Semantic Characterizations of German Question-Embedding Predicates*

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Abstract. The paper investigates the conditions under which German two-place verbs like *wissen dass* 'know' and *bedauern dass* 'regret' embed interrogatives. We present a necessary and sufficient condition for a *dass*-verb to have an *ob*-form. The corresponding verbs we call *objective.* An objective verb has a *wh*-form (*F weiß, wer kommt* 'F knows who is coming') if it satisfies a further condition stating that it has to be consistent with *wissen dass*. A non-objective *dass*-verb does not have an *ob*-form, but it can have a *wh*-form if it permits a *da*- or *es*-correlate and meets particular *consistency conditions* which render it *factive* or *cognitive* in the presence of the correlate (cf. *bedauern* 'regret' vs. *annehmen* 'assume') It turns out that the meaning of the *wh*-form of non-objective verbs deviates distinctly from the meaning of the *wh*-form of objective verbs. Unlike other approaches our rules are general and hold without exceptions.

Keywords: interrogatives**,** question embedding, axioms, correlates, factivity, cognitivity, consistency, compatibility

1 Introduction

This paper discusses German simplex predicates which embed declarative or interrogative clauses, cf. (1-5). The paper focuses on only those semantic and syntactic properties which rule the type of the embedding clause. It neglects the syntax and semantics of the embedded clauses as far as possible. The set of verbs we analyse is the union of three partially overlapping syntactic classes of verbs allowing a *dass*- or an *ob*- or a *wh*-form. Below we list the five relevant subsets of {*dass*-, *ob*–, *wh*–form} with appropriate examples.

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(1) {*dass*-, *ob*-, *wh*-form}
   a. *Frank weiß/sagt, dass Maria) kommt.*
      Frank knows/says that Maria is coming.
   b. *Frank weiß/sagt, ob Maria kommt.*
      Frank knows/says whether Maria is coming.
   c. *Frank weiß/sagt, wer kommt.*
      Frank knows/says who is coming.

(2) {**dass*-, *ob*-, *wh*-form}
   a. **Frank fragt, dass Maria kommt.*
      *Frank asks that Maria is coming.
   b. *Frank fragt, ob Maria kommt.*
   c. *Frank fragt, wer kommt.*

(3) {*dass*-, *ob*-,* *wh*-form}
   a. *Frank zweifelt, dass Maria kommt.*
      Frank doubts that Maria is coming.
   b. *Maria zweifelt, ob Frank kommt.*
   c. **Maria zweifelt, wer kommt.*

(4) {*dass*-,**ob*-, *wh*-form}
   a. *Frank ist überrascht, dass Maria kommt.*
      Frank is surprised that Maria is coming.
   b. **Frank ist überrascht, ob Maria kommt.*
   c. *Frank ist darüber überrascht, wer kommt.*

(5) {*dass*-,**ob*-,**wh*-form}
   a. *Maria hofft, dass Frank kommt.*
      Maria hopes that Frank is coming.
   b. **Maria hofft, ob Frank kommt.*
   c. **Maria hofft (darauf), wer kommt.*

Considering the more or less recent literature on question-embedding predicates, which discusses the grammatical rules concerning the embedding behaviour of *dass*-, *ob*, and *wh*-verbs, one notices that it does not give a satisfying answer to the characterization problems we have in mind - for an overview, cf. Dipper (1997) and Krifka (2005).

Karttunen (1977) presents a comprehensive classification of English question-embedding predicates, which is, however, as he remarks, not exhaustive insofar as it lacks, for example, predicates such as *be surprised* and *doubt*. He establishes nine classes of question-embedding verbs which, however, do not reflect coherently the selectional behaviour of their elements.

Groenendijk & Stokhof (1982) argue that verbs such as *know* and *tell* are extensional in that they operate on the denotations of their interrogative or declarative complements, i.e. on "propositions". Verbs like *guess*, *be certain*, *ask*, *be im-*

portant, and *depend on* operate on intensions, i.e. on "propositional concepts". Since all extensional and some intensional predicates (cf. *guess*, *estimate*, and *ask*) select interrogatives, the distinction between extensionality and intensionality is not adequate for our purposes. Like Karttunen, Groenendijk & Stokhof do not discuss predicates like *be surprised, regret* and *doubt*.

