



An Analysis of the Evidential Use of German Perception Verbs

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*This paper presents a frame-theoretic account of the inferential and non-inferential use of German perception verbs like *klingen* ‘sound’, *aussehen* ‘look (like)’, and *sich anfühlen* ‘feel (like)’. We argue that a proper analysis of constructions based on these verbs requires explicit reference to object attributes like *SOUND*, *SIGHT*, and *TOUCH*, to which we refer as ‘dimensions’. It will be shown that a frame analysis, in which object dimensions can easily be represented as frame attributes, is ideally suited for the treatment of perception verbs of this type. Following Barsalou (1992), we define frames as recursive attribute-value structures, which are represented as directed labeled graphs with the arcs corresponding to attributes and the nodes to their values (cf. Petersen 2007). Furthermore, we assume that the knowledge about admissible frames is represented in type hierarchies which restrict the set of appropriate attributes and their values for object classes. Given our frame model, the admissible inferential and noninferential uses of perception verbs are captured as constraints on attributes assigned to the subject referent, the verb and the predicative complement of the verb. Finally, a comparison between the German data and verb-based evidentials in French will show that the inferential use of perception verbs exhibits marked differences cross-linguistically.*

Keywords: perception verbs, inferential evidential, object dimensions, frame-theoretic analysis

1. Introduction

For some time now, there has been an increasing interest in evidentiality understood as a grammaticalized source of information. In the course of this process, a number of mostly typological studies have arisen which have a strong focus on evidentiality encoded by grammatical markers, that is, by verbal affixes or modal auxiliaries (Chafe and Nichols 1986; Willett 1988; de Haan 1999; Aikhenvald 2004 among others). However, as recently argued by Gisborne (2010) for English and Whitt (2009, 2010) in a comparative corpus study of English and German, perception verbs like English *sound* and

German *klingen* ‘sound’ are another lexical means to express evidentiality. For example, beside the noninferential use of *klingen* in (1a), *klingen* can also be used to mark inferential evidentiality as in (1b):

- (1) a. Die Melone klingt dumpf.
 ‘The melon sounds muffled.’ (direct perception)
 b. Die Melone klingt reif.
 ‘The melon sounds ripe.’ (inferential evidential)

(1a) is an instance of direct perception, in which the predicative complement *dumpf* ‘muffled’ refers to an auditory quality of the melon, which is directly perceived by hearing. Therefore, we will refer to the use of the perception verb in (1a) as the ‘direct sensory use’. In (1b), however, *reif* ‘ripe’ does not specify an auditory quality of the melon. Instead, the quality of being ripe is inferred from the way the melon sounds. The statement in (1b) is based on the observation that there is a correlation between the ripeness of a melon and the sound it produces when thumped: if it sounds muffled, it is usually ripe. By contrast, a bright and clear sound indicates that the melon is still unripe. Since the verb in (1b) denotes the kind of sensory evidence from which the property specified by the predicative complement *reif* ‘ripe’ is inferred, the sentence can be considered as an inferential evidential.

In this paper, we present a frame-theoretic account of both the nonevidential and the evidential use of perception verbs. The following questions are central to our analysis: first, how is the evidential use in (1b) interpreted and how is it related to the nonevidential use in (1a)? Second, how can awkward sentences such as (2) be ruled out? Since both *klingen* ‘sound’ and *teuer* ‘expensive’ can take *Melone* ‘melon’ as an argument, (2) cannot be ruled out as a simple instance of a violation of sortal restrictions.

- (2) #Die Melone klingt teuer.
 lit.: ‘The melon sounds expensive.’

Our analysis is based on the assumption that perception verbs like *klingen* ‘sound’ and *schmecken* ‘taste (of)’ encode attributes like SOUND and TASTE and that these attributes represent cognitive ‘dimensions’ of the subject referent. In the simple case of direct perception given in (1a), an intra-dimensional quality is specified. However, in an evidential use like (1b) a mismatch between the dimension encoded by the verb and the value specified by the predicative complement leads to a ‘dimensional shift’ in which a compatible dimension is inferred from the dimension expressed by the verb. We will argue that both uses can be captured easily in a frame-theoretic account.

2. A Typology of Perception Verbs

As shown by Whitt (2009, 2010), the inferential use is characteristic of a subclass of perception verbs he calls *object-oriented perception verbs*. Other terms of reference for this subclass are *stimulus subject perception verbs* (Levin 1993) and *phenomenon-based verbs* (Viberg 2001). We will follow Viberg and use the term *phenomenon-based verbs* (henceforth: PBVs). This

type constitutes one of the three subclasses of perception verbs distinguished in the typological investigation presented in Viberg (1984). The tripartite classification of perception verbs is given in Figure 1 below.

