Composition, Values, and Interpretation

An Introduction to Elements of Semantic Theory

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1 Introduction

A semantic theory always stands in relation to other disciplines of linguistic theorizing. For example, it operates on syntactic inputs and it feeds pragmatic processes. This introductory text looks a bit more closely at these relationships and sketches an account of how one should think about the interrelatedness of semantic theory with other disciplines of linguistics, as well as with related domains of investigation like ontology, epistemology and logic. Thereby, it sets the frame for the contributions collected in this volume, which can be understood as partaking in the general enterprise of getting the balance between all these fields and semantics right.

The paper is organized as follows. Section 2 presents two perspectives on semantic theories. One resembles most textbook characterizations of semantics (see among many others Zimmermann & Sternefeld 2013) and should sound very familiar. The other one emphasizes the rôle of interfaces as a relevant factor in the characterization of semantic theories as such. This second perspective is laid out in more detail in Section 3, where examples of seemingly different semantic theories are provided that turn out to be equally well suited to answer the demands posed by pragmatics. Section 4 looks at a more realistic example, which also sheds some light on the relation between semantics and pragmatics (although from a different point of view). The implications of this concrete example are scrutinized in Section 5, where the key notions developed to describe the interrelatedness are extended to other disciplines like the examples mentioned above. Also, it is briefly shown how the contributions fit into the general enterprise laid out in this introduction and an overview of the contributions is provided.

2 Varieties of Semantic Theories

A quite natural way to characterize semantic theories is to describe them as the kind of theory that is concerned with the (*literal*) *meaning* of natural language expressions. Although this view cannot be completely mistaken, it may lead to a misconception of what semanticists are actually doing. One may think that

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semanticists have a clear idea of what literal meaning really is and that they fully agree on its definition, its ontological and epistemological status, its rôle in actual speech, its cognitive representation, etc. Surprisingly, this is not the case. And, maybe even more surprisingly, there seems to be no evidence that can completely settle these issues.

One common notion of *meanings* identifies them with (contributions to) the *truth conditions* particular natural language expressions, viz. sentences, have. Intuitively, the truth or falsehood of a (declarative) sentence is not absolute, but relative to the *circumstances* that it is taken to describe or that it is evaluated against. Consider the following simple declarative sentence.

(1) Ede is smiling on September 26th 2014 in Frankfurt.

Whether (1) is true or not, depends on what is the case in the real world, and what Ede is doing there (what properties he has/exemplifies/instantiates/...) while the sentence is uttered. And, given that the sentence negation of (1) in (2) happens to have the opposite, or simply any other, *truth value* under these circumstances, one can conclude that these two sentences differ (among other things) in *meaning*.

(2) Ede isn't smiling on September 26th 2014 in Frankfurt.

This observation can be expressed in the following conditional, which was first proposed in Cresswell (1982: 69) and has become famous under the label *most certain principle*:

(3) If two sentences differ in truth value at least under some circumstances, then they do not have the same meaning.

Taking this conditional for granted, one can start to discriminate the (immediate) parts of these sentences, and compare their contributions to the truth conditions of sentences in which they occur in other examples. That is, one starts to identify the meaning of *subsentential* expressions as contributions to the meanings of whole sentences, and thereby finds out which contribution to the *meaning* of the whole sentence is to blame for this difference in meaning of the original examples (cf. Zimmermann 2012a). Needless to say, all of this aims at a determination of what the literal meanings of the parts of a sentence are. This is a natural way to carry out a semantic investigation in a *compositional* fashion and it is characteristic for formal semantics. But one has to keep in mind that this method rests on the *identification* of truth conditions with

meanings that is not justified by the conditional in (3), which only states that (contributions to) truth conditions and meanings *covary*, without claiming that they are the same (Zimmermann 2011: 763). Therefore, treating the connection between truth conditions and meanings as a biconditional—as one does, when the identification happens—needs further justification. However, this does not mean that there is no way to justify this additional move. Usually, plausibility considerations are used to accomplish that. What is the important point here is just that this may not be the route every semantic theory has to take. This makes it less surprising that the notion of *meaning* may differ from one semantic theory to the next.

Assigning different meanings to sentences is not the only reason for variation between semantic theories, of course. Another cause may be rooted in the anchoring of semantics in a more general theory of *linguistics*. This perspective is certainly not incompatible with the other view, but it puts more emphasis and constraints on the semantic *interfaces*. For example, semantic theories are constrained by what syntactic theories offer as a structural description of natural language expressions. If there are syntactic arguments in favor of one structure instead of another, then this is the structure that semantic theories have to adjust their rules to. This is what the core business of semantic theories consist in. They assign certain (semantic) objects to lexical expressions and to larger expressions by applying compositional rules to the immediate parts of these larger expressions. Let us call these objects assigned to expressions *semantic values*. Additionally, semantic theories are constrained by the demands posed by the interfaces, for instance, pragmatic theories in the broadest sense of the term. If, for example, pragmatic reasoning needs a certain semantic output to feed its processes like, say, Gricean reasoning, this output should be the result of the semantic calculation along the lines of the syntactic structure of the expressions. Note that not all semantic values have to be relevant at all the interfaces. For instance, if pragmatics solely acted on the semantic values of whole sentences, the values of subsentential expressions would be irrelevant for this interface. Therefore, the former deserve to be qualified as *internal* semantic values, while the latter may be called *external* semantic values (Zimmermann 2006c). Another way to use this distinction is to talk about internal and external *rôles* of semantic values. We use these two notions interchangeably.

That this characterization is on the right track can be seen by looking at an extreme mirror image. A semantic theory without any theory external constraints on its value assignments is vacuous, as triviality proofs for the notion of compositionality show (cf. Zadrozny 1994). Roughly put, if one can freely assign any value to an expression, compositionality issues can be resolved by propos-

ing semantic values that serve no purpose other than solving the problem.[1] Needless to say that this is not a desirable semantic *theory*.