Ginzburg & Sag (2000), referring to, among others, Vendler (1980) and Asher (1993), concentrate on the ontology of question-embedding predicates. For them, predicates operating on fact-like or question-like objects embed interrogatives. They regard all embedded interrogatives to be questions. If the predicate operates on facts, the question is coerced into a fact. They include predicates such as *regret,* saying that they are factive, but do not explain why they do not embed *whether*-questions. Zifonoun et al. (1997) discussing German propositional predicates do not explain why *bestätigen* 'confirm', *bedauern* 'regret', and *sich freuen* 'be glad' can have a *wh*-form.

The account presented in this paper contributes to this issue in providing a comprehensive answer to the question which semantic properties enable propositional predicates to embed yes/no- or constituent questions. In this paper we concentrate on German two-place predicates involving pairs of individual subjects and embedded statements.

2 Basics

The semantic *structures* $\mathfrak{A}$ modelling the embedded clauses correspond to common first-order predicate structures. They consist *i)* of a set of elements called *subjects* and *ii)* of interpretations of basic *statements* such as *x kommt* 'x comes' or $\sigma(x)$ where x is substitutable by individual constants or elements of $\mathfrak{A}$ and belongs to a first-order language determined by the context. The language usually includes some names (individual constants) like *Maria*, allowing for statements like *Maria kommt* or σ(*Maria*). For later convenience, let I be the set of individual variables and constants. The more complex statements are built up by the use of the *logical signs* $\neg, \wedge, \vee, \leftarrow, \rightarrow, \leftrightarrow, \forall, \exists$. Statements containing no logical signs are called *atomic formulas.* The language might contain the expression $x = y$ in order to permit statements involving numbers. The set of *atomic formulas* will be labelled Σ, while $\Phi(\Sigma)$ is the set of all formulas of the first-order language mentioned so far. The latter just corresponds to the set of embedded clauses. They are subordinated to simplex matrix predicates either by overt complementizers such as *dass* or *ob* or by silent ones as is the case with respect to embedded *wh*-interrogatives – cf. *Maria weiß, dass Frank kommt* 'M knows that F is coming', *Maria fragt, ob Frank kommt* 'M asks whether F is coming' or *Maria sieht, wer kommt* 'M sees who is coming'. More formally, the predicates look like *x verb dass/ob σ(y)* or *wh*(*x, verb, σ*). An example containing a quantifier is $\forall x$ *A verb ob σ(x)* for *A weiß, wer kommt* 'A knows who is coming'. Notice that we consider first embed-

ding constructions without *correlates*, i.e., we do not discuss *Maria sieht* ***es****, wer kommt* 'M sees it who is coming' or *Frank freut sich* ***darüber,*** *dass Pauline kommt* 'F is glad about that P is coming'. Constructions with optional correlates will be introduced in Section 4.2, those with obligatory ones will be considered in a forthcoming paper.

Embedding predicates like *wissen dass/ob* and *fragen ob* constitute a set of new data, say *V*, the interpretation of which has to be defined on top of the semantic structure א. For this purpose, we consider the union

$$\underline{\Sigma}: = \Phi(\Sigma) \cup \{x \textit{ verb dass/ob } \tau \mid \tau \in \Phi(\Sigma), x \in \mathrm{I}, \textit{verb} \in \mathrm{V}\}$$

to be defined on top of the semantic structure א. We consider the union $\underline{\Sigma}$ to be a set of atomic formulas for a new first-order language and extend the previous interpretation of $\Phi(\Sigma)$ on א by determining the validity for the remaining formulas in

$$\{x \textit{ verb dass/ob } \tau \mid \tau \in \Phi(\Sigma), \mathrm{x} \in \mathrm{I}, \mathrm{verb} \in \mathrm{V}\} \text{ from } \underline{\Sigma}.$$

We arrive at an enriched type of structure א which we call a c*onstellation.* The determination of the validity of the new formulas *x verb dass/ob* τ must take into account the intended meaning of the *verb.* For this reason, the *verbs* are subjected to appropriate *semantic axioms*. These in turn will yield the criteria needed to explain which complementizers fit the verb in question, and how they modify the verb meaning. The most basic *verb* here is *wissen dass*.

