Why event structure templates are not enough –
A frame account of bleeding and droning

Jens Fleischhauer & Thomas Gamerschlag & Wiebke Petersen

University of Düsseldorf

The common assumption of most decompositional approaches to natural language semantics is that event structure templates as in (1) represent the grammatically relevant meaning components of verbs.

(1)   Event structure templates (Rappaport Hovav and Levin 1998, p.108, based on Dowty 1979)
   State: $[x \langle \text{PRED} \rangle]$
   Activity: $[x \, \text{ACT}_{\langle \text{PRED} \rangle}]$
   Achievement: $\text{BECOME}[x \langle \text{PRED} \rangle]$
   Accomplishment: $[x \, \text{CAUSE}[\text{BECOME}[y \langle \text{PRED} \rangle]]]$

As these approaches are confined to representing event structural properties, the idiosyncratic lexical content is often reduced to an unanalyzed atomic root. In our talk we will demonstrate by the example of *verbs of emission* that a more fine-grained analysis is necessary in order to account for the semantics of these verbs. Following the traditional approach in Rappaport Hovav and Levin (2010), verbs of emission would be represented as in (2), in which the specific type of emission appears as a subscripted modifier root of the primitive predicate ACT.

(2)   a.   bleed: $[x \, \text{ACT}_{\langle \text{BLEED} \rangle}]$
   b. drone: $[x \, \text{ACT}_{\langle \text{DRONE} \rangle}]$

Representations in this fashion, however, neglect the semantic differences that exist between verbs of substance emission like *bleed* in (2-a) and verbs of sound emission like *drone* in (2-b): while the ACT-predicate indicates that both verbs denote activities, it does not express that they fundamentally differ with respect to the relation between the properties of the emission and the progression of the event. In the case of (2-a) the emission of substance is monotonically related to the progression of the event, i.e., the quantity of emitted substance increases in the course of the event (event-dependent emission). By contrast, there is no relation between the progression of the event and the emission of a sound in (2-b) such that any property (quantity, intensity or whatever) necessarily increases in the progress of the event (event-independent emission). This difference is evident in the context of verbal degree gradation: *sehr* 'very' specifies the quantity of emitted blood in (3). If the verb is used in a progressive construction as in (3-a), the quantity of blood at a certain stage of the event is specified whereas the perfective-like construction in (3-b) refers to the total amount of emitted blood:

(3)   a.   Die Wunde war sehr am Bluten.
     the wound was very at.the bleeding
     'The wound was bleeding a lot.'
   b. Die Wunde hat sehr geblutet.
     the wound has very bled
     'The wound bled a lot.'

By contrast, grammatical aspect does not affect the interpretation of degree gradation in case of verbs of sound emission. In both examples in (4), *sehr* indicates the intensity (= loudness) of the emitted sound.

(4) a. Der Motor ist sehr am Dröhnen.
         the engine is very at.the droning
         'The engine was droning a lot.'
     b. Der Motor hat sehr gedröhnt.
         the engine has very droned
         'The engine droned a lot.'

Decompositional representations like those in (2) are not able to capture this difference between verbs of substance emission and verbs of sound emission as they do not represent the relation that holds between the event and the emitted stimulus.

A promising framework for the analysis of emission verbs is frame theory which is based on Barsalou's ideas about frames as the fundamental structures of cognitive representation (Barsalou, 1992). Frames are recursive attribute-value structures that allow one to zoom into conceptual structures to any desired degree and to access meaning components by attribute paths (cf. Petersen, 2007). The static event frame of *sehr dröhnen* as in (4) is given in (5)(a). It models the static dimensions of the event (cf. Fillmore, 1982), that is the relations to the two participating objects, i.e. the *emitter* and the *emittee*, of the event (note that the emittee is an implicit argument while the emitter is an open argument). Additionally, the frame represents the result of applying the intensifier *sehr* 'very': it restricts the value of the INTENSITY-attribute of the emitted sound to 'high' (which is a context-dependent subinterval of the intensity scale).

(5)

