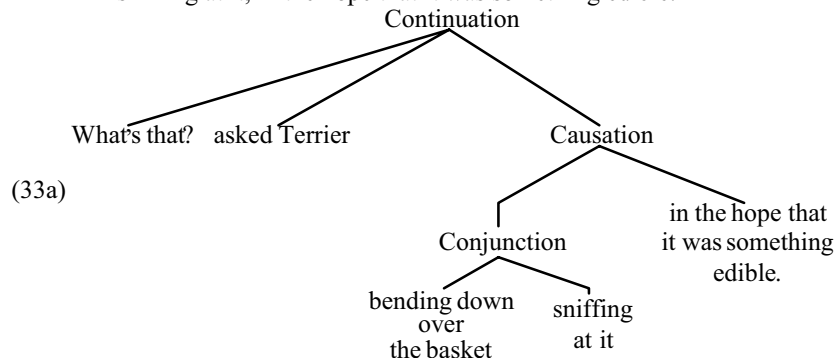riechenden Mönch]

We can assign different discourse relations to the discourse units associated with the intonational phrasing. A discourse unit is defined by its appropriateness to serve as an argument in a discourse relation, rather than by its content or some other intrinsic property. This means that we can only define discourse units by defining discourse relations that operate on them.

5. DISCOURSE UNITS AND DISCOURSE RELATIONS

Discourse relations are generally described in terms of relations between propositions. Therefore, the arguments for discourse relations are associated with clauses (or other linguistic phrases that express a proposition). This can be illustrated with (8), repeated as (33).

(33)   "Was ist das?" sagte Terrier und beugte sich über den Korb und
        schnupperte daran, denn er vermutete Eßbares. (02-002)
        "'What's that?' asked Terrier, bending down over the basket and
        sniffing at it, in the hope that it was something edible."

Continuation

What's that?   asked Terrier   Causation

(33a)

Conjunction   in the hope that
                       it was something
                       edible.

bending down   sniffing
over   at it
the basket

The relation between the first two sentences can be described by *Continuation*, while the relation between the last clauses are *Causation*. Approaches to discourse or text structure that use these kind of discourse relations are fairly widespread (e.g. Mann & Thompson 1987, 1988 for *Rhetorical Structure Theory* (RST) or Asher 1993, 2004 for segmented DRT).

None of these approaches allow for subclausal discourse units and relations between them. However, we have seen in the last sections that intonational phrasing often corresponds to subclausal units. We have also said that discourse units are defined by the relations they establish. If we assume subclausal discourse units we must also define discourse relations that hold between them. In the following I discuss five discourse relations: (i) non-restrictive modification, (ii) backgrounding, (iii) enumeration, (iv) topicalization, and (v) frame-setting. While the first four are discussed in the literature, the relation of frame-setting is new.

5.1 Non-restrictive modification

The relative clause in (34) consists of two intermediate phrases which correspond to *der zu den genialisten (Gestalten gehörte)* and to *(der zu den) abscheulichsten Gestalten... gehörte.* These two modifications are independent of each other, even though they both modify the same discourse referent *x* for *a man.* The point is that the main character of the book is not only one of the most gifted and abominable personages, but he is at the same time one of the most gifted personages *and* one of the most abominable personages. This is difficult to express in a purely linear way. However, if we assume two independent discourse representations, we can capture these two relations.

(34)   [ein Mann | der zu den genialsten | und abscheulichsten Gestalten .... gehörte] "a man who was one of the most gifted and abominable personages "
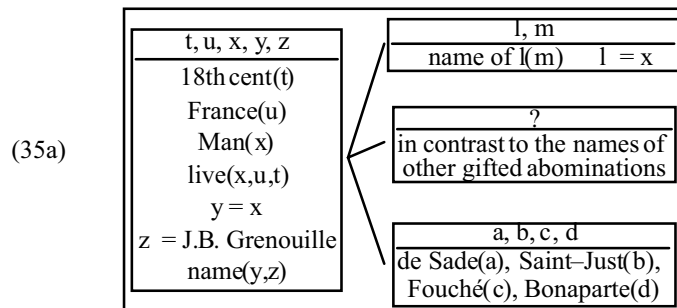
(34a)
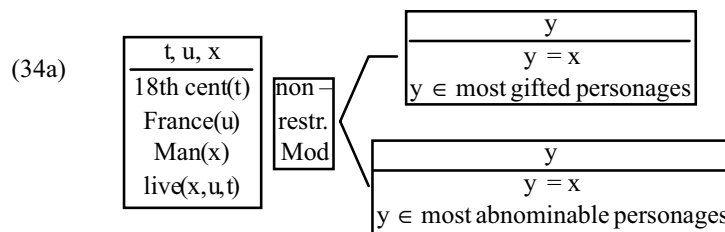
5.2 Backgrounding