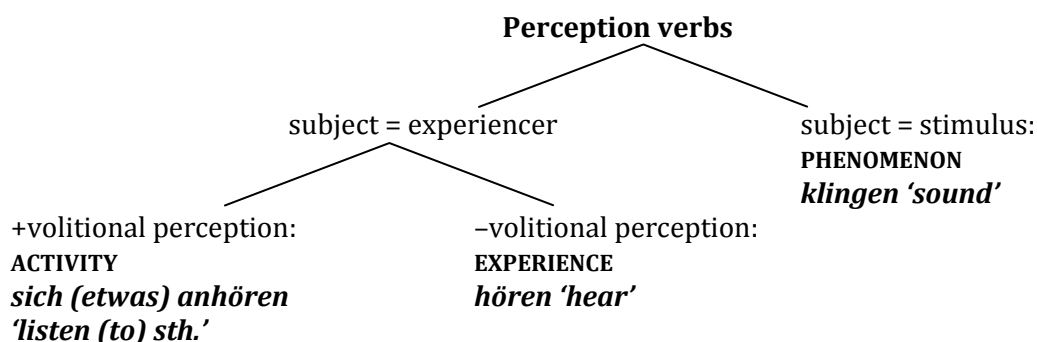


Figure 1. Types of perception verbs (Viberg 1984, 2001)

In both the activity and experience subtype the experiencer is realized as subject. The two types differ with respect to volitionality. Verbs of the activity type such as *sich (etwas) anhören* ‘listen to’ refer to volitional perception, whereas verbs such as *hören* ‘hear’ belong to the experience type since they denote involuntary perception. Verbs of the phenomenon subtype such as *klingen* ‘sound’ are differentiated from the other two subtypes by the fact that the stimulus is realized as subject while the experiencer can remain unrealized. (Hence the alternative term of reference *stimulus subject perception verbs*). As an effect of demoting the experiencer, perception verbs of this type focus on the phenomenon. Since they select a predicative argument they involve an embedded proposition which consists of the subject referent and the embedded predicate. This property makes verbs of this subtype particularly suitable for an evidential use.

The overview in Table 1 shows the inventory of perception verbs in German. As can be seen, each of the three subtypes has a full-fledged paradigm of verbs for all of the five sense modalities.

Because of their specific potential to express inferential evidentiality we will concentrate on the subtype of PBVs illustrated in the rightmost column. Like the other two subtypes, PBVs have a specific verb for each of the five sense modalities: *aussehen* ‘look’ refers to the SIGHT of an entity whereas *klingen* ‘sound’ allows for the specification of a SOUND quality, which is perceived auditorily. As a near synonym of *klingen* German also has the pseudoreflexive verb *sich anhören*, which lacks a counterpart in English. *Sich anfühlen* ‘feel (like)’, *schmecken (nach)* ‘taste (of)’, and *riechen (nach)* ‘smell (of)’ involve the object properties TOUCH, TASTE, and SMELL, which are perceived via one of the remaining three senses.

EXPERIENCER-BASED		PHENOMENON-BASED	
ACTIVITY	EXPERIENCE		
S I G H T	Peter sah (sich) die Vögel an . 'Peter looked at the birds.'	Peter sah die Vögel. 'Peter saw the birds.'	Peter sah fröhlich aus . 'Peter looked happy.'
H E A R	Peter hörte sich den Vortrag an . 'Peter listened to the talk.'	Peter hörte den Donner. 'Peter heard the thunder.'	Peter klang traurig/ hörte sich traurig an . 'Peter sounded sad.'
T O U C H	Peter fühlte den Stoff an . 'Peter felt the cloth.'	Peter fühlte einen Stein unter seinem Fuß. 'Peter felt a stone under his foot.'	Der Stoff fühlte sich weich an . 'The cloth felt soft.'
T A S T E	Peter kostete das Essen. 'Peter tasted the food.'	Peter schmeckte Ingwer in der Suppe. 'Peter tasted ginger in the soup.'	Die Suppe schmeckte nach Ingwer. 'The soup tasted of ginger.'
S M E L L	Peter roch an dem Essen. 'Peter smelled the food.'	Peter roch Ingwer in der Suppe. 'Peter smelled ginger in the soup.'	Die Suppe roch nach Ingwer. 'The soup smelled of ginger.'

Table 1. German perception verbs
(English data partially adopted from Viberg 2001: 1295)

3. Phenomenon-based Perception Verbs

3.1 Dimensionality

PBVs isolate a sensory attribute like SOUND and TASTE and allow for the specification of a value for this attribute. Cognitively, these attributes can be conceived of as dimensions, that is, object properties which, at a specific point of time, are characterized by a unique quality. For instance, a PBV like *klingen* 'sound' refers to **the** sound of a sound-emitting object. Dimensions understood in this way correspond to mathematical functions, which map objects of an adequate type onto values of a specific type. Out of the possible values determined by the dimension-specific variation space only one value can be assigned to the subject referent at a given point of time. Thereby, dimensions correspond to 'functional concepts' in the sense of Löbner (2011).

The dimensionality of PBVs is illustrated for the subject *Melone* 'melon' in (3). Each of the verbs in (3a) to (e) refers to a specific sensory dimension, for which a value is specified by the adjective. For example, *länglich* 'oblong' in (3a) specifies a value within the dimension of SIGHT whereas *dumpf* 'muffled'

in (3b) explicates a value within the dimension of SOUND. The dimensions encoded by the PBVs in (3) can directly be translated into attributes in frame representations as in (4), which shows a partial frame of a melon.