(6) ***Axiom for wissen dass*** '*know*'
Wissen dass is subject to the *axiom of semi-implicativity*.

(7) **Definition**: ***semi-implicativity (semi-implicative)***[1]
X *verb dass* $\sigma \rightarrow \sigma$, for all $\sigma \in \Phi(\Sigma)$

The following condition will turn out to be decisive for the question-embedding:

(8) **Definition**: ***Witness Existence Condition (WEC)***
$\exists X\,(X \textit{ verb dass/ob } \sigma) \vee \exists X\,(X \textit{ verb dass/ob } \neg\sigma)$, for all $\sigma \in \Phi(\Sigma)$

[1] We claim that *wissen dass* and *bedauern dass* are not factive, in distinction to the usual assumption (cf. for instance Krifka 2005) since σ need not necessarily be valid in a valid expression like *A weiß/bedauert nicht dass* σ 'A does not know/regret that σ'. Imagine an exam situation where a professor when listing some statements the candidate did not know says that the candidate did not know that the "Unfinished" was Schubert's last symphony. Unlike *wissen*, *bedauern* is not even semi-implicative. *A* can regret that *σ* even if he wrongly believes that *σ*.

It expresses that for each σ, there is a "witness X with respect to *verb dass/ob*". It follows that *wissen dass* is compatible with WEC. For a predicate to be *compatible* or *consistent* with some property respectively means that there is a constellation where the predicate satisfies the required property.

If WEC actually holds in א with respect to a semi-implicative *dass*-verb, it follows $\exists A$ (*A verb dass* σ) $\leftrightarrow \sigma$, for all $\sigma \in \Phi(\Sigma)$.

A structure א with respect to $\Phi(\Sigma)$ can generally be extended into a constellation with respect to *wissen dass* in various ways. One possibility is that all $\alpha \in$ א know all valid σ's. Another one is that just one α knows all valid σ's. In both cases WEC happens to hold with respect to *wissen dass.*

Like *wissen dass*, *beweisen dass* 'prove' is semi-implicative, but unlike *wissen dass*, it is incompatible with WEC. The respective sets of statements $\{\exists x$ (*x verb dass* $\sigma) \vee \exists x$ (*x verb dass* $\neg\sigma) \mid \sigma \in \Phi(\Sigma)[א]\}$ cannot equal $\Phi(\Sigma)[א]$; the set of all statements with parameters from א substituted for the free variables. The reason for this is that *beweisen dass* singles out very special valid statements never being meant to cover all possible valid statements σ without exception. Thus, *beweisen dass* is subject to the axiom *semi-implicative & ¬WEC* – cf. V in the Appendix. The next basic definition we need is:

(9) **Definition: *anti-semi-implicativity (anti-semi-implicative)***
A verb dass $\sigma \rightarrow \sigma$, for all $\sigma \in \Phi(\Sigma)$

This property is, for instance, fulfilled by *widerlegen dass* 'refute'. Like *beweisen*, it is incompatible with WEC because of:

(10) ***Axiom for widerlegen dass*** 'refute'
A widerlegt dass $\sigma \leftrightarrow$ *A beweist dass* $\neg\sigma$

The subsequent, third basic verb *fragen ob* is characterised by the following axiom – cf. (2). The property given in (11) is called *negation-invariance.*

(11) ***Axiom for fragen ob*** '*ask*'
A fragt ob $\sigma \leftrightarrow$ *A fragt ob* $\neg\sigma$

(12) **Definition**: ***negation-invariance (negation-invariant)***
A verb dass/ob $\sigma \leftrightarrow$ *A verb dass/ob* $\neg\sigma$, for all $\sigma \in \Phi(\Sigma)$

Fragen ob is negation-invariant and compatible with WEC. The complementizer *dass* in (12) is motivated by *zweifeln dass* 'doubt' which, as will be shown in Section 3, exhibits negation invariance in some but not all constellations – cf. (3). Another negation-invariant verb is *kontrollieren ob* 'check'. However, it is not compatible with WEC since tautologies and contradictions representing constant truth functions are not meant to be checked with respect to changing truth values.

