Compositionality in Truth-Conditional Pragmatics

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Abstract In the past decade various linguists and philosophers (e.g. Pagin, Pelletier, Recanati, Westerståhl, Lasersohn) have proposed a weakening of the standard interpretation of compositionality for propositional content. Their move is motivated by the desire to accommodate radical forms of context sensitivity within a systematic account of natural languages. In this paper I argue against weakening compositionality in the way proposed by them. I argue that weak compositionality fails to provide some of the expected benefits of compositionality. First, weak compositionality fails to provide systematic meaning-rules which can handle forms of context-sensitivity that are not amenable to explanation in terms of a fixed and limited set of contextual parameters. Secondly, I argue that weak-compositionality fails to play any role in explaining speakers' ability to calculate the semantic values of complex expressions. I conclude that weak compositionality is not a viable alternative to standard interpretations of compositionality, and that it doesn't offer an acceptable way to accommodate radical forms of context-sensitivity within a systematic account of natural languages. Given the central role that weak-compositionality plays in recent approaches to natural language (e.g. in truth-conditional pragmatics) this also casts doubt on the viability of these projects.

Keywords Compositionality · Context-sensitivity · Formal semantics · Truth-conditional pragmatics

1 Introduction: Meaning and Compositionality

Formal semantics aims to model the fundamental meaning properties and meaning relations of natural languages with the tools of formal logics. It aims to build formal characterizations of natural languages that can serve as explanatory models of our

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semantic competence – of what a speaker knows in knowing her language. The formal theory can start from the basic insight that to know the meaning of a sentence is to know the conditions under which the sentence is true, and the conditions under which the sentence is false. Then as a way of specifying our competence with meaningful natural language expressions, the theory will seek to systematically pair each meaningful sentence of a language with its truth-conditions. The theory is descriptively adequate if its pairings of sentences with truth-conditions, match native speakers' intuitions about the conditions under which these sentences are true and the conditions under which they are false. Moreover, given that speakers of natural languages have the ability to produce and understand complex meaningful expressions that they have never encountered before, one central goal is to explain how linguistic competence extends to novel expressions. Since the most plausible explanation is that speakers derive their competence with novel sentences from their competence with the constituents of the sentences and competence with ways in which expressions can combine, a semantic theory should derive in a finite number of steps the truth-conditions of sentences from the meanings of their simple parts and their syntactic structures. For this reason, the vast majority of semanticists believe that compositionality is a fundamental property of natural languages: that the meaning of complex expressions is a function of the meaning of their immediate constituents and syntactic structure.

Still, philosophers and linguists with a Wittgensteinian bent believe that the existence of pervasive forms of context-sensitivity in natural languages, and the apparent unruliness of language use, threatens the very project of formal semantics.[1] They believe that natural languages exhibit forms of context-sensitivity that cannot be treated in terms of a fixed set of contextual parameters (in the way in which expressions like "I" or "that" are treated) and that this is incompatible with the principle of compositionality. More recently, though, a motley coalition of linguists and philosophers deny that there is incompatibility between (some versions of) compositionality and radical forms of context sensitivity.[2] The position defended by the latter is the focus of this paper. I will argue that their proposals to weaken the principle of compositionality, in order to accommodate within a compositional framework recalcitrant data, loses the theoretical benefits promised by compositionality.

The plan of the paper is the following. This first section presents a framework in which claims about meaning and compositionality can be clearly formulated. Section 2 presents the challenge from radical forms of context-sensitivity to the very project of formal semantics, and Sect. 3 presents the truth-conditional pragmatics' (henceforth TCP) proposal to accommodate radical forms of context-sensitivity within a compositional framework. The last two sections are dedicated to an

[1] Ziff (1972), Searle (1978), Travis (1978, 1997), Margalit (1979), Moravcsik (1994), Bezuidenhout (2002), Carston (2002), Recanati (2004)

[2] See Pelletier (2003), Pagin (2005), Pagin and Pelletier (2007), Westerståhl (2012), Lasersohn (2012) and references therein.

extensive criticism of the TCP approach and its proposed interpretation of the principle of compositionality.

1.1 Linguistic Meaning and Propositional Content

Following Kaplan (1989) and Lewis (1980) it is customary to distinguish two types of meaning: what an expression means independently of any context of utterance (or *linguistic meaning*) and what an expression means relative to a context of utterance (or *propositional content*).

The linguistic meaning of an expression is the convention associated with that expression and something like a rule of use: it tells what an expression can say when used in any arbitrary context. For example, the linguistic meaning of the first person pronoun "I" can be thought of as a rule that states that "I" when used in an arbitrary context refers to the speaker of that context. Linguistic meaning can be modeled as a function from possible contexts of utterance to propositional contents. The linguistic meaning of some expressions is a non-constant function that returns different contents for different contexts of utterance (e.g. indexicals like "I", "today", descriptions like "the tallest man in town", etc.), while the linguistic meaning of others is a constant function that returns the same content at any context of utterance (proper names like "David Kaplan", numerals like "two", etc.). Contexts, as formal objects of the theory, have the job to represent the concrete situation in which language use takes place. Since any use of an expression is done by an agent, at a place and time in a possible world, contexts can be represented as a sequence of individuals consisting of an *agent*, a *time*, a *location* and a *world*. An essential assumption in semantic theorizing is that we can give the linguistic meaning of any natural language expression in terms of a limited and fixed set of contextual parameters, even if we *may* need to extend the list of parameters beyond agent, time, location and world.