(3) Die Melone... ‘The melon...’	(4) Partial frame of a <i>melon</i>
<ul style="list-style-type: none"> a. sieht länglich aus. ‘looks oblong.’ b. klingt dumpf. ‘sounds muffled.’ c. fühlt sich glatt an. ‘feels smooth.’ d. schmeckt süß. ‘tastes sweet.’ e. riecht fruchtig. ‘smells fruity.’ 	$\left[\begin{array}{l} \textit{melon} \\ \text{SIGHT } [\textit{oblong}] \\ \text{SOUND } [\textit{muffled}] \\ \text{TOUCH } [\textit{smooth}] \\ \text{TASTE } [\textit{sweet}] \\ \text{SMELL } [\textit{fruity}] \\ \dots \end{array} \right]$

All of the examples provided in (3) are instances of the direct-sensory use, in which an intra-dimensional value is specified. However, as shown in the following, PBVs can be used to mark inferential evidentiality in addition to their noninferential direct-sensory use.

Explicit reference to object dimensions is a necessary abstraction for generalizations such as the sense-modality hierarchy proposed by Viberg:



Figure 2. Sense-modality hierarchy (Viberg 1984, 2001)

The hierarchy in Figure 2 captures the fact that not all five sense modalities are treated equally in languages. For example, verbs encoding an object dimension belonging to a sense modality higher in the hierarchy are used more frequently and, in cross-linguistic terms, tend to extend their meaning to dimensions lower in the hierarchy. As shown by Whitt (2010), this generalization covers both the evidential and nonevidential uses.

3.2 Valency Patterns

PBVs exhibit an array of different valency patterns. Ignoring marginal patterns, the major construction types are summarized in (5). As can be seen, PBVs can select an adjective as in (5a), a comparative phrase as in (5b), a prepositional phrase headed by *nach* as in (5c), and a finite complement clause as in (5d). To keep things simple we will deal exclusively with the patterns in (5a) and (b), that is with adjectival complements and the *wie*-comparative phrase.

- (5) a. perception verb + AP
Der Stoff fühlt sich seidig an.
'The cloth feels silky.'
- b. perception verb + *wie*-comparative phrase
Der Stoff fühlt sich wie Seide an.
'The cloth feels like silk.'
- c. perception verb + *nach*-PP
Der Stoff fühlt sich nach Seide an.
'The cloth feels like silk.'
- d. perception verb + finite subordinate clause (*wie wenn.../als ob...* 'as if')
Der Stoff fühlt sich an, als ob er Seide wäre.
'The cloth feels as if it were silk.'

3.3 Direct Sensory Use versus Inferential Evidential Use

The sentences in (6) to (10), which are combinations of PBVs and adjectival complements, show that both the direct sensory and the inferential evidential use are available for each of the sense modalities. The a-sentences are instances of the direct-sensory use whereas the b-sentences are instances of inferential evidentials. For example, *zylindrisch* 'cylindrical' in (6a) refers to the SIGHT of a device. However, its SOLIDITY, which is characterized by the predicate *stabil* 'stable,' is a dimension which is inferred from visual properties in (6b). Likewise, being soft in (8a) is a directly perceivable quality of the car seats' TOUCH while being expensive is a value of the dimension PRICE, which is inferred from TOUCH in (8b). Since the qualities denoted by the adjectives in the b-sentences do not specify a value of the dimension encoded by the verb, they can be characterized as 'extra-dimensional' as opposed to the 'intra-dimensional' value specification in the a-sentences.

- (6) a. Das Gerät sieht zylindrisch aus.
'The device looks cylindrical.' SIGHT
- b. Das Gerät sieht stabil aus.
'The device looks solid.' SIGHT → SOLIDITY
- (7) a. Ilse's Stimme klingt schrill.
'Ilse's voice sounds shrill.' SOUND
- b. Ilse's Stimme klingt gelangweilt.
'Ilse's voice sounds bored.' SOUND → MOOD
- (8) a. Die Autositze fühlen sich weich an.
'The car seats feel soft.' TOUCH
- b. Die Autositze fühlen sich teuer an.
'The car seats feel expensive.' TOUCH → PRICE
- (9) a. Die Schokolade schmeckt süß.
'The chocolate tastes sweet.' TASTE
- b. Die Schokolade schmeckt alt.
'The chocolate tastes old.' TASTE → AGE
- (10) a. Das Olivenöl riecht fruchtig.
'The olive oil smells fruity.' SMELL
- b. Das Olivenöl riecht verdorben.
'The olive oil smells rotten.' SMELL → FRESHNESS

The inferences in the b-examples are implicatures, which can be negated without contradiction. As shown by (11), the example in (10b) is compatible with the negation of the inferred proposition that the olive oil is rotten.

(11) Das Olivenöl riecht verdorben, ist aber nicht verdorben.

‘The olive oil smells rotten, but it is not rotten.’

In the next section, we will present an analysis which is compatible with the observation that the inferred proposition can be negated.

Note that the nonevidential type comprises two subtypes which can be differentiated as ‘characterization’ versus ‘appraisal’ (cf. the FrameNet representation of PBVs like *sound* at <http://framenet.icsi.berkeley.edu/>). In the first type, which is illustrated by the a-examples in (6) to (10), the adjective specifies some sense-specific quality whereas in the second type the adjective denotes some kind of (positive or negative) judgment given to the (unspecified) way something looks, tastes, feels, etc. For example, in a sentence like *Ilse's Stimme klingt angenehm* ‘Ilse’s voice sounds pleasant,’ *angenehm* ‘pleasant’ is a judgment on the sound of Ilse’s voice and not a specification of its acoustic characteristics. Moreover, there are evidential uses in which the PBV has undergone some metaphoric drift; as in *Der Vorschlag klingt vielversprechend* ‘The proposal sounds promising.’ Here, *klingen* ‘sound’ does not refer to auditory qualities of the proposal but rather to the way its contents is conveyed. As a first approach to a frame analysis, we will concentrate on the uses illustrated in (6) to (10) above, which we consider as the most central types.