Wissen, *beweisen*, *widerlegen, kontrollieren,* and *fragen* all satisfy:

(13) **Definition**: ***Witness Independence Condition (WIC)***
If *X verb dass/ob σ* and (*Y verb dass/ob τ ∨ Y verb dass/ob ¬τ)* and if *σ* and *τ* have the same truth value, then *Y verb dass/ob τ.*

Believe, for instance, need not fulfill WIC, even if σ and τ coincide. It is just an exercise to show:

(14) *WIC ↔ semi-implicative ∨ anti-semi-implicative ∨ negation-invariant***,** the three alternatives excluding each other.

For the purpose of illustration, we show that any negation-invariant verb satisfies WIC: Because of the negation invariance of the verb, the part (*Y verb dass/ob τ ∨ Y verb dass/ob ¬τ*) of the assumption is already logically equivalent to the assertion *Y verb dass/ob τ* to be proved.
Wissen dass being semi-implicative and *fragen ob* being negation-invariant submit to WIC. *Bedauern dass, glauben dass*, *denken dass* '*think*' and *zweifeln dass* do not always satisfy WIC, they are only compatible with it, i.e. *bedauern dass, glauben dass* and *denken dass* are compatible with semi-implicativity, and *zweifeln dass* is compatible with negation-invariance.

3 Conditions for the *ob*-Form for *dass*-Verbs

What are the precise conditions for a predicate allowing the *dass*-form also to allow the *ob*-form, and how can the *ob*-form be expressed by the *dass*-form? Recall that *dass*-predicates allowing the *ob*-form are *wissen dass*, *sagen dass,* and *zweifeln dass* – cf. (1b) and (3b). The predicates of the classes (4) and (5) forbid the *ob*-form both (cf. (4-5b)).

(15) ***Condition for the ob-Form: Objectivity Condition***
A necessary and sufficient condition for a *dass*-predicate to have an *ob*-form is that it is *objective*. A *dass*- or *ob*-verb is objective if it is simultaneously compatible with WEC and just one of the two main alternatives in WIC, either semi-implicative or negation-invariant, i.e. if it is compatible with WIC & WEC.

This condition entails that a negation-invariant *dass*/*ob*-verb is objective iff it is compatible *with ∃X(X verb dass/ob σ)*, for each $\sigma \in \Phi(\Sigma)$. Objective predicates are, for example, *wissen dass,* which is compatible with semi-implicativity & WEC and *fragen ob,* which is compatible with negation-invariance &WEC. The restriction to the two main alternatives in WIC does in fact not exclude any predicates

simultaneously compatible with anti-semi-implicativity and WEC, since there are no such predicates in German. *Lesen dass* '*read*' and *sagen dass* are ambiguous with respect to semi-implicativity – cf. Ginzburg & Sag's (2000) *resolutive* predicates. The reason for this is that, for instance, *A sagt dass σ* can be true in a constellation where *σ* is not valid. Being ambiguous with respect to semi-implicativity and incompatible with negation-invariance & WEC, *sagen dass* is simultaneously compatible with just the alternative *semi-implicativity* and with WEC. Thus, it can exhibit the *ob*-form as shown in (1b).

Another ambiguous verb is *zweifeln dass* which is compatible with negation-invariant.[2] If *zweifeln dass* is negation-invariant, the following equivalence holds: *A zweifelt dass σ* ↔ *A zweifelt ob σ* – cf. (16). Like *sagen dass*, *zweifeln dass* is compatible with WIC & WEC and allows the *ob*-form, as we have seen in (3b). Furthermore, it is inconsistent with *wissen dass* – cf. III in the Appendix.

Wissen dass and *fragen ob* always satisfying WIC and, being compatible with WEC, are *inherently objective*, whereas *sagen dass* and *zweifeln dass*, being ambiguous with respect to WIC, but nevertheless compatible with WIC & WEC, are *non-inherently objective*.