Driven by the interfaces, this view on semantics does not start by asking what meanings are or what meanings intuitively connect to, but considers this to be determined by several other disciplines like pragmatics, logic, ontology, epistemology, discourse theory, and so on. Therefore, what meanings are and how they are used is determined externally, by *interpreting* semantic values. So, we reserve the term *meanings* for the interpretation that the interfaces assign to the (external) semantic values. That is, apart from its core business of capturing the composition of (internal) semantic values, semantic theories have to deliver meanings that fulfill the external rôles as required by the interfaces. In this sense, it takes the notion of *contribution* (which traces back to Frege 1884) seriously. Of course, this is also compatible with semantic theories of the first characterization. The main difference solely lies in the notion of meaning. Under the first characterization, it is just a given, where in the second, it emerges from the various theories that are external but related to semantics. Therefore, it is in order to introduce two notions of semantics here. Semantics *in the narrow sense* is just concerned with the core business of solving compositionality puzzles, whereas semantics *in the broad sense* deals with the interfaces and hence, strictly speaking, engages in a non-semantic enterprise, by doing so. Throughout this article, if used without further qualification, *semantics* refers to the narrow conception.

Understood along the sketched lines, semantic theories can differ in their value assignments without differing in their outputs at the interfaces, that is, in their meanings. To see this more clearly, the next sections look at an example.

3 Equivalence of Semantic Theories

The second characterization of semantic theories sketched in the previous section is taken from Zimmermann 2012b, where it is a crucial part of a definition of *equivalence* between semantic theories. For two semantic theories to be equivalent, they have to agree on what he calls "interpretable semantic values", viz., external semantic values. Consider the extremely simplified example of a pragmatic theory $\mathscr{P}_1$ that is only interested in the truth values of whole sentences. Let's take a look at the value assignments of the three semantic theories

1 Thanks to Ede Zimmermann (p.c.) for pointing this out.

TABLE 1 *Three different semantic theories*

Theory	$\mathcal{T}_1$	$\mathcal{T}_2$	$\mathcal{T}_3$
Expressions		**Values**	
Ede	Ede	$\{X\colon \text{Ede} \in X\}$	Ede
loves	$\{(x,y)\colon (x,y) \in L_w\}$	$\{(x,y)\colon (x,y) \in L_w\}$	$\{\Re\colon \{x\colon \{y\colon (x,y) \in L_w\} \in \Re\}\}$
somebody	$\{X\colon Per_w \cap \text{X} \neq \varnothing\}$	$\{X\colon Per_w \cap \text{X} \neq \varnothing\}$	$\{X\colon Per_w \cap \text{X} \neq \varnothing\}$

$\mathcal{T}_1$–$\mathcal{T}_3$ given in Table 1. Per_w stands for the set of individuals that are *per*sons in w, and L_w for the relation between two individuals a, b such that a loves b in w.

According to the value assignments of $\mathcal{T}_1$ (and some simple combinatorial rules), the calculation of the truth value of a declarative sentence (4) runs as shown in (5). For the sake of the argument, let us ignore tense and aspect.

(4) Ede loves somebody

(5) $[\![\textit{Ede loves somebody}]\!] = 1$ iff
$\text{Ede} \in \{x : \{y\colon \{(x,y)\colon (x,y) \in L_w\} \in \{X\colon Per_w \cap \text{X} \neq \varnothing\}\}\}$ iff
$Per_w \cap \{y\colon (\text{Ede}, y) \in L_w\} \neq \emptyset$

$[\![\textit{Ede}]\!] =$ Ede

$[\![\textit{loves somebody}]\!] = \{x : \{y\colon \{(x,y) : (x,y) \in L_w\} \in \{X\colon Per_w \cap \text{X} \neq \varnothing\}\}\}$

$[\![\textit{loves}]\!] = \{(x,y) : (x,y) \in L_w\}$

$[\![\textit{somebody}]\!] = \{X\colon Per_w \cap \text{X} \neq \varnothing\}$

As is easily seen, the value assignments of $\mathcal{T}_2$ and $\mathcal{T}_1$/$\mathcal{T}_3$ (with somewhat different combinatorial rules) boil down to the same result. Since all possibilities agree on the values that are assigned to sentences, these little theories turn out to be equivalent according to the criterion proposed above. Any other semantic value is internal in the sense that it just accounts for the composition, while only the semantic value of the whole sentence has an external rôle.

What this little example shows is that internal values can be chosen on purely internal grounds, for example, to solve compositionality issues as long as the external values are not affected. For a survey of combinatorial puzzles

and strategies of how to solve them, see Zimmermann (2012a). Note that this is the same kind of attitude that semanticists usually adopt in regard to syntax-internal rules. Basically, semantic theories are just interested in the output of syntactic rules, that is, in the (unique) determination of part-whole relations, which in turn serve as (unique) syntactic individuation of natural language expressions. Whether this is achieved via minimalistic rules, transformations, term algebras, or whatever you like, does not matter for semantic purposes. Likewise, as long as pragmatics does not put any demands on the semantic values of, e.g., proper names, they may be rendered as direct referential expressions,[2] as quantifiers,[3] or whatever one needs to account for their combinatorial behavior. This does not change if $\mathscr{T}_1$–$\mathscr{T}_3$ are intensionalized or otherwise modified to yield different semantic values for sentences, in case pragmatics asks for them. As long as pragmatic theories just need to know about the external values of sentences, the equivalence of (adapted versions of) $\mathscr{T}_1$–$\mathscr{T}_3$ holds. See Zimmermann (2012b) for more details.