The propositional content of an expression can be thought of as the information that determines the denotation of an expression at any possible state of affairs. Propositional content can be modeled as a function from circumstances of evaluation (which at minimum are possible worlds but, in principle, could be richer) to denotations: individuals for singular terms, sets for predicates, truth-values for sentences. The idea is, in somewhat simplified terms, that the linguistic meaning of a sentence determines a unique content with respect to any given context, and the content determines, in its turn, a unique denotation with respect to any given circumstance of evaluation.

A fundamental tenet that underlies all semantic theorizing is that for any context of utterance the linguistic meaning of a sentence determines its truth-conditions at that context, and that all context sensitivity can be handled in terms of a fixed and limited set of contextual parameters, more or less along the lines in which expressions like "I", "today", "here" are treated. The idea is that the theory assigns a finite number of meanings to simple expressions and uses a finite number of

rules to derive, out of these meanings, the truth-conditions of every sentence of that language. As I will detail in the second section, this general picture has been vigorously contested by authors who are skeptical towards the very possibility of formal semantics.

1.2 Varieties of Compositionality

Depending on whether we require that it is the linguistic meaning of complexes or their propositional content that is a function of the values of constituents we obtain different versions of compositionality. Here is how semanticists traditionally formulated compositionality for linguistic meaning and for propositional content, respectively.[3]

A. *Compositionality of linguistic meaning*: The linguistic meaning of a complex expression is a function of the linguistic meaning of its constituents and of its syntactic structure. More precisely, a semantics **I*** is linguistic meaning compositional (LM compositional) iff for any syntactic rule α there is function *f* such that for any two expressions e_i, e_j if $\alpha(e_i,e_j)$ is meaningful then:

$$\mathbf{I}^*\left(\alpha\left(e_i, e_j\right)\right) = f\left(\alpha, \mathbf{I}^*\left(e_i\right), \mathbf{I}^*\left(e_j\right)\right).$$

A semantics fails to be LM compositional if for some expressions e_i, e_j, e_n, and syntactic rule α,

$$\mathbf{I}^*\left(e_j\right) = \mathbf{I}^*\left(e_n\right) \text{ and } \mathbf{I}^*\left(\alpha\left(e_i, e_j\right)\right) \neq \mathbf{I}^*\left(\alpha\left(e_i, e_n\right)\right).$$

In plain words, a semantics fails to be LM compositional if substitution of synonyms is not meaning preserving in that semantics.

Since content is assigned to expression-context pairs, in order to formulate compositionality for content we need to take into account the role that context plays in the determination of the content of complexes.

B. *Strong compositionality for content*: the content of a complex expression relative to a context is a function of the content of its constituents at that context and of its syntactic structure. More precisely, a semantics **I*** is *strongly compositional*

[3]See Kaplan (1989, 507) where both varieties are given informally. For their formal rendering see Pagin and Westerståhl (2010, 259–260), Dever (2006, 634), Szabó (2010, 258–260). Given that linguistic meaning is a property of expressions themselves, linguistic meaning will be assigned directly to expressions, and given that propositional content is a property of expressions at contexts, content will be assigned to expression-context pairs. Furthermore, since linguistic meaning is a function from contexts to propositional content, and propositional content is a function from circumstances to extensions, a semantics **I*** which assigns linguistic meaning directly to expressions is the curryied version of a semantics **I** which assigns propositional content to expression-context pairs. That is, for any expression *e* and any context C, $\mathbf{I}(e,C) = \mathbf{I}^*(e)(C)$.

iff for every syntactic rule α there is a function f such that for any two expressions e_i, e_j and for any context C if $\alpha(e_i, e_j)$ is meaningful at C then:

$$\mathbf{I}\left(\alpha\left(e_i, e_j\right), C\right) = f\left(\alpha, \mathbf{I}\left(e_i, C\right), \mathbf{I}\left(e_j, C\right)\right)$$

A semantics fails to be strongly compositional if for some expressions e_i, e_j, syntactic rule α and some contexts C_1, C_2

$$\mathbf{I}\left(e_i, C_1\right) = \mathbf{I}\left(e_i, C_2\right) \text{ and } \mathbf{I}\left(e_j, C_1\right) = \mathbf{I}\left(e_j, C_2\right)$$
$$\text{and } \mathbf{I}\left(\alpha\left(e_i, e_j\right), C_1\right) \neq \mathbf{I}\left(\alpha\left(e_i, e_j\right), C_2\right).$$

In other words, a semantics fails to be strongly compositional if a complex expression varies its content across contexts of utterance but its constituents have unvarying contents across the very same contexts of utterance. A relevant consequence of strong compositionality is that the content of a complex expression depends on the context only in so far as the contents of its constituents do. If the content of a complex expression is context dependent this should be traceable to the context-dependency of at least one of its simple constituents.

Recently, various theorists have argued that context should be given a more substantive role in the determination of the content of complexes, and that this is compatible with the spirit of compositionality. We get, then, another principle of compositionality for content:

C. Weak compositionality for content: The content of a complex expression relative to a context C is a function of the contents that its constituents have at C *and of C itself*. More precisely: a semantics **I** is weakly compositional iff: for every syntactic rule α there is a function f such that for any expressions e_i,e_j and for any context C if $\alpha(e_i, e_j)$ is meaningful then

$$\mathbf{I}\left(\alpha\left(e_i, e_j\right), C\right) = f\left(\alpha, \mathbf{I}\left(e_i, C\right), \mathbf{I}\left(e_j, C\right), C\right).$$

A semantics fails to be weakly compositional if for some expressions e_i, e_j, e_n, syntactic rule α and context C: $\mathbf{I}(e_j,C) = \mathbf{I}(e_n,C)$ and $\mathbf{I}(\alpha(e_i, e_j),C) \neq \mathbf{I}(\alpha(e_i,e_n),C)$.