4. Case study Melone ‘melon’

Our analysis develops along a case study based on constructions in which the subject *Melone* ‘melon’ is combined with varying PBVs and adjectival complements. The examples in (12) show combinations of the subject *Melone*, the verb *aussehen* ‘look (like)’, which refers to the dimension SIGHT, and different adjectives. The examples in (12a) to (c) are admissible sequences of *aussehen* and varying adjectives whereas the combination of *aussehen* and *dumpf* ‘muffled’ in (12d) is ruled out:

- (12) a. Die Melone sieht hohl aus.
‘The melon looks hollow.’
b. Die Melone sieht reif aus.
‘The melon looks ripe.’
c. Die Melone sieht oval aus.
‘The melon looks oval.’
d. #Die Melone sieht dumpf aus.
lit.: ‘The melon looks muffled.’

If the verb is changed from *aussehen* ‘look (like)’ to *sich anfühlen* ‘feel (like)’, which encodes TOUCH, the acceptability of the examples does not alter, as shown in (13). Again, only the combination with *dumpf* ‘muffled’ in (13d) is ruled out whereas all other sequences are acceptable.

- (13) a. Die Melone fühlt sich hohl an.
‘The melon feels hollow.’
b. Die Melone fühlt sich reif an.
‘The melon feels ripe.’
c. Die Melone fühlt sich oval an.
‘The melon feels oval.’
d. #Die Melone fühlt sich dumpf an.
lit.: ‘The melon feels muffled.’

Substituting *sich anfühlen* ‘feel (like)’ with *klingen* ‘sound’, which refers to the dimension SOUND, yields the sentences given in (14). As can be seen, all examples are acceptable now. The combination of *klingen* and *oval* ‘oval’ in (14c) seems awkward at first sight. However, as pointed out to us by Bill Croft (p.c.), the sentence is acceptable if one thinks of a situation in which a blindfolded person has to recognize the form of different melons by means of the sound they produce when rolled on a table. This example clearly shows that the acceptance of certain combinations depends heavily upon the background knowledge and the context in which they are used.

- (14) a. Die Melone klingt hohl.
‘The melon sounds hollow.’
b. Die Melone klingt reif.
‘The melon sounds ripe.’
c. Die Melone klingt oval.
‘The melon sounds oval.’
d. Die Melone klingt dumpf.
‘The melon sounds muffled.’

The examples in (15) and (16) show sentences with the verbs *schmecken* ‘taste (of)’ and *riechen* ‘smell (of),’ which refer to the dimensions TASTE and SMELL, respectively. For both verbs only the combination with *reif* ‘ripe’ in (15b) and (16b) is acceptable, whereas all other sequences are ruled out.

- (15) a. #Die Melone schmeckt hohl.
lit.: ‘The melon tastes hollow.’
b. Die Melone schmeckt reif.
‘The melon tastes ripe.’
c. #Die Melone schmeckt oval.
lit.: ‘The melon tastes oval.’
d. #Die Melone schmeckt dumpf.
lit.: ‘The melon tastes muffled.’

- (16) a. #Die Melone riecht hohl.
lit.: ‘The melon smells hollow.’

- b. Die Melone riecht reif.
'The melon smells ripe.'
- c. #Die Melone riecht oval.
lit.: 'The melon smells oval.'
- d. #Die Melone riecht dumpf.
lit.: 'The melon smells muffled.'

The above examples demonstrate that the subject argument *Melone* 'melon' can be combined with a perception verb independent of the sensory dimension encoded. In addition, each of the adjectives can – depending on the verb – combine with the subject *Melone* 'melon.' Thus, the awkward combinations in (12) to (16) cannot solely be excluded by a mismatch between the sort of the subject referent and the sortal restrictions of the verb and/or the adjective. Instead, an analysis is required which relates the subject, the verb and the predicative complement to inherent dimensions. A frame analysis, in which dimensions directly correspond to frame attributes, is therefore ideally suited for an analysis of evidential constructions of the type under investigation.

5. Frame Analysis

Following Barsalou (1992), we define frames as recursive attribute-value structures, which are represented as directed labeled graphs with the arcs corresponding to attributes and the nodes to attribute values (cf. Petersen 2007).

5.1 Direct Perception Use: Intra-dimensional Value Specification

In the direct perception use, the predicative complement specifies an intra-dimensional value. For this (trivial) case, the 'dimension matching' constraint formulated below assures that the subject referent exhibits the dimension encoded by the perception verb.

Dimension Matching

The subject referent must exhibit the dimension encoded by the PBV.

The constraint above can be seen as a specific variant of a more general principle which captures the selectional restrictions of a verb (or of heads in general) by means of a constraint that requires the arguments to mirror (some of) the attributes encoded by the verb. For the sake of simplicity, we will not attempt to give an adequate formulation of such a general principle and stick to the particular version given.

In order to fulfill the above constraint, the referent of any subject selected by *klingen* 'sound' must exhibit an attribute referring to the dimension SOUND. Since this is the case with *Melone* 'melon' (cf. the representation in (4)), it can combine with *klingen*. In the resulting frame provided in Figure 3 the SOUND attribute of *Melone* and the SOUND attribute encoded by *klingen* are unified. Note that the doubly encircled node is the central node of the frame, which

specifies what the frame is about.