In the example (35) below, a more general type of backgrounding can be found. Actually, there are even two levels of backgrounding: First the phrase *in contrast to the names of other gifted abominations* and second the actual names. The discourse relation of backgrounding relates these discourse units directly to the already established main DRS - there is no need to wait for the interpretation of the actual sentence. This is informally represented in (35a).

(35)   [Er hieß | Jean-Baptiste Grenouille,] [und wenn sein Name]
        His name was Jean-Baptiste Grenouille, and if his name –

[im Gegensatz zu den Namen | anderer genialer Scheusale,]
in contrast to the names of other gifted abominations,

[wie etwa de Sades, | Saint-Justs, | Fouchés, | Bonapartes | undsoweiter,]
de Sade's, for instance, or Saint-Just's, Fouché's, Bonaparte's etc. –

[heute in Vergessenheit geraten ist,]
has been forgotten today,

(35a)

t, u, x, y, z
18th cent(t)
France(u)
Man(x)
live(x,u,t)
y = x
z = J.B. Grenouille
name(y,z)

l, m
name of l(m)   l = x

?
in contrast to the names of other gifted abominations

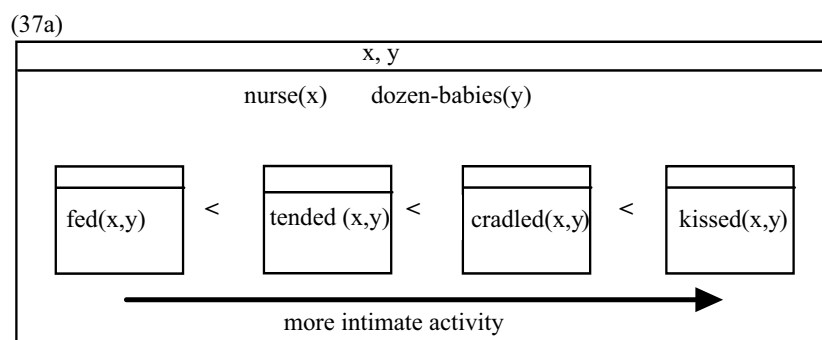| a, b, c, d |
| --- |
| de Sade(a), Saint–Just(b), Fouché(c), Bonaparte(d) |

5.3 Enumeration

A classical case of independent units is enumeration, which is here illustrated by (36). The intonational phrasing suggests that the discourse structure is constructed via independent representations for each predicate NP *with goat's milk, with pap,* and *with beet juice,* as given in (36a).

(36)   [Jetzt könnt Ihr ihn selber weiterfüttern]
          'Now can you him yourselves feed

          [mit Ziegenmilch, | mit Brei, | mit Rübensaft.]
          with goat's milk, with pap, with beet juice.'

(36a)

x, y
feed(x,y,z)
y = a
x = you

goat's_milk(z)

pap(z)

beet_juice(z)
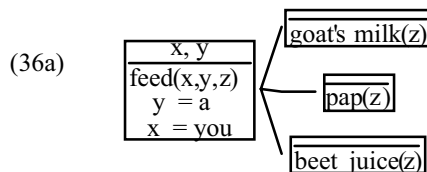
Once we have an independent representation of each of the conjuncts, we can compare them and establish additional relations of gradation between them. This works particularly well for the following example (02-121), where we can compare the different representations according to a scale of intimacy.

(37)   H*   H*   H*   H*   H*
                          | | | | |
[sie hatte doch schon Dutzende | genährt, | gepflegt, | geschaukelt, | geküsst...|
after all she had fed, tended, cradled and kissed dozens of them...