Observe that according to weak compositionality (as opposed to strong compositionality) context is taken as an extra argument of the composition function and *the contribution that this extra argument makes can be non-vacuous*. A consequence of weak compositionality is that the context sensitivity of complex expressions need not be traceable to the context-sensitivity of some of its constituents. Weak compositionality allows that context determines the content of a complex expression in ways that go over and above determining the contents of its constituents.[4]

[4]Strong compositionality is a proper generalization of weak compositionality, which, in its turn, is a proper generalization of linguistic meaning compositionality. For proofs see Westerståhl (2012). For an alternative proof and a further discussion of how weak and strong compositionality for content interact with various types of context-sensitivity see Briciu (2018).

2 Radical Context-Sensitivity and Semantic Underdetermination

Ever since its inception skeptical voices claimed that the very project of formal semantics is wrongheaded and doomed to fail. According to them, because English exhibits forms of context-sensitivity that cannot be handled simply in terms of the lexical and syntactic properties of its expressions, formal semantic theories cannot give correct truth-value predictions even for simple English sentences like (1).

(1) The leaves are green

The following scenario, imagined by Travis (1997, 89–90), is meant to show this.[5] Suppose Pia paints the leaves of a Japanese russet maple tree green for a photographic installation. Upon ending the job she might utter truly (1) while pointing to the leaves. Later, a botanist friend seeking green leaves for an experiment on green-leaves chemistry drops by. Pia offers her botanist friend the leaves she has just painted, and utters (1) while pointing towards them. But now, she might for all the paint, utter falsely (1) while pointing to the leaves. Intuitively, the two utterances of (1) have different truth values; the first is true while the second is false, although the brute state of the leaves did not change in between the two utterances. According to Travis, (1) is neither ambiguous nor elliptical; it contains neither vague nor indexical expressions, nor are our intuitions about its truth value the result of what might be indirectly conveyed by its respective utterances (i.e. intuitions about the truth or falsity of what is implicated by those utterances).[6]

If skeptics are right, whether (1) is true or false at the imagined scenario depends not only on its linguistic meaning and how the world is, but on a multitude of potentially unrepeatable and formally intractable factors, like the participants' immediate interests, purposes and concerns. Allegedly, the difference in truth-values is due to the fact that (1) has different truth-conditions at the two contexts of utterance: it is true in the photographer context iff the leaves *appear green* at the time of the utterance; while it is true in the botanist context iff the leaves *are naturally green* at the time of the utterance. Skeptics further argue that the difference in truth-

[5] According to skeptics, radical context-sensitivity affects virtually any natural language sentence. Arguments similar with Travis' have been put forward concerning rather pedestrian sentences like (2) "It is raining" (Recanati 2002), or (3) "The cat is on the mat" (Searle 1978), or (4) "The ham sandwich stinks" (Recanati 2010), or (5) "The snow is white" Moravcsik (1994). This skepticism is also shared by linguists like Chomsky (2002). For discussions of many more such examples see Bezuidenhout (2002), Recanati (2004), Cappelen and Lepore (2005), Szabó (2007), García-Carpintero (2006).

[6] Obviously some of these claims were contested. For example Kennedy and McNally (2010) argue that (1) is ambiguous because color terms are ambiguous between gradable and non-gradable interpretations. Given that there are many other similar arguments put forward by skeptics that do not involve color terms and that TCP accepts, for the sake of the argument I will go along with skeptics and truth-conditional pragmatists and accept their claim that no vagueness, ellipsis or ambiguity is involved in (1).

conditions of (1) is not determined by its linguistic meaning. Their argument can be reconstructed in the following way:

(A) The two utterances of (1) have different truth values. (*Data*)
(B) The difference in truth value is due to the fact that (1) expresses different contents at the two contexts of utterance.
(C) The constituents of (1) do not vary their content across the relevant contexts of utterance
(D) Since the linguistic meaning of constituents of (1) is not context-sensitive, the linguistic meaning of (1) should determine the very same content at the two context of utterance.

From (B) and (D) it follows:

(E) Underdetermination: the contextual variation in the content of (1) is not determined by its linguistic meaning (*Conclusion*)[7]

According to Travis, as far as the meanings of constituents of (1) and its syntax go, whether we can predicate truly "green" of the leaves in question is an open matter: on some occasions we can, on others we can't. What determines whether an utterance of (1) is true in the photographer context and false in the botanist context is not just its linguistic meaning and the brute state of the leaves, but also an intricate web of immediate interests, intentions and beliefs of the conversational partners.

Skeptics believe that for virtually any natural language sentence what that sentence literally means, together with formal aspects of context (who is speaking when and where), plays some role in determining its truth-conditions, but not an exhaustive one. Its truth-conditions depend on factors that cannot be made completely explicit in the semantic analysis of the sentence. One reason is that these factors are not fixed: there is *no constant set of factors* that determines the truth conditions of a sentence relative to *any* context of utterance. Another reason is that the list of factors relevant for determining the truth-conditions of a sentence is open-ended: "information from virtually anywhere and about virtually anything might have a bearing"[8] on truth-conditions. Even for the simplest sentences, human interests, concerns and beliefs can play a role in determining whether they are true or false at a given context of use, and there is no determinate boundary at the outset on which facts could turn out to be relevant for the interpretation of a sentence. Skeptics take this to show that no systematic account of the meaning properties of natural languages, with the tools of formal logic, is possible. If true, then an important part of our linguistic competence might lie beyond the reach of systematic theorizing.