Figure 3. Frame representation of *Die Melone klingt dumpf.*
'The melon sounds muffled.'

If the subject referent does not have a SOUND attribute, it cannot combine with *klingen* since this would constitute a violation of DIMENSION MATCHING. Consequently, abstract entities such as *time interval* or *despair* cannot show up as subject of this PBV.

A comparison construction like (17) can also be treated as an instance of direct perception.

- (17) *Die Melone klingt wie ein Rugbyball.*
'The melon sounds like a rugby ball.'

Here, the value of the SOUND attribute of *Melone* 'melon' is not specified by an adjective but instead is identified with the SOUND attribute of the object of comparison, which is *Rugbyball* 'rugby ball'. In the case of a comparison as in (17), both entities involved in the comparison must fulfill Constraint 1 since (17) can be paraphrased by the equivalent construction in (18), in which both *Melone* 'melon' and *Rugbyball* 'rugby ball' figure as subject.

- (18) *Die Melone klingt, wie ein Rugbyball klingt.*
'The melon sounds as a rugby ball sounds.'

The comparison constructions in (17) and (18) can be represented by the frame in Figure 4, in which the values of the SOUND attribute of both melon and rugby ball are identified.

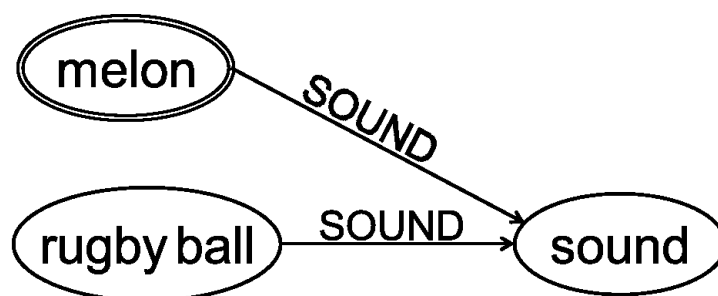


Figure 4. Frame representation of *Die Melone klingt, wie ein Rugbyball.*
'The melon sounds like a rugby ball.'

5.2 Inferential Use: Extra-dimensional Value Specification

Against the background of the comparison construction discussed in the preceding section, the inferential use can be analyzed as an incomplete comparison. For instance, the inferential evidential in (19a), can be paraphrased roughly by the comparison constructions in (19b) and (c).

- (19) a. Die Melone klingt reif.
 ‘The melon sounds ripe.’
 b. Die Melone klingt wie eine reife Melone.
 ‘The melon sounds like a ripe melon.’
 c. Der Klang der Melone ist wie der Klang einer reifen Melone.
 ‘The sound of the melon is like the sound of a ripe melon.’

In (19a) the adjective *reif* ‘ripe’ does not specify a value along the dimension encoded by the verb *klingen*. This extra-dimensional value specification leads to what we call a ‘dimensional shift.’ In such a ‘dimensional shift’ an implicit dimension is inferred which is compatible with the value. However, based on the paraphrases in (19b) and (c), the implicit dimension is activated as an attribute of the object of comparison rather than of the object denoted by the subject. This is illustrated by the frame in Figure 5: both melons – the melon in focus and the melon of comparison – exhibit the attribute SOUND and thereby fulfill Constraint 1. In addition, they share the value of SOUND. Moreover, the attribute RIPENESS with the value ‘ripe’ is inferred from the attribute SOUND with the specific value ‘muffled.’ Here, ‘muffled’ is supposed to be the typical sound of a ripe melon. Instead of ‘muffled’ we could have chosen a value like ‘sound of a ripe melon.’ The inference relation is indicated informally by means of the broken line with the arrows pointing in both directions to show that the relation is usually bidirectional: from the state of ripeness a specific sound can be inferred as well as a specific sound suggests a certain state of ripeness.

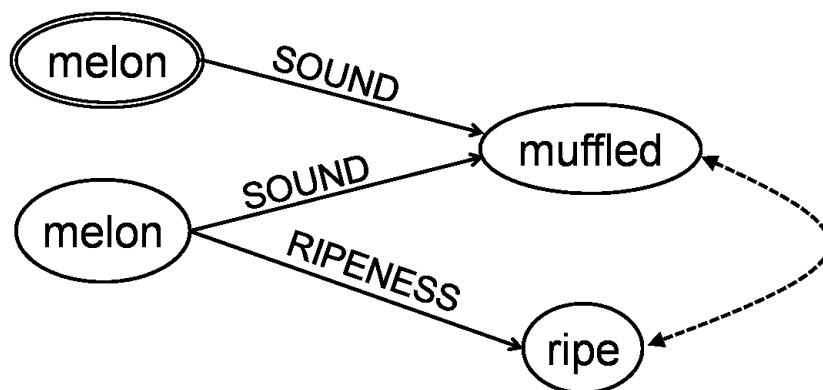


Figure 5. Frame representation of *Die Melone klingt reif.*
 ‘The melon sounds ripe.’

In Figure 5, ‘ripe’ is a value of the RIPENESS-attribute of the melon of comparison and not of the melon in focus. This is in line with the fact that the inference can be negated. If ‘ripe’ was the value of the ripeness attribute of the

melon in focus, negation of the inference would be expected to result in a contradiction. However, as shown by (20), negation of the inference does not lead to a contradiction.