But let us now consider a pragmatic theory $\mathscr{P}_2$ that is interested in the values of proper names in addition to truth conditions. That is, $\mathscr{P}_2$ aims at a theory of reference that treats proper names as rigid designators. The question is whether this enhanced pragmatic theory necessarily leads to the non-equivalence of $\mathscr{T}_1/\mathscr{T}_3$ and $\mathscr{T}_2$, since $\mathscr{T}_2$ assigns a different value to *Ede* than $\mathscr{T}_1$ and $\mathscr{T}_3$. The answer is no. The interpretation of the semantic values does not necessarily reduce to identity mappings, as one might expect from $\mathscr{T}_1$ and $\mathscr{T}_3$. It is possible that this interpretation is more complex in itself. So, for example, $\mathscr{P}_2$ could take the value that $\mathscr{T}_2$ assigns to *Ede* and interpret it by taking the sole element of the intersection:

$$(6) \quad \iota x : x \in \bigcap [\![Ede]\!] = \iota x : x \in \bigcap \{X : \text{Ede} \in X\} = \iota x : x \in \{\text{Ede}\} = \text{Ede}$$

Note that the same argument works for semantic theories that assign quantifiers to definite descriptions in the tradition of Russell (1905) and its type theoretical reconstruction by Montague (1970)[4] compared to semantic theories that assign the referent directly (cf. Zimmermann 2012c: 630). The moral to be drawn here is that semantic values do not need to match perfectly to ensure equivalence. Matching values are a sufficient, but not a necessary condition for

2 On proper names in general see also Lerner & Zimmermann 1991, Zimmermann 1984, and Zimmermann 2005b.

3 That is, *scopeless quantifiers* in the sense of Zimmermann 1987 and Zimmermann 1993b.

4 See Zimmermann (1991b) and Zimmermann (1996b) for further informations on Montague.

equivalence. For equivalence, meanings have to match. So, there is a bit of leeway between the semantic values on the one hand and meanings on the other.

Applying this view on equivalence of semantic theories, it may well come out that the analysis of indefinite complements of opaque verbs, like e.g. that proposed in Zimmermann (1993a) and Zimmermann (2006b), come out as equivalent. As long as only the values of whole sentences are interpreted by the interfaces. If it turns out that a pragmatic theory is in need not only of the truth-conditional interpretation of the sentence but also of information that is buried more deeply in the sentence, this difference in value assignment may lead to a difference in meanings and therefore to non-equivalence.

Or consider traditional truth-conditional semantics in comparison to dynamic semantic theories. The most common view is that theories of this kind cannot be equivalent, due to the representation of discourse referents in the latter, but not in the former. But, by a slightly different interpretation (see Zimmermann 1999a), it is also possible to render them indistinguishable from a pragmatic point of view. Setting the representation of discourse referents aside, however, it is not a difficult task to read off propositional contents (instead of *updates*, that is, relations between information states) of the semantic values that are assigned to sentences by dynamic treatments.[5] If this is true, then these theories can, in principle, turn out to be equivalent.

Considerations involving the notion of equivalence carry over to what one may regard as mere technical questions. As it is argued especially in Zimmermann 2011, the choice between a model theoretic approach to semantic interpretation and a possible worlds framework is not a matter of taste (see also Zimmermann 1996a, 1999a). Model theory is "too powerful" for the interpretation of natural language, as it allows variation in all kinds of areas where natural language does not display it, e.g. in the meaning of lexical expressions like *life*.[6] As one may be accustomed from model theoretic interpretation of predicate logic, non-logical constants vary in meaning relative to the model. This kind of variation is superfluous for the interpretation of natural language. Without going into details too much, intuitively, one has to restrain the power of pure model theoretic interpretation to yield exactly the interpretation possible worlds semantics assigns to natural language expressions. To arrive at a natural interpretation, model theory has to be restricted. Early attempts to restrain model theory in a Montagovian fashion by *meaning postulates* are dis-

5 For more details on the relation between traditional and dynamic frameworks see for example Hamm & Zimmermann (2002).

6 "What is the meaning of *life*?" (Zimmermann 1999a: 539).

cussed by Zimmermann (1983, 1985a, 1993c). He draws the conclusion that this method is highly suspicious, to say the least. Since meaning postulates are no viable alternative, models are firstly restricted to particular *intended models*. That is, only models that contain logical space as it is also used in possible world semantics are taken into consideration. Secondly, *correspondence conditions* are needed, since they allow for a (homomorphic) mapping between real entities and their model theoretic representations. Without these preconditions, model theory allows for an infinitely large family of semantic theories. Some of them may even be equivalent, but in general they are not. And only a few of them can be equivalent to possible world semantics. And even if these conditions are implemented, model theory does not boil down to a possible worlds framework. First, there is still a difference between intended models and logical space. And second, the interpretation of, e.g., noun phrases still varies with models. This is why model theory is not able to capture *sense relations* between expressions, for example, synonymy (Zimmermann 2011: 798). This, of course, has consequences for the semantic values pragmatic theories are interested in. Since model theory fails to account for (7a), it also fails with respect to (7b).

(7) a. *Woodchuck* and *groundhog* are synonyms.
b. $[\![$*Ede loves a woodchuck*$]\!] \leftrightarrow [\![$*Ede loves a groundhog*$]\!]$

Therefore, the choice between these two general frameworks for interpretation should already be made based on a pragmatic theory. But crucially this must not be confused with other methodological choices. For example, allegedly different formal languages[7] that were used in Montagovian *indirect* interpretation do not fiddle with the semantic values of expressions at all. In general, the formal language involved as an intermediate step in indirect interpretation (first, translate natural language expressions into a formal language, second, interpret this formal language, that is, map its formulae to the semantic values) is dispensable. So, they are simply not able to do any harm to the semantic values of a theory and therefore cannot be taken into account for the question of equivalence.