[7]Needless to say, defenders of formal semantics try to resist the above argument by rejecting some of its premises. Borg (2004a, b) and Cappelen and Lepore (2005) deny that the data put forward by skeptics are semantically relevant, Predelli (2005) denies premise (B) and argues that (1) expresses the same content at the two contexts where the difference in truth-value is the result of evaluating the content for truth at different circumstances; Szabó (2001) and Rotschild and Segal (2009) deny premise (C) and argue that "is green" is context-sensitive after all.

[8]Carston (2002, 2). This is also the central argument in Searle (1978), Bezuidenhout (2002) and Recanati (2004, chapter 9).

Underdetermination of truth-conditions by linguistic meaning also entails failure of strong compositionality: the content of sentences (relative to a context) *is not* determined by the content of their constituents (at that context) and the way the constituents are syntactically combined. Premise (B) together with (C) entail the following claim:

(F) Some complex expressions –e.g. (1) – vary their content across contexts of utterance although the content of their constituents remains stable across the very same contexts.

Arguments surrounding the truth of these premises constitute the bulk of the debate on whether the project of formal semantics is wrongheaded or not. Given that TCP accepts these arguments, I will not judge their worthiness, nor will I try to adjudicate on whether natural languages exhibit radical forms of context sensitivity. Rather, my aim is to discuss if the TCP proposal to accommodate radical context-sensitivity within a weakly compositional account delivers the explanatory benefits that we expect from compositional theories of natural languages.

3 Truth-Conditional Pragmatics and Weak Compositionality

TCP accepts that natural languages exhibit forms of context-sensitivity which cannot be treated by fixing the values of a limited set of contextual parameters, and accepts that this brings about semantic underdetermination. But it claims that a compositional account of natural languages can still be given, although not as initially conceived. According to TCP, semantics and pragmatics mix in determining truth-conditional content: pragmatic factors (i.e. factors not mandated by the lexical and syntactic properties of expressions) play a role in the determination of contents of sentences (at contexts of use). This is where weak compositionality comes in. A theory that allows for pragmatic intrusion through and through fails to be strongly compositional, but it *can* be weakly compositional. By making use of weak compositionality, TCP promises to model natural languages by systematically pairing sentences with their truth-conditions (i.e. what formal semantics traditionally aims to do) in a way that can accommodate recalcitrant cases brought up by skeptics like Travis: sentences whose truth-conditions depend on a potentially open-ended number of pragmatic factors.[9] Here is how Recanati (2010, 127) summarizes the main idea behind TCP:

> [T]ruth conditional pragmatics is the view that the effects of context on the content need not be traceable to the linguistic material in the uttered sentence. Some effects of context on content are due to the linguistic material (e.g. the context sensitive words or morphemes which trigger the search for contextual values), but others result from "top down" pragmatic processes that take place not because the linguistic material demands it, but because

[9] Pagin and Pelletier (2007, 32) are explicit about this.

utterance's content is not faithfully or wholly encoded in the uttered sentence, whose meaning requires adjustment or elaboration in order to determine an admissible content for the speaker's utterance.

In TCP pragmatics kicks in not only to derive what is conveyed by an utterance of a sentence (e.g. to derive the conversational implicatures), but plays a role also in determining the truth-conditions of that sentence.[10] Although both semantic processes (like indexical resolution) and primary pragmatic processes determine semantic content, they are distinct in that the first, but not the latter, are required by the lexical and/or syntactic properties of expressions. Because they are lexically and/or syntactically required, semantic operations are *mandatory* (in the sense that in their absence a sentence fails to express a truth-evaluable content) while pragmatic operations, are merely *optional* (in the sense that in their absence a sentence might still express a truth-evaluable content).

To get the gist of TCP, consider how it analyses (4).

(4) The ham sandwich stinks

There are numerous contexts in which (4) expresses exactly what its linguistic meaning says, namely that the contextually salient ham sandwich stinks. For example, if one sorts rotten food from good one, and utters it, (4) is taken to be true iff the salient ham sandwich stinks. But imagine that in order to maximize speed and efficiency restaurant workers tend to refer to their customers by the dish that they order. If used in such a context (4) is true just if the person who ordered the ham sandwich stinks; its truth conditions at this context involve a person and not a ham sandwich.

TCP believes that these intuitions about (4) constitute bona-fide data that theories which seek to model competence with natural language meanings must account for.[11] It puts forward the following proposal. The linguistic meaning of each simple constituent of (4) determines together with the context of utterance the literal content of that expression at that context. The contents thus determined are combined step-by-step following the syntactic structure of (4) into the content of complex constituents ending with the content of (4) at that context. At some contexts though (e.g. the restaurant context) the contribution of the noun-phrase to the content of (4) does not involve a sandwich, and thus it is not what is determined by its lexical and syntactic properties. Its contribution is, in part, determined by pragmatic operations. Loosely speaking we could say that there is a context-specific pragmatic function that maps dishes into their orderers which is relevant for the interpretation of (4)

[10]For this purpose Recanati (2004, 23–37) distinguishes two types of pragmatic operations: *primary* (they play a role in the determination of truth-conditions) and *secondary* (they play a role solely in the derivation of conversational implicatures).

[11]This phenomenon was first discussed in Nurnberg (1995). Of course, the first-blush reaction that defenders of formal semantics have in the face of these examples is to deny their semantic significance: to deny that intuitions about metonymic uses of (4) are to be treated on a par with those of literal use, and that a common treatment of both is desirable. For a discussion along these lines see Stanley (2007, 206–207).

at the restaurant-context. What results from combining the content of the parts determined by their linguistic meaning according to the syntactic structure of (4) is only an intermediate stop in the overall process of determining the content of (4). Relative to some contexts, its content is determined in part by context-specific pragmatic operations.