- (20) Die Melone klingt reif, ist aber nicht reif.
 'The melon sounds ripe but it is not ripe.'

Now, we turn to the sentence in (21), which is an instance of a nonadmissible inference. The sentence in (21) cannot be ruled out by DIMENSION MATCHING because the subject referent exhibits the dimension encoded by the verb.

- (21) #Die Melone klingt teuer.
 literally: 'The melon sounds expensive.'

As in the preceding example, the value specification and the dimension encoded by the verb do not match. This leads to a dimensional shift, in which the compatible dimension PRICE is introduced. However, as a contrast to the admissible inference denoted by *klingt reif* 'sounds ripe,' the present frame is ruled out because it involves an implicit dimension (PRICE) which is not inferable from SOUND. This is indicated informally by the crossed-out line in the corresponding frame in Figure 6.

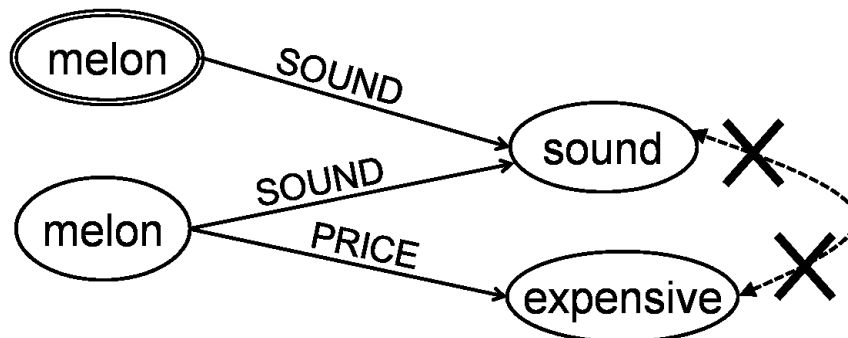


Figure 6. Frame representation of #Die Melone klingt teuer.
 'The melon sounds expensive.'

To cope with a mismatch between dimension and value specification and exclude non-admissible shifts like (21), an additional constraint is necessary, which is given in a preliminary version below.

DIMENSIONAL SHIFT (preliminary version)

If the dimension encoded by a phenomenon-based perception verb and the value specified by the predicative complement do not match, an implicit dimension is introduced which is

- a) compatible with the value specification and
- b) inferable from the dimension encoded by the verb.

In order to decide if the second subcondition in the formulation above is fulfilled, one has to have knowledge of admissible and nonadmissible inferences, which can be considered part of the speaker's overall object

knowledge. Some admissible inferences in the frame of an object of the type 'melon' are indicated informally in Figure 7. As can be seen, the dimensions COLOR, SOUND, TOUCH, TASTE, and SMELL are all related to RIPENESS via a bidirectional inference relation.

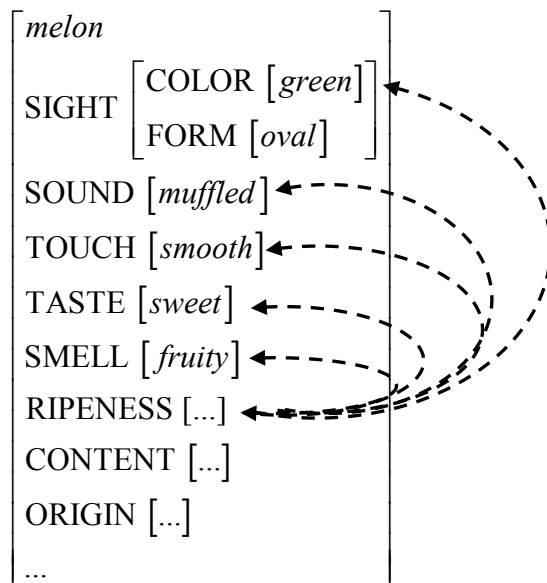


Figure 7. Frame of a *melon* with inferability indicated by arrows

The arrows in Figure 7 are for illustrational purposes; they are not part of our formal frame model. In our frame model, admissible inferences from one dimension to another are captured as attribute value covariation in the type hierarchy: if the value of one dimension varies, the value of the other dimension must also vary. This is illustrated in the partial hierarchy of melons in Figure 8 below, which shows subtypes of melons of different forms. If one looks at the oval melon subtype, it becomes obvious that FORM does not covary with RIPENESS: both *melon1* and *melon2* exhibit the value 'oval' for the attribute FORM but vary with respect to the value of RIPENESS. By contrast, SOUND covaries with RIPENESS: *melon1* has a bright sound and is unripe whereas *melon2* has a muffled sound and is ripe. The same holds for *melon3* and *melon4*, which belong to the subtype of round melons. Consequently, RIPENESS can be inferred from SOUND and vice versa. However, since FORM and RIPENESS do not exhibit covariation, an inference relation between these dimensions cannot be construed.