(a)   (b)
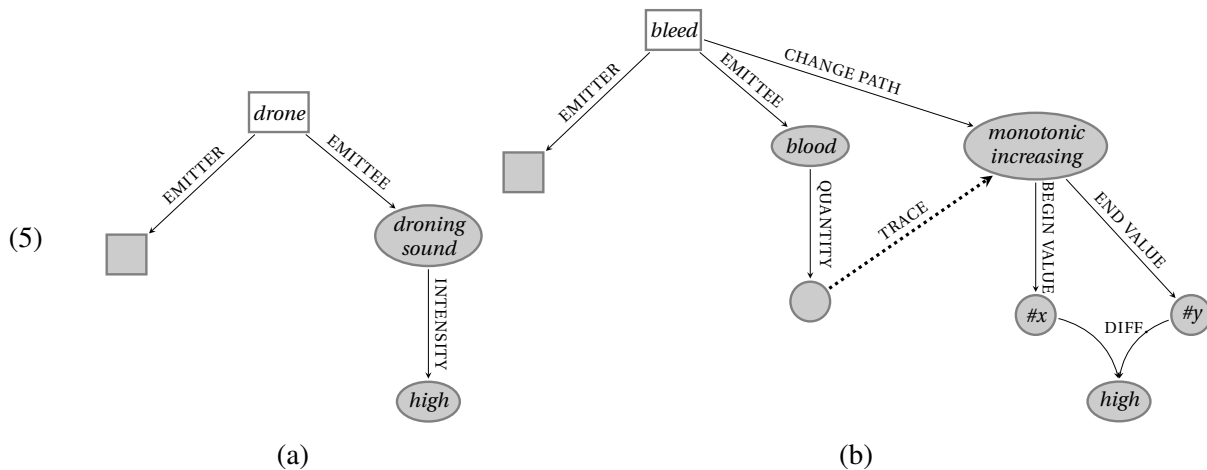
The case of the event-dependent degree gradation in (3) is more complex. In order to model the dependency relation that the more the event progresses, the higher the degree on the quantity scale is, the level of static event frames is not sufficient. In our analysis we follow the three-level event decomposition model proposed in Naumann (2013) and further developed and exemplified in Gamerschlag et al. (2014). Figure (6) shows the three level model for the examples in (3) ((3-b) is depicted in (6)(a) and (3-a) in (6)(b)). At the top, the *static event frame level* represents the relation of the event to the participating objects (emitter and emittee). In the middle, on the *event decomposition level* the event is decomposed into single subevents. This level represents the temporal structure of the event and links it to the *situation frame level* at the bottom that represents the participating objects and the changes they undergo at the different time points of the event, here the amount of emitted blood.

(6) (a) (b)
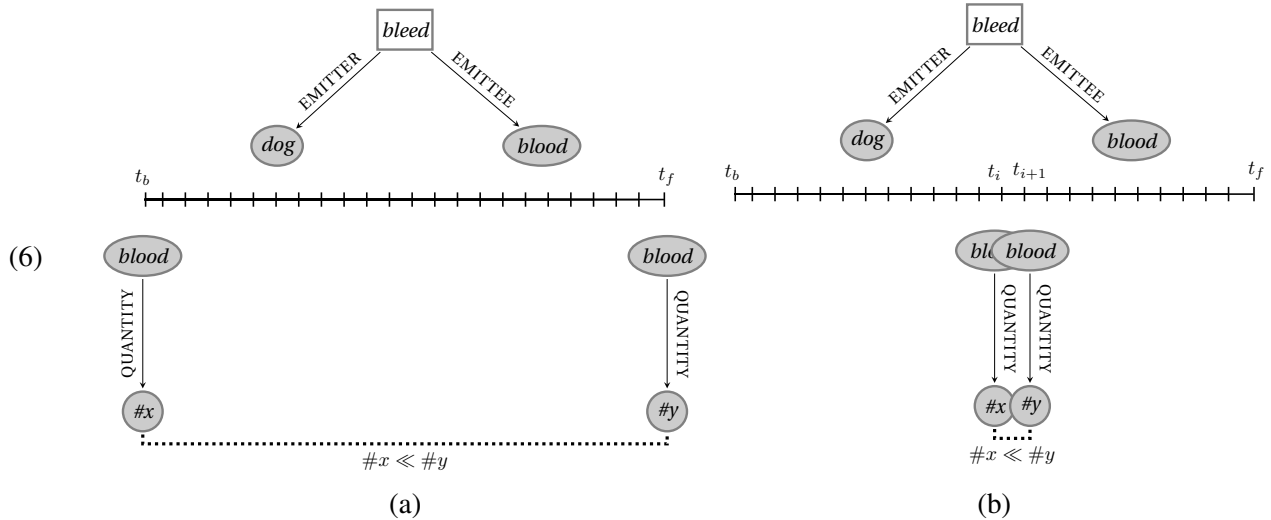
The three levels can be merged into the single frame in Figure (5)(b) by establishing the dynamic attribute TRACE that is projected from the event decomposition frame in (6) and maps the QUANTITY value of the emitted blood to the record of its trace in the time span of the event. The recorded trace is of type 'path' and hence a static spatial object with a begin and an end value. The intensifier *sehr* restricts the difference of these two values (here indicated by the 2-place attribute DIFF) to the value range 'high'. Thus, in our frame account the attested asymmetry between substance and sound emission verbs illustrated in (3) and (4) results from the structural difference between the representation of intensity scales (as used in sound emission frames) and quantity specifications in frames. In particular, the accumulation of the quantity of a substance over the course of the event is made explicit at a level of the frame representation which captures the temporal change of the participants' properties.