Before turning to the more detailed outline of the contributions, let us look a bit closer at an example taken from the linguistic literature. What is shown in the following section is the development of *context theory*. In the course of the development one can see that several different demands are

7 That is, Montague's *intensional logic* and Gallin's *two-sorted type theory*, which were proved to be equivalent in Zimmermann (1989).

fulfilled by a single semantic theory. This is why we take up the example here. Its primary goal consisted in giving a semantic account of indexicals. But as it turned out very soon, the 2-dimensionalism developed to do this allows for the definition of certain other notions like *direct* and *absolute* reference, leading to a more concrete *reference theory*. Another motivation comes from the context theoretic definitions of *a priori truth* and *necessary truth*, which answer a demand on semantic theory raised by Kripke (1972), among others. At first glance, it is not obvious that notions like these are related to the semantic values of indexical expressions such as *I*, but the concrete shape of context theory seems to be suited for answering these additional demands as well.

4 Context Dependency

In many overviews of pragmatics one still finds a canonical chapter on indexicals (and other kinds of context dependency). Since the seminal work carried out by David Kaplan—which began circulating in the 1960s but was printed as the definite version in 1989—the notion of context dependency has become one of the biggest chunks of linguistically relevant aspects that has been brought into formal semantics back from the pragmatic wastebasket.[8]

The basic motivation for this semantic reclaim of context dependency comes from the insight that, even if some linguistic expressions, like indexicals and demonstratives, are inherently context dependent, they nevertheless are governed by conventional linguistic rules, and not by the rational considerations and conversational inferences that can be considered as the hallmark of (Gricean-)pragmatics. That is, while the extension of the first person indexical *I* depends on the utterance context, the way in which one comes from the utterance context to the extension is governed by a conventional linguistic rule: the extension of *I* is always the speaker in that utterance context.[9] Similar rules can easily be stated for other indexicals.

8 Still the best introduction and overview over this topic is, of course, Zimmermann (1991a), followed by a more recent version Zimmermann (2012b), which is accessible for non-German speakers as well. For a different but related case in which it is not obvious how to categorize the phenomenon see for example Zimmermann (1997).

9 Direct quotation and other forms of mention are obvious exceptions for which this rule does not apply.

(8) a. $[\![I]\!](c) = \textsc{speaker}(c)$
b. $[\![you]\!](c) = \textsc{addressee}(c)$
c. $[\![here]\!](c) = \textsc{place}(c)$
d. $[\![now]\!](c) = \textsc{time}(c)$

Prima facie, this context dependency is very similar to the way in which the extension of sortal nouns like, say, *penquin* (the set of penguins), definite descriptions like *the Professor of Semantics at the University of Frankfurt* (the unique individual that is the semantics professor at the University of Frankfurt), or sentences like *Ede is laughing* (a truth value) is dependent on the situation in which that expression is evaluated. When uttered, e.g., on September 26, 2014 in the actual world, these expressions receive the following extensions.

(9) a. $[\![penguin]\!](w) = \{x : x \text{ is a penguin in } w\}$
b. $[\![\textit{the Professor of Semantics at the University of Frankfurt}]\!](w) = \textit{Ede Zimmermann}$
c. $[\![\textit{Ede is laughing}]\!](w) = 1$

Despite this parallelism between the situation dependency of the extension of such expressions with the situation dependency of indexicals, the major result of Kaplan's investigation is that they should not be treated on a par. The main observation supporting this observation concerns the behavior of indexicals in intensional contexts. If they were treated on a par with, e.g., definite descriptions, then their world argument should get bound in these contexts. This means that *today* and something like *the day this sentence is uttered* should behave in the same way, contrary to fact:

(10) a. Ede thinks that today is his birthday.
b. Ede thinks that the day this sentence is uttered is his birthday.

Therefore, even though the extensions of indexicals and other expressions are dependent, they do not depend on the same things. A semantic theory that is just concerned with the core business could stop with this observation and develop a compositional theory. Kaplan does this, too. He concludes that there are two realms of world variables the extension of an expression can be dependent upon. He develops a third semantic value to account for this observation. That is, beside just the extension and the intension, or the *content* as Kaplan calls it, there is also the *character* of an expression. While the content abstracts away from the situation dependency of the extension, it is the character that abstracts away from the context dependency of the content. One can define the

character of an expression as a function from contexts into intensions, while the intension of an expression in turn is a function from worlds (or situations) into extensions.

(11) $\text{CHARACTER} \overset{c}{\Longrightarrow} \text{INTENSION} \overset{w}{\Longrightarrow} \text{EXTENSION}$

That is, the extension of an expression depends on two arguments and in this sense, Kaplan's context theory can be called 2-dimensional. To get the compositional machine running, one needs to single out the combinations of expressions that call for the invocation of a particular internal value. This leads to the definition of *extensional* and *intensional* constructions (cf. Zimmermann 2012b: 2382, 2393). Since back then there did not seem to be a construction that calls forth the character of an expression, no *characterial* constructions were defined. Instead, the famous *ban on monsters* was proposed. Since then, the general opinion has changed due to impressive counterexamples. For an overview, see Zimmermann (2012a) and the references given therein.

Kaplan (1989) is not just concerned with semantics in the narrow sense of the word. Under the impression of Kripke (1972), among others, he notices two other properties of indexicals. The first observation is that indexicals lead to a different kind of triviality than non-indexicals do. First, consider a standard case of a necessarily true utterance.

(12) Every penguin is a bird.

The lexical meanings of *penguin* and *bird* are such that this sentence is true in every situation in which it is uttered. That is, it is true regardless of the specifics of the situation that determine the extension of *penguin* or *bird*. (12) expresses a necessary and a priori truth. Now, consider Kaplan's classic example.

(13) I am here now.

This sentence, too, seems to be trivially true in a sense: whoever utters (13) is obviously at the place at which the utterance is made at the time that it is made. If (13) is uttered by, say, Ede on September 26, 2014 in Frankfurt—let's call this context c_e for further reference— the utterance trivially comes out as true, because the extensions that the indexicals receive in that context (Ede, Frankfurt, 2014-09-26) make the entire sentence true.