The term used by TCP for these types of pragmatic operations is *modulation*. Formally, modulation can be represented as a function that takes us from the content determined by the lexical and syntactic properties of an expression to a conversationally more appropriate content – that is, a function from content to content. Modulation is *context-specific* in that it can vary with the context of utterance: for every expression-context pair <*e*,C > there can be a distinct modulation function *mod(e,C)* that determines the content of that expression at that context.[12]

For example, the modulation function that determines the content of the compound nominal in (4) at the restaurant-context is distinct from the one that determines its content in the context of sorting food.[13] According to TCP, at some contexts C, what a simple expression *e* contributes to the content of complexes, is not the content determined solely by its lexical and syntactic properties **I**(e,C), but a pragmatically determined content *mod(e,C)*(**I**(e,C)). Furthermore, pragmatic functions can also operate on complexes directly, as is the case with the compound nominal in (4). The content of a complex itself can be the result of a contextually salient pragmatic function:

$$Mod\left(\mathbf{I}\left(\alpha\left(\mathrm{e_i},\mathrm{e_j}\right),\mathrm{C}\right)\right)=\mathrm{mod}\left(\alpha\left(e_i,e_j\right),C\right)$$
$$\left(f\left(\alpha,\mathrm{mod}\left(e_i,\mathrm{C}\right)\left(\mathbf{I}\left(\mathrm{e_i},\mathrm{C}\right)\right),\mathrm{mod}\left(e_j,C\right)\left(\mathbf{I}\left(\mathrm{e_j},\mathrm{C}\right)\right)\right)\right)$$

It is clear that pragmatic functions which operate on complexes destroy strong compositionality. For example, such an account of (4) fails to satisfy strong compositionality since it allows (4) to vary its content across contexts of utterance although its simple constituents keep constant contents across the very same contexts. Nevertheless such an account of (4) *can* satisfy weak compositionality.

[12] As Recanati puts it, "modulation itself is context-sensitive: whether or not modulation comes into play, and if it does, which modulation takes place, is a matter of context" (Recanati 2010, 19). In their formal apparatus both Pagin and Pelletier (2007) and Recanati (2010) make use of a general modulation function *mod* which sole purpose is to determine the particular, context-specific modulation functions: *mod* takes pairs of expressions *e* and contexts *C* as arguments and delivers, for each such pair, the contextually appropriate modulation function *mod(e,C)*.

[13] Within this account literalness can be treated as a limiting case: the context-specific function that delivers the content of "the ham sandwich" in the context of sorting food is the identity function.

4 Against Weakening Compositionality

If the threat to the project of formal semantics is that truth-conditions of natural language sentences vary in an un-systematic way, finding out that natural languages satisfy weak compositionality won't save the project of building a systematic theory of their meaning properties. In this section I'll argue for this, taking into account two different ways in which TCP can be implemented.

Truth-conditional pragmatics can have two distinct, but formally equivalent, architectures. In one, interpretation takes place in one fell swoop employing context-sensitive meaning-rules: rules that introduce meaning-operations which vary with the context of utterance. In the other, interpretation is a two-steps process whereby context-insensitive meaning rules operate on the lexical and syntactic properties of expressions, and they feed context-specific pragmatic functions which determine the truth-conditions of sentences at contexts of utterance.

4.1 Weakly Compositional Meaning Rules

In order to keep things clear let me rehearse, first, the distinction between *rules* and *operations*, a distinction that applies both at the level of syntax and at the level of semantics. *Syntactic rules* state how expressions of a language combine to form larger grammatical expressions. Here is an example of syntactic rule: if e_1 is an expression of category NP and e_2 is an expression of category VP then concatenating e_1 and e_2, in this order, results in an expression of category S. This particular rule introduces one type of *syntactic operation* by which expressions combine, namely concatenation. *Meaning-rules* state how the meaning of complex expressions with a certain syntactic structure is obtained. Here is an example of meaning-rule: if $e_1 \wedge e_2$ is a complex expression formed by concatenating e_1 and e_2, in this order, and the meaning of e_1 is a function whose domain contains the meaning of e_2 then the meaning of $e_1 \wedge e_2$ is the value of the meaning of e_1 for the meaning of e_2 as an argument: $\mathbf{I}^*(e_1 \wedge e_2) = \mathbf{I}^*(e_2)(\mathbf{I}^*(e_1))$. This meaning-rule introduces one type of *meaning-operation* by which meanings combine, namely functional application[14,15]. Importantly, this rule specifies the semantics $\mathbf{I}^*$ in a way that allows to derive the semantic value of complex expressions once we match

[14]This is but one of many compositional rules available to theorists. Other rules can introduce other types of operations for various complex expressions. For a discussion see Chung and Ladusaw (2004, 2–14)

[15]In a sense, meaning-rules interpret syntactic ones. Each syntactic rule states that expressions of certain syntactic categories can combine to form expressions of a certain syntactic category, and determine the operation by which they combine. And each meaning-rule states how (i.e. by which operation) the meanings of complex expressions with a certain syntactic structure are built from the meanings of their constituents.

up the variables in the rule with the constituents that correspond to them in each particular expression.

What type of meaning rules are needed by TCP? More precisely, what type of rules are needed by a theory which allows for pragmatics to determine what content an expression has relative to a given context of use? If constituents do not vary their content, what is, then, the source of this variation? It must be the manner in which the contents of constituents combine at different contexts. Then the theory needs *context-sensitive meaning-rules*: rules that introduce meaning-operations which vary with the context of utterance. Such meaning-rules look handy for TCP, for they promise to help explain how (1) and (4) vary their content across contexts of utterance in the absence of a corresponding variation in the content of their simple constituents. Furthermore, such rules are weakly compositional.