The meaning of the *ob*-form of an objective *dass*-predicate can be paraphrased as follows:

(16) ***Meaning of the ob-form of an objective dass-verb***
X verb ob σ ↔ (*X verb dass σ* ∨ *X verb dass* ¬*σ*),
where for any ambiguously semi-implicative *dass*-verb and any particular *X* and *σ,* the validity of *X verb dass σ* →*σ* is taken for granted.

Thus, *Maria told us whether Pauline was coming* does not only mean *Maria told us that Pauline was coming or Maria told us that Pauline was not coming,* but even *if Pauline was coming, Maria told us that Pauline was coming and Maria did not tell us that Pauline was not coming* and *if Pauline was not coming, Maria told us that Pauline was not coming and Maria did not tell us that Pauline was coming*.[3]

Unlike *wissen*, *fragen*, *zweifeln,* and *sagen*, the predicates *bedauern*, *beweisen,* and *widerlegen* are not objective. *Bedauern* is incompatible with WEC, since *X bedauert dass σ* only holds for contingent *σ*'s.[4] *Beweisen* and *widerlegen*, being semi-implicative or anti-semi-implicative, respectively, are incompatible with WEC – cf. the remarks on (8). *Annehmen, überrascht sein*, *glauben*, and *hoffen* are

[2] Cf. Fischer's (2003) stronger claim that *Paul zweifelt ob p* ↔ *Paul zweifelt dass p und Paul zweifelt, dass* ¬*p.* For Fischer, *zweifeln dass* is inherently negation-invariant, to use our terminology. He justifies Paul's bias towards Paul's belief that ¬ *p* pragmatically.

[3] Cf. Hintikka (1976), Karttunen (1977) and Groenendijk & Stokhof (1982) who argue that *if p and A says whether p, then A says p* and *if* ¬*p and A says whether p, then A says* ¬*p.*

[4] A statement *σ* is contingent if there is a constellation where *σ* is valid and another one where it is invalid.

compatible with WIC and with WEC separately, but they are not compatible with WEC and WIC simultaneously, they are not compatible with WIC & WEC. And finally, *kontrollieren* is negation-invariant, but incompatible with WEC – cf. the comment below (12).

4 Verbs and *wh*-form

4.1 Wh-form of objective predicates

As to objective predicates, they exhibit the *wh*-form if they fulfil the following condition:

(17) ***Wh-form Condition for Objective Verbs***
Any objective *verb dass/ob* allows a well-formed *wh*-form *wh(A, verb, σ)* if and only if it is consistent with *wissen dass*.

This condition is met by *wissen*, *sagen,* and *fragen*, but not by *zweifeln* – cf. (1-2c) vs. (3c).

The meaning of *wh*-forms with predicates such as *wissen*, *sagen* and *fragen* can be paraphrased as follows:

(18) ***Meaning of the wh-form of objective verbs***
$wh(Y, verb, \sigma) \leftrightarrow \forall x\ (Y\ verb\ ob\ \sigma(x))$,
i.e. for an objective *dass*-verb
$wh(Y, verb, \sigma) \leftrightarrow \forall x\ [Y\ verb\ dass\ \sigma(x) \vee Y\ verb\ dass\ \neg\sigma(x)]$,
where $\forall x\ (Y\ verb\ dass\ \sigma(x) \rightarrow \sigma(x))$ is granted in the ambiguously semi-implicative case.

This means in particular that if *Frank says who is coming* is valid, what he says is true.

4.2 *Wh*-form of non-objective predicates

The examples in (19) illustrate *wh*-forms of non-objective verbs.

(19) a. *Frank ist darüber überrascht, wer kommt.*
Frank is *da-cor* surprised who is coming.
b. *Frank kontrolliert es, wer kommt.*
Frank checks *es-cor* who is coming

The explanatory paraphrases of these *wh*-forms deviate distinctly from the paraphrase of *wh*-forms of objective verbs. Unlike the *wh*-forms with *fragen* or *wissen*, the *wh*-forms of *überrascht sein* or *kontrollieren* cannot be paraphrased as in (18)

i.e. by *for all x, Frank is surprised that x is coming or Frank is surprised that x is not coming* or *for all x, Frank checks whether x is coming,* since these paraphrases do not reflect the intended meaning. The intended meaning of (19) is, for instance, *Frank is surprised at the fact that only women are coming* or *Frank checks whether only women are coming*. That is, the sentence relates to a specific statement or answer μ the choice of which is determined by the context. We call this statement *specification*. (19 a,b) not explicitly exhibiting their specifications *only women are coming* are semantically underdetermined versions of statements such as *Frank is surprised at that only women are coming*, i.e. *A verb da-cor dass* μ, or *Frank checks whether only women are coming*, i.e. *A verb es-cor ob* μ. Other examples are *Frank bedauert es / glaubt es, wer kommt* 'Frank regrets it/believes it who is coming'.