The crucial observation, however, is that this kind of triviality is not the same as the one induced by (12). While an utterance of (13) is also a priori true in

every context in which it is uttered—the meaning of the words alone ensures that—it is not a necessary truth. This can easily be seen by the fact that even in c_e, the following utterance is intuitively also true, because it is not necessary that Ede is in Frankfurt on that given date of utterance.

(14) It is not necessary that I am here now. I could be in Paris.

That is, for every context, (13) is (*a priori*) true in that context, but it is not necessarily true once uttered in that context.[10]

The distinction between character and intension/content can explain the two kinds of trivialities. The character of (13) can be paraphrased as follows.

(15) $[\![I\ am\ here\ now]\!] = \lambda c \lambda w.$ SPEAKER(c) is in PLACE(c) on TIME(c) in w

Applied to the context c_e as given above this character yields the following intension.

(16) $[\![I\ am\ here\ now]\!](c_e) = \lambda w.$ Ede is in Frankfurt on Sep 26, 2014 in w

It is obvious that this content is not necessary true since it may yield different truth values for different world arguments. But in which sense is the character of *I am here now* given in (15) trivial? Recall what was said above: for every context, (13) is true *in that context*; just because for every context, its speaker is at its place at its time. Technically, this means that the character in (15) is such that for every context, it delivers a content that is true if it is applied to the world of that context; that is, if the context does not only act as the argument for the character but also for the content.[11] Given the way in which one can visualize the 2-dimensionality of the character/content divide, using the context both for the character and the content is called *diagonalization*.

With the differences between character and intension, context and situation in place, it is possible to give a formal definition of the two kinds of trivialities that (12) and (13) give rise to (cf. Zimmermann 2012b: 2369).

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10 This is one half of the disentanglement of *a priori* truth from necessity, the other half being provided by examples like *Water is* H_2O, which is, if one follows Kripke in his philosophical analysis, a necessary, but *a posteriori* truth.

11 The details of the exact formulation of this idea depend on whether one assumes that contexts are special kinds of worlds/situation or whether they are parametrized.

(17) a. A sentence S is necessarily true in a context c iff S is true of every possible situation: $\forall w.\ [\![S]\!]^{c,w} = 1$.
b. A sentence S is *a priori* true iff for every context, S is true of c in c: $\forall c.\ [\![S]\!]^{c,c} = 1$.

In our terminology, this amounts to answering external demands of an interface that, for the lack of a better term, may be called (modal) *logic* or *epistemology*. For compositionality, the definitions in (17) are not needed. This does not mean that characters have to play an external role. The definitions separate different sets of worlds at which sentences are true (logical space and the subset of contexts therein). So, the interface does not need to look at the characters of the expressions involved, but just at the truth conditions. Therefore, the external values remain the same. But they are used in a different way.

Kaplan's second observation quite naturally leads to a theory of reference. Indexicals do not depend on the evaluation situation; their reference is directly fixed by the context. That is, their content is a constant function. For most non-indexical expressions, the opposite is true. The utterance context does not play a rôle so their character can be thought of as being a constant function, while their content is a non-constant function. Expressions of the former kind are called *direct*, while expressions of the latter are *absolute* (Zimmermann 2012b: 2372).

(18) a. An expression α is direct iff $[\![\alpha]\!](c)(w) = [\![\alpha]\!](c)(w')$, for any context c and worlds w and w'.
b. An expression α is absolute iff $[\![\alpha]\!](c)(w) = \alpha(c')(w)$, for any contexts c and c' and world w.

There are also expressions that are both direct and absolute, like, arguably, proper names, whose extensions therefore do not depend on context nor evaluation situation. Finally, there are expressions that are neither direct nor absolute, as they are dependent on both the utterance context and the situation. This is true of many complex expressions that involve indexicals like the following example.

(19) Ede and I saw a penguin today.

However, the majority of lexical expressions only depends on one of the two dimensions. Zimmermann (1991a: 164) even puts forward the appealing hypothesis (L), according to which lexical expressions are either direct or absolute. If

this hypothesis were true, the semantic values of all lexical expressions would depend on one intensional argument only, and the difference between deictic and absolute expressions would boil down to just which of the two parameters the expression accepts as an argument. While raising the possibility of (L), Zimmermann also is sceptical of the empirical truth of that hypothesis. And indeed, in later work, Zimmermann (1995, 2004a,b), he discusses some counterexamples like the first person *possessive* pronoun that arguably depends on both the context and situation.

(20) My penguin is drinking coffee.

The NP *my penguin* in (20) is headed by the possessive first person indexical and hence, its extension depends on the utterance context in order to get the speaker. In addition to that, however, the reference of the NP also depends on the situation. Which penguins stand in the possessive relation to the speaker depends on contingent facts of the evaluation situation. Despite such counterexamples, which are relatively rare and could be explained away be decomposing the first-person feature form the possessive, genitive feature, hypothesis (L) remains an attractive heuristic for the analysis of index/situation dependency.

This, again, answers demands external to semantics in the narrow sense. But unlike the example in Section 3, now characters of certain expressions are involved. To decide whether an expression refers directly, or absolutely, or in both or neither ways, one has to take a look at its character. Therefore, the newly introduced semantic value gets an external interpretation at an interface that may be called *reference theory*. Note again that this is not necessary if one is just interested in compositionality. Of course, since indexicals necessitate a new semantic value by displaying a different kind of dependency, and since this new value has to be spread over to other expressions as well, at least due to technical reasons, every expression gets assigned a character. But this is justified by the overall compositional procedure alone. Adapting the values of other expressions to fit in well with indexicals is not the same as interpreting these values. Kaplan's classical paper therefore turns out to be engaged in semantics in the broad sense of the term.

5 *Realistic* Semantic Theories and Their Goals

Doing semantics in the broad sense of the term amounts to engaging in at least three quite different tasks as the discussion so far suggests:

(21) a. Getting the composition of semantic values right (the 'core business').
b. Finding out which semantic values have to have an external rôle.
c. Getting the interpretation of external semantic values right.