In our talk we will further demonstrate that frame theory allows for an adequate analysis of a second class of grammatical asymmetries which are not predicted by the representations in (2) – this time within the class of sound emission verbs. In German, motion verbs can be derived from verbs of sound emission such as *jaulen* 'whine' as in (7):

(7)   Kaufmann (1995, p.91)

    a.   Der Welpe jault.
        the Puppy whines
        'The puppy yowls.' '

    b.   § Das Motorrad   jault.
         the Motorbike whines
        'The motorbike yowls.'

    c.   Das Motorrad   jault   über die Kreuzung.
        the Motorbike whines over the crossing
        'The motorbike whines over the crossing.'

    d.   § Der Welpe jault   unter das Bett.
         the Puppy whines under the bed
        'The puppy whines under (dir) the bed.'

As already observed by Kaufmann (1995) and Levin and Hovav (1995) among others, the motion verb use of sound emission verbs is accessible only if the specific sound can be interpreted as a side-effect of motion as in (7-c) whereas this use is not licensed if such a relation does not hold as in (7-d). At the same time, the sortal restrictions of the verb in the basic use and the derived use are reversed as illustrated by the contrast

between (7-a)/(7-b) and (7-c)/(7-d). Neither the accessibility of the motion verb use nor the change in sortal restrictions is adequately captured by representations as in (2). What is needed instead is a representational framework which allows for making reference to the co-occurrence of sound and motion.

We will demonstrate how this grammatical asymmetries can be analysed in frame theory. Here, the strength of frame representations is that we can model the detailed relations between an event, its participants and the sound produced either independently by the actor ('puppy' in (7-a), (7-d)) or by the theme in dependence of the event ('motorbike' in (7-b), (7-c)). The constructional constraints can be formulated by making reference to specific frame components. In particular, the frame of the base verb referring to the emission of a particular sound licenses the activation of a movement frame in which the theme argument is embedded. Thereby, it introduces an additional argument, namely the directed path PP. We will show that frame representations show a flexible degree of complexity (zooming in and out by expanding/not expanding nodes) which allows for easy access to the details of verb and noun meaning needed for an analysis of the different uses of emission verbs.

Barsalou, L. W. (1992). Frames, concepts, and conceptual fields. In Lehrer, A. and Kittay, E. F., editors, *Frames, Fields, and Contrasts*, pages 21–74. Lawrence Erlbaum Associates Publishers, Hillsdale NJ.

Dowty, D. R. (1979). *Word Meaning and Montague Grammar: The Semantics of Verbs and Times in Generative Semantics and in Montague's PTQ*. Reidel.

Fillmore, C. J. (1982). Frame Semantics. In Society, T. L., editor, *Linguistics in the Morning Calm. Selected Papers from SICOL-1981*, pages 111–137. Hanshin Publishing Company.

Gamerschlag, T., Geuder, W., and Petersen, W. (2014). Glück auf, der Steiger kommt– a frame account of extensional and intensional 'steigen'. In Gerland, D., Horn, C., Latrouite, A., and Ortmann, A., editors, *Meaning and Grammar of Nouns and Verbs*, volume 1 of *Studies in Language and Cognition*, pages 115–144. DUP, Düsseldorf.

Kaufmann, I. (1995). What is an (im)possible verb? Restrictions on semantic form and their conse-quences for argument structure. *Folia Linguistica*, XXIX(1-2):67–103.

Levin, B. and Hovav, M. R. (1995). *Unaccusativity*. The MIT Press, Cambridge, Mass.

Naumann, R. (2013). Outline of a dynamic theory of frames. In Bezhanishvili, G., Löbner, S., Marra, V., and Richter, F., editors, *Proceedings of TbiLLC 2013*, volume 7758 of *LNCS*, pages 115–137, Berlin, Heidelberg. Springer.

Petersen, W. (2007). Representation of concepts as frames. In Skilters, J., Toccafondi, F., and Stemberger, G., editors, *Complex Cognition and Qualitative Science*, volume 2 of *The Baltic International Yearbook of Cognition, Logic and Communication*, pages 151–170. University of Latvia.

Rappaport Hovav, M. and Levin, B. (1998). Building verb meanings. In Butt, M. and Geuder, W., editors, *The Projection of Arguments: Lexical and Compositional Factors*, pages 97–134. CSLI Publications., Stanford, CA.

Rappaport Hovav, M. and Levin, B. (2010). Reflections on manner/result complementarity. In Rappaport Hovav, M., Doron, E., and Sichel, I., editors, *Syntax, lexical semantics, and event structure*, page 21–38. Oxford University Press, Oxford.