A context-sensitive meaning rule looks the following way: if e1∧e2 is a complex expression formed by concatenating e_1 and e_2, in this order, then for any context C, there is an operation *O* such that the semantic value of $e_1 \wedge e_2$ at C is the result of combining by *O* the semantic value of e_1 at C with the semantic value of e_2 at C. This, though, is rather uninformative; obviously, at every context the semantic values of constituents combine in one way or another. For context-sensitive rules to be of any use to natural language semantics they must specify *how* semantic values combine: they must specify, for any context, the value of the variable *O* for that context.

To get a flavor of how context-sensitive rules work, consider a toy language which has the same vocabulary and syntax as English but its meaning-rules introduce operations which vary across contexts of utterance as a function of the height of the speaker. Its meaning-rule states that if $e_1 \wedge e_2$ is a complex expression formed by concatenating e_1 and e_2, in this order, then for any C, the content of $e_1 \wedge e_2$ at C is the result of applying the content of e_1 at C to the content of e_2 at C if the speaker of C is shorter than 1.60 m, *or* the content of $e_1 \wedge e_2$ at C is the result of applying the content of e_1 at C to the content of e_2 at C and applying negation to the content thus obtained, if the speaker of C is taller than 1.60 m. In this language the sentence "John walks" expresses the proposition that John walks if uttered by a speaker shorter than 1.60 m and expresses the proposition that John doesn't walk if uttered by a speaker taller than 1.60.[16] Its context-sensitive rule specifies how operations vary with the context of utterance.

[16]It is obvious that this rule is not strongly compositional. But it is weakly-compositional. Under the assumption that a fragment of English, of which Vertical English is an extension, is weakly compositional, it can be shown that Vertical English is weakly compositional too. If the initial language is weakly compositional then extending it with the above rule does not destroy its weak compositionality. In Vertical English for any two sentences $e_1 \wedge e_2$ and $e_1 \wedge e_3$ and any context C, if $a_c \leq 1.60$ m and $I(e_2,C) = I(e_3,C)$ then $I((e_1 \wedge e_2),C) = I((e_1 \wedge e_3),C)$ – the content of constituents combine through functional application. And for any two sentences $e_1 \wedge e_2$ and $e_1 \wedge e_3$ and any context C if $a_c > 1.60$ m and $I(e_2,C) = I(e_3,C)$ then $I((e_1 \wedge e_2),C) = I((e_1 \wedge e_3),C)$ – the content of constituents combine through the complex operation described. Thus, the failure condition of weak compositionality, given in Sect. 1.2, does not obtain.

What kind of context-sensitive rules are suitable for TCP? According to TCP, sentences vary their contents across contexts of use in virtue of various pragmatic factors, so the rules it needs must introduce meaning-operations which vary with pragmatic factors. More precisely, the weakly compositional rules needed by TCP must systematically match meaning-operations with the corresponding pragmatic factors in terms of which they vary. For example, TCP needs rules of the following form: if $e_1 \wedge e_2$ is a complex expression formed by concatenating e_1 and e_2, in that order, then for any C if the conversational partners have the intention *i* and concern *b* at C then the content of $e_1 \wedge e_2$ at C is the result of combining the content of its constituents by operation *X* (say, functional application), *or* if the conversational partners have intention *i* and concern *d* at C the content of $e_1 \wedge e_2$ at C is the result of combining the content of its constituents by operation *Y* (say, predicate restriction).

But this is problematic for anyone wedded to the idea that natural languages exhibit radical forms of context sensitivity; that is, the type of context sensitivity that can't be handled by fixing the value of some definite contextual parameter(s). If there is no determinate boundary at the outset on which factors can turn out to be relevant in determining the set of truth-conditions of a sentence, it is impossible to pair each meaning-operation with those in terms of which it varies. To pair them, theorists must predict ahead of time each and all of the potentially open-ended number of pragmatic factors that, in principle, can be relevant for the interpretation of sentences with a certain syntactic structure. In other words, the type of rules that systematically pair meaning operations (i.e. ways of combining meanings) with pragmatic factors are incompatible with the very idea that the truth-conditions of a sentence depend on an indefinite number of pragmatic factors "i.e. factors which cannot be fully encoded into the sentence" meaning. [17]

To put this worry from a different angle: if natural languages are weakly compositional and their expressions are radically context sensitive, a single syntactic structure will contribute in more than one way to the interpretation of complex expressions, and its contribution will vary freely with the context of utterance. A weakly compositional meaning rule, then, will have to specify for the syntactic structure it interprets several manners of combining meaning. If these ways of combining meanings vary across contexts not as a function of a fixed and limited set of parameters, but vary together with a potentially open-ended number of highly specialized and intricate arrangements of intentions, interests, and expectations of the conversational partners, then stating such rules is highly problematic, for several reasons.

First, nothing short of a full model of human practical reasoning must be packed into meaning-rules. Even theorists, who are optimistic about achieving such a model, should find this a serious drawback for a theory that aims to model the meaning properties of natural languages. Secondly, If meaning rules are sensitive to the vicissitudes and peculiarities of each possible context of use, it is not clear at all why TCP needs compositionality. Compositionality is desirable because

[17] See Recanati (2004, 194), Travis (1996, 451), Bezuidenhout (2002, 105)

it delivers rules which are an effective procedure for calculating the semantic values of complexes such that executing the procedure requires no imagination or cleverness, but is a matter of merely following instructions carefully. But if truth-conditions depend on the intentions, practical concerns and the common assumptions of the conversational partners, then calculating them cannot be a matter of merely following instructions carefully. Rather, deriving them requires assigning mental states to conversational partners and reconstructing their practical reasoning. In other words, derivation of truth-conditions becomes an inference to the best explanation.