With regard to well-formed *wh*-forms of non-objective verbs, three points turn out to be important. First, the non-objective *dass*- or *ob*-predicate needs an appropriate correlate, either a *da*-correlate (*da*-cor) or an *es*-correlate (*es*-cor), which relates to the contextually given specification. Second, without its correlate, the non-objective predicate has to satisfy particular consistency conditions concerning the embedded clause. And third, without its correlate, the non-objective predicate must not be semi-implicative or anti-semi-implicative. The last point explains why *beweisen dass* or *widerlegen dass* do not have a *wh*-form. The second issue concerns the fact that, for instance, the non-objective predicates *es annehmen dass* 'assume', *es denken dass* 'think', *es/daran glauben dass* 'believe (it/in)' and *es/darauf hoffen dass* 'hope it/for', cannot construe the *wh*-form despite exhibiting a correlate – cf. **Frank nimmt es an, wer kommt* 'Frank assumes es-cor who is coming', **Frank denkt es, wer kommt* 'Frank thinks es-cor who is coming', **Frank glaubt es/daran, wer kommt* 'Frank believes es/da-cor who is coming' and **Frank nimmt hofft es/darauf, wer kommt* 'Frank hopes es/da-cor who is coming'. The reason for their behavior is, as will be shown in (20-24), that *es annehmen dass, es denken dass, es glauben dass,* and *es hoffen dass* do not entail the validity of their embedded statement, and that *daran glauben dass* and *darauf hoffen dass* do not entail that the embedded statement follows from what the subject knows – cf. IV and V in the Appendix.

(20) ***Consistency conditions*** *to allow the wh-form for non-objective dass/ob-verbs with optional es- or da-correlates*

a. For a non-objective *dass*-verb, the *wh*-form with an ***es***-cor is well-formed iff

i. it is neither semi-implicative nor anti-semi-implicative

and

ii. *A verb dass* σ entails σ *is consistent*

or

iii. *A verb dass* σ entails σ *is valid* $\vee$ σ *does not follow from what A knows*

b. For a non-objective *ob*-verb, the *wh*-form with an *es-cor* is well-formed without any restrictions.

c. For a non-objective *dass*-verb, the *wh*-form *with da-cor* is well-formed iff

iv. *A verb dass σ* entails *σ* is *consistent with what A knows* or

v. *A verb dass σ* entails *σ is not tautological* ∨ *σ follows from what A knows*

As shown in IV in the Appendix, *bedauern dass* fulfils *i* and *ii*, *überrascht sein* fulfils *iv*, and *denken* fulfils *v*. However, predicates like *beweisen dass*, *widerlegen dass*, *annehmen dass*, and *hoffen dass,* which do not exhibit the appropriate consistency conditions, do not have a *wh*-form with their correlates – cf. V in the Appendix.

The correlates induce two remarkable modifications of the original meaning of a non-objective, non-negation-invariant *dass*-verb:[5]

(21) ***Semantic impact of the es-correlate***
If *i* and *ii* or *i* and *iii*, then

a. *A verb es-cor dass σ* means *A verb dass σ & σ is valid* and

b. *A es-cor nicht verb dass σ* means ¬*A verb dass σ & σ is valid*.

Any predicate *verb* ***es-cor*** *dass* satisfying (21) is called *factive* – cf. e.g. Kiparsky & Kiparsky (1970). Factivity obviously implies semi-implicativity. As to non-objective *ob*-verbs like *kontrollieren* '*check*', the *es*-correlate does not change the original meaning of *A verb ob σ* – cf. (19b) and (20b).