Bearing in mind that covariation is an indicator of inferability, dimensional shift can be revised as follows:

DIMENSIONAL SHIFT (final version)

If the dimension encoded by a phenomenon-based perception verb and the value specified by the predicative complement do not match, an implicit dimension is introduced which is

- a) compatible with the value specification and
- b) exhibits covariation of values with the dimension encoded by the verb

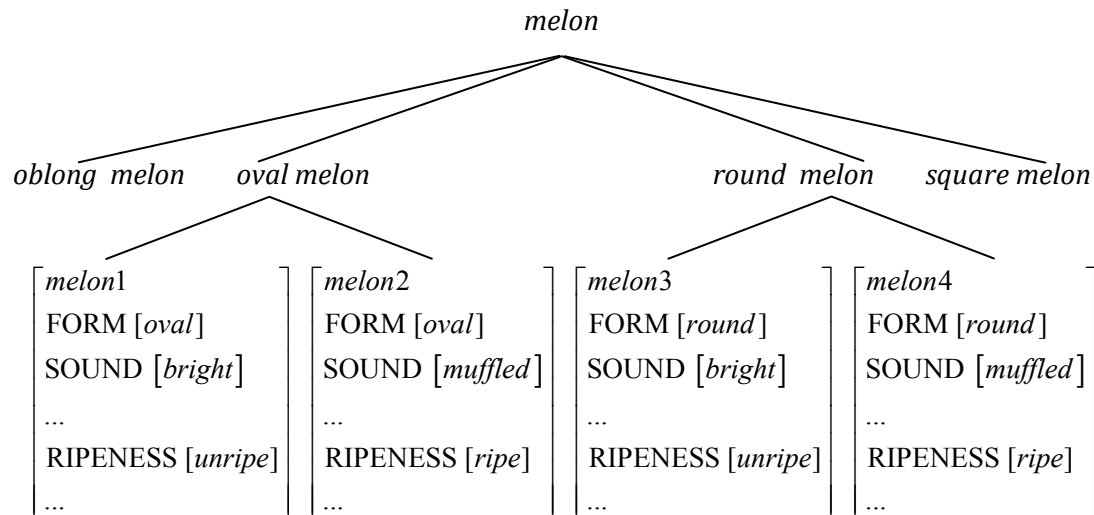


Figure 8. Partial type hierarchy of 'melon' with covariation of SOUND and RIPENESS

Note that the constraint in this final formulation of dimensional shift is designed to capture bidirectional inferences. Some instances of the evidential construction under discussion may be better analyzed as unidirectional inferences. However, we will not elaborate on these instances here. Suffice it to say that the constraint as now formulated can be refined to also capture unidirectional inferences.

An additional example of an inferential evidential is provided in Figure 9 below. Here, it is the implicit dimension MOOD which is compatible with the value specification *gelangweilt* 'bored.' MOOD is inferable from SOUND, although MOOD and SOUND are not connected to the same node: SOUND is an attribute of the voice-node, whereas MOOD is an attribute of the person-node. Nevertheless, (22) is well-formed since there is covariance between the MOOD of a person and the SOUND of her voice. Note that the object of comparison in Figure 9 is not 'Ilse' but 'person,' which is a super-type of 'Ilse'. This is admissible since (22) is understood as 'Ilse sounds like a bored person sounds' rather than 'Ilse sounds like Ilse sounds when she is bored.'

- (22) Iلسes Stimme klingt gelangweilt.
'Ilse's voice sounds bored.'

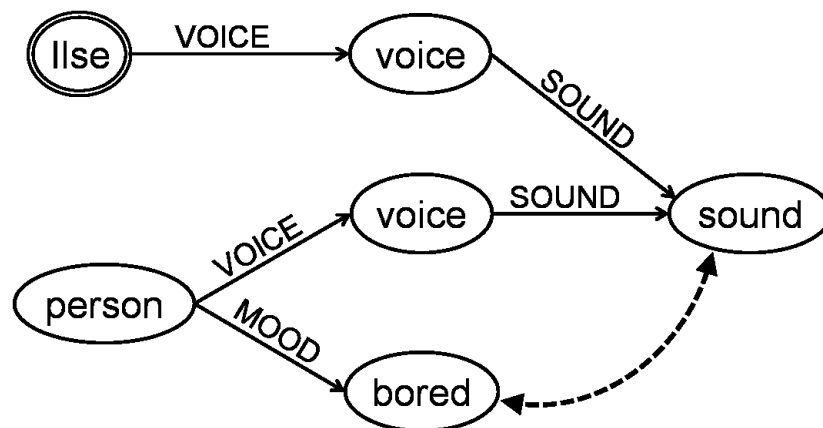


Figure 9. Frame representation of *Ilse's Stimme klingt gelangweilt.*
'Ilse's voice sounds bored.'

The last example of an inferential evidential in (23) shows a more complex instance of a dimensional shift:

- (23) Die Autositze fühlen sich teuer an.
'The car seats feel expensive.'