Thirdly, stating such rules requires doing precisely what the underdetermination claim denies it can be done: to predict ahead of time each and all of the potentially open-ended number of factors that might turn out to be relevant for the interpretation of an expression. And TCP accepts, and is motivated by, the alleged existence of semantic underdetermination.

There are several defensive moves that TCP can try, in order to alleviate these worries, but none of them are convincing.

As a first defensive move TCP might point out the obvious fact that not every possible way of combining meaning is permissible in English (nor in any other natural language). Although, in principle, there are an open-ended number of propositions that (1) can express, it can't express *any* proposition. There are limits on how much speakers can tinker with the meaning of sentences they use. TCP will propose, then, to distinguish those operations on semantic values which are permissible in English from those which are not.[18] Unfortunately this won't help. Even if we assume that there are a small number of meaning operations, given that there are a potentially open-ended number of pragmatic factors with which these operations vary, a theory must give indefinitely many pairings between them.[19] Obviously, introducing the pairs by listing them is not an option. The meaning-rule must be, or include, a systematic procedure that matches every meaning-operation with the appropriate pragmatic factors. But, again, this is incompatible with the main point of semantic underdetermination, namely that the linguistic meaning of a sentence is essentially open-ended: no set of rules can determine its truth-conditions for all possible contexts of utterance.[20]

A different defensive move for TCP is to use meaning-rules that introduce operations which vary with a fixed and limited number of parameters. This,

[18] Recanati (2010, 11) and Pagin and Pelletier (2007, 57) hint towards this move

[19] That TCP can do with a small number of meaning operations already concedes a lot. It looks to me that TCP is committed to the claim that there are a potentially open-ended number of meaning-operations. This follows directly from two of its other claims: (a) that a sentence can, in principle, express an open-ended number of propositions, each particular to a given context, and (b) that this variation need not be traceable to a corresponding variation in the content of the simple constituents, but that it can be the result of combining the content of constituents by different operations at different contexts

[20] See Searle (1978) and Margalit (1979).

though, involves giving up on the idea that natural languages exhibit radical forms of context sensitivity, the very phenomenon that motivated the appeal to weak-compositionality in the first place. Why is this solution incompatible with radical forms of context-sensitivity? If natural languages make use of this type of rules, any sentence would vary its content only as a function of a fixed and limited number of parameters, precisely what is denied by those who believe that natural languages exhibit radical forms of context sensitivity. In other words, such rules are of no use for TCP.[21]

Finally, TCP might argue that there is no need for meaning-rules to pair each meaning-operation with the pragmatic factors in terms of which they vary. They might point to analyses of demonstratives which rely on the notion of demonstratum or salience, without giving an explanation of how it is determined what is demonstrated, or what is salient. In fact, Pagin and Pelletier (2007, 58–59) suggest that determining what meaning-operation is at work in a context is similar to selecting the referent of a demonstrative relative to a context. We don't have a general and fully satisfactory theory that will tell us how to predict what is the most salient person, object or relation in a certain context of utterance, but we don't take this limitation to impinge on the systematicity of semantic theories. We should take the same attitude when it comes to operations on meaning. Then TCP should be content with formulating very general rules of the form: if e_3 is a complex expression and e_1 and e_2 are its immediate constituents, then the content of e_3 at any given context C, is the result of combining the content of e_1 at C with the content of e_2 at C *in the way relevant at C*.

There are good reasons to believe that this move is not available to TCP and that appeal to reference resolution for demonstratives is not helpful. In fixing the reference of a demonstrative relative to a context, the determination of the saliency profile of the context is beyond the reach of semantics. So is the determination of the salience profile of the context when it comes to determining which way of combining meanings is relevant at that context of utterance. A formal theory will tell us what "That is red" means relative to a context, but it won't tell us why "that" refers to *x* and not to *y*, relative to that context, other than that *x* and not *y* is the salient (or demonstrated) object. What object is the most salient one (or the demonstrated one) in a context is beyond the reach of semantic theories. There is no reason to suppose that semantic theories should tell us what particular object satisfies the property of being the most salient object (or the demonstrated object) at a given context. Thus a semantic theory might deliver an analysis of "That is red" along the following lines: if the speaker of "that is red" refers with the utterance of

[21] This is acknowledged also by Lasersohn. He writes with respect to such rules: "the contextual effects that threaten compositionality are of a much more thorough-going nature than the effect illustrated in [this rule], and do not lend themselves to an analogous treatment" (2012, 186).

"that" therein to x and to nothing else, then this sentence, as uttered in this context, is true if and only if x is red.[22]

Can we really say that determining the way in which meanings combine (relative to a context) is beyond the scope of semantics, just as determining the most salient (or the demonstrated) object of a context, is beyond the scope of semantics? This seems absurd, for just as one can't have a theory about the combinatorial and structural properties of expressions (i.e. syntax) without an account of how expressions combine, one can't have a theory about the meaning properties of a language in without an account of how meanings themselves combine.

In other words, such a rule is useless for a theory that seeks to model the fundamental meaning properties of a natural language. For such a rule doesn't tell us *how* to calculate the semantic value of complex expressions, since it doesn't introduce any meaning operation. And stating how to calculate the semantic values of complex expressions is precisely what semantic rules are expected to do. To say that the semantic values of complexes (with a given syntactic structure) are the result of combining the semantic values of their constituents in the relevant way is to say something trivial.[23] It is part and parcel of any theory that models the meaning-properties of a language to assign meaning to simple expressions *and* to determine the semantic effects of combining those meanings in given syntactic configurations. A theory that employs the type of rule described above won't tell us what the semantic effects of combing expressions in a certain syntactic configuration are.