(22) ***Semantic impact of the da-correlate***
If *iv* or *v*, then

a. *A verb da-cor dass σ* means
A verb dass σ & *σ follows from what A knows*
and

b. *A da-cor nicht verb dass σ* means
¬*A verb dass σ* & *σ follows from what A knows.*

Any predicate *verb da-cor dass* satisfying (22) is called *cognitive.* Cognitivity obviously implies factivity.

We can summarise the behaviour of non-objective *dass*-verbs with respect to construing their *wh*-form by the following condition:

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[5] Which correlate type is licensed by which predicate is the subject of Schwabe & Fittler (forthcoming).

(23) ***Wh-Form Condition for non-Objective Verbs***
A non-objective *dass/ob*-verb has a well-formed *wh*-form iff it has an *es*- or a *da*-correlate and fulfils the respective consistency statement in (20). This in its turn corresponds to the factivity of the *es-cor verb dass* or the cognitivity of the *da-cor verb dass,* respectively.

As to the meaning of the *wh*-form of a non-objective predicate, it can be summarised as follows:

(24) ***Meaning of the wh-form of non-objective verbs***
a. The *wh*-form *wh*(A, *es-cor*, (not) *pred dass*, σ) means
A (not) *pred dass* μ & μ is valid;
b. The *wh*-form *wh*(A, *da-cor*, (not) *pred dass*, σ) means
A (not) *pred dass* μ & μ follows from what A knows;
where μ is the contextually given specification.

5 Conclusion

The main issue of our paper was to describe the precise conditions under which German propositional verbs embed interrogatives. First we investigated predicates not exhibiting their correlates such as *wissen dass* or *zweifeln dass* which embed declaratives, with respect to their ability to embed also *ob*-interrogatives and with respect to their ability to embed *wh*-interrogatives without correlates. Second, we investigated predicates like *überrascht sein dass* or *kontrollieren ob* which do not embed *wh*-interrogatives without correlates*,* with respect to their ability to embed *wh*-interrogatives with correlates*.*

I) A *dass*-verb has an *ob*-form if and only if it is *objective*, i.e., if it satisfies the *Objectivity Condition* (15) saying that the verb has to be compatible with WEC and just one of the first two alternatives of WIC simultaneously. WIC actually means that the verb is either semi-implicative or negation-invariant or anti-semi-implicative (13) and WEC demands that for all σ, there exists an X with *X verb dass/ob* σ or *X verb dass/ob* $\neg\sigma$ (8). Since there are no German propositional verbs which are simultaneously compatible with WEC and anti-semi-implicativity, the latter condition is omitted in the Objectivity Condition.

Ambiguous objective verbs such as *sagen dass* and *zweifeln dass* are, like *wissen dass* and *fragen ob*, compatible with WEC. But unlike *wissen dass* and *fragen ob,* they are only compatible with WIC, i.e. they need not satisfy WIC in every constellation. However, they are simultaneously compatible with just the appropriate main alternative of WIC and with WEC. Thus they are objective, although not *inherently objective*.

The distinction between objective and non-objective verbs makes *ad hoc* explanations for the impossibility of the *ob*-form of *dass-verbs* like *bedauern* or

überrascht sein unnecessary – cf. for instance, d'Avis' (2002) or Abels' (2007) approaches.

II) An objective predicate has a well-formed *wh*-form without correlate if it satisfies the *wh-Form Condition for Objective Verbs* (17) saying that any objective *dass/ob*-predicate has such a well-formed *wh*-form *wh(A, verb, σ)* if and only if it is consistent with *wissen dass*. The *wh*-form *wh(Y, verb, σ)* means $\forall x$*(Y verb ob σ (x))*.

III) A non-objective predicate has a well-formed *wh*-form if it obeys the *Wh-Form Condition for non-Objective Verbs* (23). It demands that the wh-form contains a *da*- or an *es*-correlate and that the non-objective *dass*-predicate meets particular consistency conditions (20). Under these conditions, it has turned out that using an *es*- or *da*-correlate modifies the meaning of a non-negation-invariant non-objective *dass*-verb distinctly in that an *es*-correlate makes it *factive* and the *da*-correlate makes it *cognitive* – cf. (23) and (24).