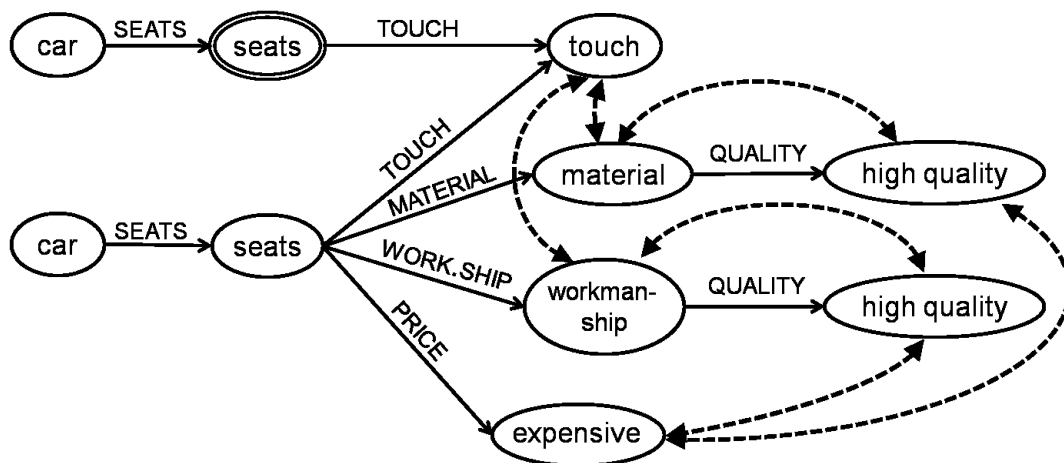


Figure 10. Frame representation of *Die Autositze fühlen sich teuer an.*
'The car seats feel expensive.'

In the frame in Figure 10, the TOUCH of the car seats is related to their PRICE. As indicated in the frame, TOUCH covaries with the MATERIAL and WORKMANSHIP of the seats, which covary with the QUALITY attributes. Finally, the QUALITY determines the PRICE of the seats. (19a) is well-formed with respect to DIMENSIONAL SHIFT since the TOUCH attribute and the PRICE attribute exhibit covariation via an inferential chain.

6. PBV-based Constructions in German versus French

We assume that the two constraints introduced above govern the inferential use of PBVs universally. Nevertheless, languages display considerable contrasts with respect to a) the repertory of PBVs and b) the availability and flexibility of the inferential use. These contrasts, which will be shortly illustrated below by data taken from French, indicate that the inferential use of PBVs can be further constrained by language-specific properties which make generalizations more difficult.

The examples in (24) show the repertory of French PBVs. As can be seen, French has PBVs only for the dimensions SOUND and SMELL, whereas it resorts to nominal constructions to explicitly refer to the remaining sense modalities.

(24) Repertory of PBVs and alternative strategies in French

- a. Il a l'air (de'être) triste. (SIGHT)
'He looks sad.' (lit.: 'He has the air (of being) sad.')
- b. La cloche sonne fort. (SOUND)
'The bell sounds loud.'
- c. La sucette a un goût amer. (TASTE)
'The lolly tastes bitter.' (lit.: 'The lolly has a bitter taste.')
- d. Le parfum sent la rose. (SMELL)
'The perfume smells of roses.' (lit.: 'The perfume smells the rose.')
- e. Le cuir est doux (au toucher). (TOUCH)
'The leather feels soft.' (lit.: 'The leather is soft (by touch).')

In addition to the limited repertory of PBVs, the array of admissible predicative complements is restricted. This is illustrated in (25) for the verb *sonner* 'sound,' which can combine with the adjectives *fort* 'loud' and *creux* 'hollow' as in (25a) and (b). (25b) can be characterized as an instance of an inferential evidential in which the sound of the barrel allows one to make inferences about its contents. However, as shown by the ungrammaticality of (25c), which is the direct translation of 'The melon sounds ripe,' combinations of *sonner* and an adjective are less flexible than in German and English. (25d) and (f) are additional examples of ungrammatical sequences of *sonner* and varying adjectives. Likewise, the comparison construction in (25f) is hardly acceptable.

(25) French *sonner* 'sound'

- a. La cloche sonne fort.
'The bell sounds loud.'
- b. Le tonneau sonne creux.
'The barrel sounds hollow.'
- c. *Le melon sonne mûr.
intended: 'The melon sounds ripe.'
- d. *Le morceau sonne difficile.
intended: 'This piece of music sounds difficult.'
- e. *La proposition sonne raisonnable.
intended: 'The proposal sounds reasonable.'

- f. ?Le sifflement sonne comme du Bach.
intended: 'The whistling sounds like Bach.'

We do not want to speculate here on the reasons for the unacceptability of the sentences in (25c) to (f). As shown by the first two examples in (25), combinations of *sonner* and an adjective are not generally ruled out. One might assume that sequences of *sonner* and an adjective are subject to idiosyncrasy and consequently consider any admissible combination as lexicalized. However, the resultative construction, which is another type of secondary predication, also does not generally permit (result) adjectives in French (cf. Legendre 1997). This suggests a more principled explanation for the restrictiveness of constructions based on PBVs which cannot be given here. Although the constraints we have introduced above are not sufficient for the analysis of the French data, we regard them as minimal conditions, which have to hold necessarily.

7. Summary

We have shown that the analysis of both the direct perception use and the inferential use of phenomenon-based perception verbs requires explicit reference to object dimensions. Consequently, a frame-theoretic approach, which captures object dimensions as frame attributes, is ideally suited for the analysis of both uses. For the direct perception use the constraint has to hold that the subject referent displays the dimension encoded by the verb. In the inferential use the extra-dimensional value specification leads to a dimensional shift: an implicit dimension is activated, which is compatible with the value. In this case, an additional constraint requires that the implicit dimension is inferable from the explicit dimension. The implicit dimension is inferable from the explicit dimension if both dimensions exhibit covariation of values in the type hierarchy. Although the two constraints suffice for the analysis of both uses of perception verbs in German, a comparison between French and German has shown that language-specific properties can additionally limit the range of constructions based on these verbs.

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