(37a)

| x, y |
|---|
| nurse(x)   dozen-babies(y) |

fed(x,y)   <   tended (x,y)   <   cradled(x,y)   <   kissed(x,y)

→ more intimate activity

5.4 Topicalization

Topicalization or thematization is one of the central concepts of the functional
sentence perspective of the Prague School, which was later adapted by Halliday and
others (see section 4.2). Steedman's analysis of the thematic structure of a sentence
focuses exactly on this aspect (see section 2.2 for discussion). The fragment (38)
(02-126) illustrates this. The theme-rheme or the topic-comment establishes a
functor-argument structure on a sentence that is independent from the grammatical
relations. Since this issue is repeatedly discussed, I will continue to the next
subclausal discourse relation.

(38)[also an den Füßen zum Beispiel|da riechen sie wie ein glatter | warmer |Stein]
      Their feet for instance,   they smell like a smooth warm stone

      [wie frische Butter riechen sie.] [Und am Körper] [riechen sie wie...]
      They smell like fresh butter.   And their bodies smell like...'

5.5 Frame-setting

The discourse relation of "frame-setting" is illustrated by the first sentence of the
second chapter (14), repeated as (39). The phrase *einige Wochen später* cannot be
the topic, since the topic is the introduced person or the thing the sentence is about.
However, it stands in its own phrase. I therefore assume the discourse relation of
frame-setting. The phrase "sets the frame" for what there is to come. Here it shifts
the reference time. The phrase can be integrated into the already established
discourse before the rest of the sentence is interpreted, as illustrated in (39a) (see
Maienborn 2003 for a related concept with the same name):

(39)   [Einige Wochen später]   [stand die Amme | Jeanne Bussie] ...(02-001)
            'Few   weeks later   stood the wet nurse Jeanne Bussie...'

(39a)

| x, y, z, t_1, ... | t_2 |
| wet nurse(x) | t_2 = few weeks later as t_1 |

u
stood(u)
u = x
the wet nurse Jeanne Bussie(u)
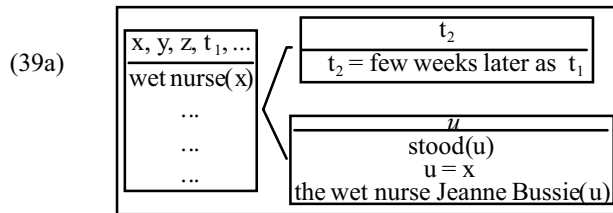
6. SUMMARY

The presented analysis associates intonational phrasing with discourse units. I have proposed an extension of Asher's SDRT with smaller discourse representations and new relations between subclausal discourse representations. This allows us to assign discourse functions to intonational phrases, including phrases that do not correspond to entire clauses. Many more discourse relations must be defined, and I am convinced they can be defined in terms of discourse construction rules.

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7. NOTES

[1] An intonational phrase boundary always coincides with an intermediate phrase boundary, therefore we shorten "[|...|...|]" to "[...|...]". Even though English and many other languages mark their intermediate phrases by boundary tones, in German it is very controversial if there is evidence for boundary tones for intermediate phrases (Féry 1993, 59-79).

[2] A short summary of the novel: "In the slums of 18th-century Paris a baby is born and abandoned, passed over to monks as a charity case. But the monks can find no one to care for the child—he is too demanding, and he doesn't *smell* the way a baby should smell. In fact, he has no scent at all.

Jean-Baptiste Grenouille clings to life with an iron will, growing into a dark and sinister young man who, although he has no scent of his own, possesses an incomparable sense of smell. Never having known human kindness, Grenouille lives only to decipher the odors around him, the complex swirl of smells—ashes and leather, rancid cheese and fresh-baked bread—that is Paris. He apprentices himself to a perfumer, and quickly masters the ancient art of mixing flowers, herbs, and oils. Then one day he catches a faint whiff of something so exquisite he is determined to capture it. Obsessed, Grenouille follows the scent until he locates its source—a beautiful young virgin on the brink of womanhood. As his demented quest to create the "ultimate perfume" leads him to murder, we are caught up in a rising storm of terror until his final triumph explodes in all of its horrifying consequences." (Short decription of the English translation of the novel, Süskind 1987)

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