IV) The meaning of the *wh*-form *wh*(*Y*, *da /es-cor*, *pred dass*, *σ*) of non-objective predicates is semantically underspecified since its meaning *Y verb da/es-cor dass/ob* μ is determined by a specification μ which is contextually given and not determined by the *wh*-form *wh*(*Y*, *da /es-cor*, *pred dass*, *σ*) alone.

Appendix:

Objective predicates:

I ***wissen*** *dass* 'know'
A:[6] *X weiß dass σ → σ is valid*, i.e. semi-implicative
C: compatible with WIC & WEC, inherently objective, *ob*- and *wh*-form

lesen *dass* 'read'
A: WEC → *lesen dass* is not anti-semi-implicative,
WEC → *lesen dass* is not negation-invariant
C: compatible with semi-implicative, compatible with WIC & WEC, objective, but not inherently objective, *ob*-form, consistent with *wissen dass*, *wh*-form

sagen *dass* 'say' see *lesen dass*

II ***fragen*** *ob* 'ask'
A: *X fragt ob σ ↔ X fragt ob ¬σ*
C: negation-invariant, compatible with WIC & WEC, inherently objective, consistent with *wissen dass*, *wh*-form

III ***zweifeln*** *dass* 'doubt'
A: WEC → *zweifeln dass is not (anti-)semi-implicative*,
X zweifelt dass σ → ¬X weiß dass σ
C: compatible with negation-invariant, compatible with WIC & WEC, objective, but not inherently objective, not consistent with *wissen dass*, no *wh*-form

Non-objective predicates:

IV ***bedauern*** [*es*] *dass* 'regret'
A: *X bedauert dass σ → σ is contingent,*
incompatible with WEC
C: not objective, no *ob*-form, axioms imply factivity in connection with *es*, *wh*-form with *es*

überrascht sein [*darüber*] *dass* 'be surprised'
A: *X ist überrascht dass σ → σ is consistent with what X knows*,
incompatible with WIC & WEC
C: not objective, no *ob*-form, axioms imply cognitivity in connection with *darüber, wh*-form with *darüber*

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[6] A = axiom, C = comment

denken [*es*/*daran*] *dass* 'think'

A: *X denkt dass* σ → (*σ is not tautological* ∨ *σ follows from what X knows*), incompatible with WIC & WEC

C: not objective, no *ob*-form, axioms imply cognitivity in connection with *daran*, but do not imply factivity in connection with *es*, *wh*-form with *daran,* no *wh*-form with *es.*

V ***annehmen*** [*es*] *dass* 'assume'

A: *X nimmt an dass σ → σ is not tautological,*
incompatible with WIC & WEC

C: not objective, no *ob*-form, axiom does not imply factivity in connection with *es*, no *wh*-form with *es*

glauben [*es*/*daran*] *dass* 'believe'

A: *X glaubt dass → (σ is not tautological ∨ σ is consistent with what X knows*), incompatible with WIC & WEC

C: not objective, no *ob*-form, axioms do not imply factivity in connection with *es* or cognitivity in connection with *daran*, no *wh*-form with *es,* no *wh*-form with *daran*.

hoffen [*es*/*darauf*] *dass* 'hope'

A: *X hofft dass* σ → (σ *is contingent* ∨ *σ does not follow from what X knows*), incompatible with WIC & WEC

C: not objective, no *ob*-form, axioms do neither imply factivity nor cognitivity in connection with *es* or *darauf*, no *wh*-form with *es* or *darauf*

beweisen [*es*] *dass* 'prove'

A: *X beweist dass* σ → *σ is valid*, i.e. semi-implicative,
incompatible with WEC,

C: not objective, no *ob*-form, no *wh*-form with *es*

widerlegen [*es*] *dass* 'refute'

A: *X widerlegt dass σ → σ is invalid*, i.e. anti-semi-implicative,
incompatible with WEC

C: not objective, no *ob*-form, no *wh*-form with *es*

VI ***kontrollieren*** [*es*] *ob* 'check'

A: *X kontrolliert ob σ ↔ X kontrolliert ob ¬σ,* i.e. *negation-invariant*
incompatible with WEC

C: not objective, *es*, *wh*-form with *es*

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