That composition (21a) is part of a semantic theory is hardly controversial. In this volume, especially **Manfred Kupffer**, **Mats Rooth** and **Paul Dekker** investigate problems of compositionality. In "Does Context Change?", Kupffer investigates the phenomenon that different syntactic occurrences of one and the same (pure) indexical in an utterance may refer to different objects even though there is no change of context. He develops the notion of occurrence-dependence which accounts for this behavior. He discusses two frameworks: token-reflexive semantics and occurrence-interpretation and discusses assumptions for their equivalence. Rooth's "Operators for Definition by Paraphrase" focuses on the equivalence of the semantic value of a sentence and its paraphrase and investigates two methods of deriving the equivalences compositionally: syntactic scoping and type-raising. The method of type-raising predicts the derivation of constructions with intensional operators that take sentential as well as nominal arguments using silent modification by type-shifters. Dekker takes the contextualist findings to heart in "The Live Principle of Compositionality" and develops a new Principle of Compositionality which combines speaker-dependent meanings (live meanings). Live Meanings are assigned to expressions by the interlocutors as they talk. The result of the enterprise is a new prospective on inferencing. Dekker's contribution shows very well that it is not easy to tear apart the different tasks.

The distinction between internal and external rôles of semantic values, the task set out in (21b), cannot be made considering semantic theories in isolation. This is because this distinction is dependent on concrete conceptions of pragmatic theories or other interfaces. Semantic theories that are sensitive to the demands of other disciplines in the sense that they try to restrict themselves to semantic values that are useful at the interfaces can be called *realistic*. That is, realistic semantic theories allow for the interpretation of certain values by other disciplines. Or, to put it differently, realistic semantic theories are aware of the fact that at least some of their semantic values have to fulfill other, external rôles. The question is which semantic values are needed to account for phenomena other disciplines are trying to explain.

This task also is quite commonly dealt with in semantic theories in the broad sense. For example, if attitude verbs are taken into consideration, semantic theories seldom are satisfied with proposing a relation between individuals and propositions as their semantic value. What is aimed at is a more thorough understanding of attitudes, relations among them and inferences between

them. In other words, what is aimed at is an epistemic (or deontic) logic if not a theory of epistemology.[12] In this volume, the contributions by **Ivano Ciardelli, Jeroen Groenendijk, and Floris Roelofsen**, by **Graeme Forbes** and by **Kjell-Johan Sæbø** can be grouped under this heading, even though this task only partly characterizes the scope of their papers. Sæbø takes up the partly semantic, partly ontological question *what it takes to be missing*. In his "*Do You Know What it Means to Miss New Orleans?* More on *Missing*", he elaborates on Zimmermann's (2010) proposal to analyze the argument of *missing* as an individual concept and brings up a realm of interesting examples that corroborate this idea.

Ciardelli et al. elaborate on their theory called inquisitive semantics in "Information, Issues, and Attention" and present a case study of the modal epistemic *might* taking up results of Zimmermann. The result is that a proper account of the free choice effect motivates a third kind of information (besides regular truth-conditional content and so-called inquisitive content): attentive content. This kind of content helps selecting between the proposed ways of updating the common ground.

This paper also serves as another example for a semantic theory that may or may not turn out to be equivalent to more classical semantic frameworks. Inquisitive semantics assigns question denotations even to declarative sentences instead of propositions. Whether this ultimately leads to non-equivalence is, of course, dependent on a concrete conception of the interfaces.

Forbes is concerned with the free choice effect as well. He proposes a purely semantic account for the apparent conjunctive interpretation of disjunctive *or* in comparative clauses with *than*. The basic idea of "A Truth-conditional Account of Free-choice Disjunction" is to interpret the comparative clause as a universally quantified identity statement. This method of interpretation is applied to disjunction in modal contexts, as well.

There are other factors that can be involved to constrain the choice between different semantic values, such as the invocation of distinctions like necessary vs. a priori truth, as is shown in more detail above in Section 4. Other constraints may stem from (other) logical, ontological or metaphysical considerations. In "Being Tolerant about Identity?", **Robert van Rooij** investigates the connections between semantics and ontology. He starts out from the famous problem of identity statements in modal contexts by observing an asymmetry between the treatment of (referring) expressions on the one hand and the

12 For examples of this kind of study consult, among many others, Zimmermann (1999c, 2000, 2005a, and 2006a).

(referred) entities on the other. Usually the former is covered by the principle of substitution which is said not to apply in modal constructions while the latter is covered by Leibniz's law which is upheld even in the view of counterexamples. To resolve this tension, van Rooij argues for Tolerance Logic that deals with vague objects.

Philippe Schlenker's contribution "The Property Paradox in (not so plain) English" looks at property-talk in natural language and concludes that it allows for the formulation of paradoxes. Based on his observation, he claims that paradoxes should be modeled in semantic theories. In showing that there is a general way in which natural language paradoxes involving properties can be obtained, he shows that paradoxes are a phenomenon conceivable not just in formal but also in natural languages. Thereby, he makes a strong case for the choice of a trivalent logic as part of semantic theorizing.

One example that immediately comes to mind when concrete cases of the task set out in (21c) are asked for, is Gricean pragmatics. The hallmark of this enterprise is the interpretation of propositions in context. The starting point of the processes that are called *Gricean reasoning* are propositions, that is, the values of whole sentences handed over by semantic theories. But the investigation can turn in other directions as well.

In "On the Meaning of Fictional Texts", **Matthias Bauer and Sigrid Beck** are concerned with the difference between the subjective understanding of the meaning of a literary text and notions of meaning in truth-conditional semantics. The interesting point here is to predict why readers of a literary text may agree on its meaning. The authors locate the apparent "objectivity" of literary meaning in an assert operation that is derived from the assert operation used in speech act theory.

This contribution executes exactly what is asked for by (21c). The authors consider a special environment of natural language expressions, literary texts, and lay out the mechanisms applied to semantic values in these contexts, that lead to a somewhat non-standard interpretation.

Regine Eckardt investigates vocative expressions that usually serve to identify the addressee of an utterance. Especially interesting is the case of free indirect speech (third person narration with elements of first person speech) used in literary texts. *Dear Ede!* "Semantics and Pragmatics of Vocatives" presents an analysis of vocatives that predicts them not to occur in free indirect speech because these contexts lack the subjective contextual factors that are a necessary meaning component of the vocative.

In "Notes on Disagreement", **Markus Kracht and Udo Klein** investigate disagreement in every-day speech. They locate the disagreement in the variable use of word meanings dependent on the speaker that uses the word. So the

debate is more a debate about meaning of the words than about the state-of-affairs if faultless disagreement arises. They show that this is a major source of complication when talking to each other.

In addition, the linguistic context (or common ground) in which a sentence is used may affect its interpretation. This fact is well known from the investigation of anaphoric pronominal elements other than indexicals and the effects of focus on information packaging. Old information is anaphoric to a discourse question. New information answers such a possibly latent question under discussion.

Malte Zimmermann takes a closer look at embedded foci elaborating on the theory of *question under discussion*[13] and draws a connection to *wh*-scope-marking constructions. The idea of "*Was glaubt EDE, wer der Mörder ist?* On D-trees, Embedded Foci, and Indirect Scope Marking" is that the *wh*-scope-marking construction grammaticalizes part of a pattern of two questions where one question is a subquestion of the other. Analogously, embedded foci are licensed if there is a question denotation in the discourse that is related to a subquestion asking for the embedded focus. The paper shows that the structure of the discourse has an impact on the nesting of new information.

In the last paper of this volume, "A New Type of Informative Tautology: *Für Unbefugte Betreten Verboten!*", **Manfred Krifka** issues a compact study of a new kind of tautology the meaning of which has to be found beyond its trivial truth-conditional content and hence also involves the re-interpretation of the semantic values at the interface.

References

Bäuerle, Rainer & Thomas Ede Zimmermann (1991): "Fragesätze". In: von Stechow, Arnim & Dieter Wunderlich, eds.: *Semantik. Ein internationales Handbuch der zeitgenössischen Forschung. Semantics. An International Handbook of Contemporary Research*. Berlin/New York: de Gruyter, 333–348.

Cresswell, Maxwell J. (1982): "The autonomy of semantics". In: Peters, Stanley & Esa Saarinen, eds.: *Processes, Beliefs, and Questions*. Vol. 16. Synthese Language Library. Dordrecht: Reidel, 69–86.

13 On the semantics of questions and answers see, among others, von Stechow & Zimmermann (1984), Zimmermann (1985b), Bäuerle & Zimmermann (1991), and Plunze & Zimmermann (2006).

Frege, Gottlob (1884): *Die Grundlagen der Arithmetik. Eine logisch mathematische Untersuchung über den Begriff der Zahl*. Breslau: Wilhelm Koebner.

Hamm, Fritz & Thomas Ede Zimmermann (2002): "Quantifiers and anaphora". In: Hamm, Fritz & Thomas Ede Zimmermann, eds.: *Semantics*. Hamburg: Buske, 137–172.

Kaplan, David (1989): "Demonstratives. An essay on the semantics, logic, metaphysics, and epistemology of demonstratives and other indexicals". In: Almog, Joseph & John Perry & Howard Wettstein, eds.: *Themes from Kaplan*. Oxford: Oxford University Press, 481–563.

Kripke, Saul (1972): *Naming and Necessity*. Harvard: Harvard University Press.

Lerner, Jean-Yves & Thomas Ede Zimmermann (1991): "Eigennamen". In: von Stechow, Arnim & Dieter Wunderlich, eds.: *Semantik. Ein internationales Handbuch der zeitgenössischen Forschung. Semantics. An International Handbook of Contemporary Research*. Berlin/New York: de Gruyter, 349–370.

Montague, Richard (1970): "Universal grammar". *Theoria* 36.3, 373–398.

Plunze, Christian & Thomas Ede Zimmermann (2006): "On Truckenbrodt on Interrogatives". *Theoretical Linguistics* 32.3, 321–333.

Russell, Bertrand (1905): "On denoting". *Mind* 14, 479–493.

von Stechow, Arnim & Thomas Ede Zimmermann (1984): "Term answers and contextual change". *Linguistics* 22.1, 3–40.

Zadrozny, Wlodek (1994): "From Compositional to Systematic Semantics". *Linguistics and Philosophy* 17, 329–342.

Zimmermann, Thomas Ede (1983): "Bedeutungspostulate in der Montague-Grammatik". *Conceptus. Zeitschrift für Philosophie Salzburg* 17.40/41, 19–28.

Zimmermann, Thomas Ede (1984): "Name. III. Neuzeit". In: Ritter, Joachim & Karlfried Gründer, eds.: *Historisches Wörterbuch der Philosophie*. Vol. 6. Basel/Stuttgart: Schwabe, 384–387.

Zimmermann, Thomas Ede (1985a): "A note on transparency postulates". *Journal of Semantics* 4.1, 67–77.

Zimmermann, Thomas Ede (1985b): "Remarks on Groenendijk and Stokhof's theory of indirect questions". *Linguistics and Philosophy* 8.4, 431–448.

Zimmermann, Thomas Ede (1987): "Transparent adverbs and scopeless quantifiers". In: Groenendijk, Jeroen & Dick de Jongh & Martin Stokhof, eds.: *Foundations of Pragmatics and Lexical Semantics*. Dordrecht: Foris, 81–99.

Zimmermann, Thomas Ede (1989): "Intensional logic and two-sorted type theory". *Journal of Symbolic Logic* 54.1, 65–77.

Zimmermann, Thomas Ede (1991a): "Kontextabhängigkeit". In: von Stechow, Arnim & Dieter Wunderlich, eds.: *Semantik. Ein internationales Handbuch der zeitgenössischen Forschung. Semantics. An International Handbook of Contemporary Research*. Berlin/New York: de Gruyter, 156–229.

Zimmermann, Thomas Ede (1991b): "Richard Montague". In: Nida-Rümelin, Julian & Elif Özmen, eds.: *Philosophie der Gegenwart in Einzeldarstellungen*. Stuttgart: Kröner, 410–416.

Zimmermann, Thomas Ede (1993a): "On the proper treatment of opacity in certain verbs". *Natural Language Semantics* 1.2, 149–179.

Zimmermann, Thomas Ede (1993b): "Scopeless quantifiers and operators". *Journal of Philosophical Logic* 22.5, 545–561.

Zimmermann, Thomas Ede (1993c): "Zu Risiken und Nebenwirkungen von Bedeutungspostulaten". *Linguistische Berichte* 146, 263–282.

Zimmermann, Thomas Ede (1995): "Tertiumne datur? Possessivpronomina und die Zweiteilung des Lexikons". *Zeitschrift für Sprachwissenschaft* 14.1, 54–71.

Zimmermann, Thomas Ede (1996a): "Model theory in the analysis of natural language". In: Martínez Vidal, C. & U. Rivas Monroy & L. Villegas Forero, eds.: *Verdad: Lógica, Representación y Mundo*. Santiago de Compostela (Universidade).

Zimmermann, Thomas Ede (1996b): "Montague, Richard". In: Stammerjohann, Harro, ed.: *Lexicon Grammaticorum*. Tübingen: Niemeyer, 648.

Zimmermann, Thomas Ede (1997): "The addressing puzzle". In: Künne, Wolfgang & Albert Newen & Martin Anduschus, eds.: *Direct Reference, Indexicality, and Propositional Attitudes*. Stanford: CSLI, 133–153.

Zimmermann, Thomas Ede (1999a): "Meaning postulates and the model-theoretic approach to natural language semantics". *Linguistics and Philosophy* 22.5, 529–561.

Zimmermann, Thomas Ede (1999b): "Remarks on the epistemic rôle of discourse referents". In: Moss, Lawrence S. & Jonathan Ginzburg & Maarten de Rijke, eds.: *Logic, Language, and Computation*. Vol. 2. Stanford, CA: CSLI Publications, 346–368.

Zimmermann, Thomas Ede (1999c): "Scepticism de se". *Erkenntnis* 51.2/3, 267–275.

Zimmermann, Thomas Ede (2000): "Free choice disjunction and epistemic possibility". *Natural Language Semantics* 8.4, 255–290.

Zimmermann, Thomas Ede (2004a): "Replies to Bierwisch, Kamp & Roßdeutscher". In: Kamp, Hans & Barbara H. Partee, eds.: *Context-Dependence in the Analysis of Linguistic Meaning*. Leiden: Brill, 553–554.

Zimmermann, Thomas Ede (2004b): "Tertiumne datur? Possessive pronouns and the bipartition of the lexicon". In: Kamp, Hans & Barbara H. Partee, eds.: *Context-Dependence in the Analysis of Linguistic Meaning*. Leiden: Brill, 319–332.

Zimmermann, Thomas Ede (2005a): "Meinen und Zweifeln". In: Spohn, Wolfgang & Peter Schroeder-Heister & Erik J. Olsson, eds.: *Logik in der Philosophie*. Heidelberg: Synchron, 113–135.

Zimmermann, Thomas Ede (2005b): "What's in two names?". *Journal of Semantics* 22.1, 53–96.

Zimmermann, Thomas Ede (2006a): "Knowledge and desire, from a German perspective". In: Solstad, Torgrim & Atle Grønn & Dag Haug, eds.: *A Festschrift for Kjell Johan*

Sæbø—In Partial Fulfilment of the Requirements for the Celebration of his 50th Birthday. Oslo: University of Oslo, 211–223.

Zimmermann, Thomas Ede (2006b): "Monotonicity in opaque verbs". *Linguistics and Philosophy* 29, 715–761.

Zimmermann, Thomas Ede (2006c): "The values of semantics". In: Fuß, Eric & Patrick Brandt, eds.: *From, Structure, and Grammar*. Berlin: Akademie Verlag, 383–397.

Zimmermann, Thomas Ede (2010): "What it takes to be missing". In: Hanneforth, Thomas & Gisbert Fanselow, eds.: *Language and Logos. Studies in Theoretical and Computational Linguistics*. Berlin: Akademie Verlag, 255–265.

Zimmermann, Thomas Ede (2011): "Model-theoretic Semantics". In: Maienborn, Claudia & Klaus von Heusinger & Paul Portner, eds.: *Semantics. An International Handbook of Natural Language Meaning*. Vol. 1. Berlin/New York: de Gruyter, 762–802.

Zimmermann, Thomas Ede (2012a): "Compositionality problems and how to solve them". In: Werning, M. & Wolfram Hinzen & Edouard Machery, eds.: *The Oxford Handbook of Compositionality*. Oxford: Oxford University Press, 81–106.

Zimmermann, Thomas Ede (2012b): "Context Dependence". In: Maienborn, Claudia & Klaus von Heusinger & Paul Portner, eds.: *Semantics. An International Handbook of Natural Language Meaning*. Vol. 3. Berlin/New York: de Gruyter, 2360–2407.

Zimmermann, Thomas Ede (2012c): "Equivalence of semantic theories". In: Schantz, Richard, ed.: *Prospects for Meaning*. Berlin: de Gruyter, 629–649.

Zimmermann, Thomas Ede & Wolfgang Sternefeld (2013): *Introduction to Semantics. An Essential Guide to the Composition of Meaning*. Berlin: de Gruyter.