4.2 Context-Specific Pragmatic Functions

These problems persist even if one prefers a different architecture for TCP, one in which derivation of truth-conditional content is a two-step process. For example, in the first step the linguistic meaning of each simple constituent of (1) determines, together with the context of utterance, a propositional content for that expression at that context. At this step all meaning-rules are context-insensitive. Relative to any context of utterance, the contents of simples (as determined by their lexical properties) are combined through *functional application* into the literal content of

[22] When it comes to reference fixing this is a strategy advocated, among others, by Borg (2004c, 2012), Higginbotham (1989), and Heck (2014).

[23] Moreover, there is another reason to doubt that TCP can successfully appeal to theories of demonstratives that rely on salience in order to make a case for rules which do not introduce meaning operations. Even if the explanation of how an object becomes salient within a context of utterance is beyond the scope of a theory of meaning, there is a substantive story to be told about this. But there is no substantive story to be told about how one meaning-operation becomes more salient than another one. To say that one way of combining meaning is more salient than another is just to say that one interpretation of a complex expression is more salient, or more readily available to than another one.

(1) at that context. In the second step, for each context of utterance a *context-specific pragmatic function* takes the propositional content determined by the lexical and syntactic properties of (1) and delivers the truth-conditional content of (1) at that context.[24]

If there are contextual ingredients in the truth-conditions of (1) which are provided through pragmatic functions, a theory that aims to predict for every context under what conditions (1) is true at that context must be able to predict for every context the right pragmatic function. More generally, if for any sentence *S* and context *C* there is a pragmatic function that determines the truth-conditions of S at C, and it is possible that for each sentence-context pair there is a distinct function, then TCP must provide a systematic procedure to calculate the right pragmatic function, without making use of independent knowledge of the truth-conditions of S at C. In the absence of this there is no systematic way to derive the truth-conditions of sentences and the threat posed by radical context-sensitivity remains unaddressed.

In order to be explanatorily rewarding, that is, in order to be able to derive truth-conditions for sentences (at contexts of utterance), TCP needs to generalize in a substantive way over these particular pragmatic functions: it needs to state a rule, or a finite set of rules, which determine for each context the correct pragmatic function. This is somewhat problematic, since selecting the correct pragmatic function, out of a potentially open-ended number of such functions, does not seem to be a matter of following rules, but one of recognizing intentions and of reasoning through inference to the best explanation. In TCP, explaining how a given sentence comes to have the truth-conditions that it has, is partly an intentional explanation: it involves attributing certain intentions and practical concerns to the conversational partners. Then the assignments of truth-conditions that TCP makes are always defeasible, for the simple reason that intentional explanations are always defeasible: they can always be overridden if enough new evidence is adduced to account for the subject's linguistic behavior. In fact, Recanati points out that "a distinguishing characteristic of pragmatic interpretation is its defeasibility, [the fact] there is no limit to the amount of contextual information that can affect the interpretation" (Recanati 2004, 54).

The problem for TCP is not that finding the right pragmatic function is necessarily impossible. The problem is that finding the right pragmatic function is, essentially, an intentional explanation: it requires assigning intentions, beliefs

[24] In fact, this is closer to the organization of TCP that Recanati (2010) and Pagin and Pelletier (2007) work with. It is easy to see that the two ways of organizing TCP are formally equivalent. In the two-step version, the content of an expression $\alpha(e_i,e_j)$ at a context C is determined by a context-specific pragmatic function $mod(\alpha(e_i,e_j),C)$ which takes as argument what is determined by the lexical and syntactic properties:

$\mathbf{I}(\alpha(e_i, e_j), C) = mod\ (\alpha(e_i, e_j), C)(f(\alpha, (\mathbf{I}(e_i, C), \mathbf{I}(e_j, C))$.

Notice that this is formally equivalent with $\mathbf{I}(\alpha(e_i,e_j),C)) = f \circ mod(\alpha(e_i,e_j),C)(\alpha,(\mathbf{I}(e_i,C), \mathbf{I}(e_j,C))$

where $f \circ mod(\alpha(e_i,e_j),C)$ is a complex function obtained by combining the composition function f and the modulation function $mod(\alpha(e_i,e_j),C)$. This corresponds to the way of building TCP where a context-specific meaning operation combines the content of constituents into the content of the complex in one fell swoop.

and practical reasoning to conversational partners, and as such is always defeasible. Thus, we might legitimately doubt that TCP's answer to the skeptic's challenge really provides substantive progress towards a systematic theory. The skeptics told us that some truth-value predictions made by formal theories are bound to be wrong, while TCP tells us that any of its predictions might turn out to be wrong, for any such prediction relies on abductive reasoning.

TCP might try any of the defensive strategies discussed in the previous section, but none of them will work. I'll consider, again, the last of them. TCP might argue that there is no need to specify a procedure that determines, for each context of utterance, the particular pragmatic function that delivers truth-conditions at that context of utterance. Again, TCP might point to analyses of demonstratives which rely on the notion of demonstratum (or of salience), which do not determine what object is demonstrated (or is more salient) at the context of utterance. TCP would claim is that for each context there is a pragmatic function at work, but it is beyond the scope of the theory to determine for each context what that function is. This move is not satisfactory, for TCP will give truth-conditions to (1) of the following form:

> "The leaves are green" is true at a context C iff the objects that the speaker intends to refer to with that utterance of "the leaves" satisfy the property that the speaker intends to predicate about them with that utterance of "are green".

This amounts to saying that (1) is true at C iff the proposition that the speaker intended to express by (1) at C is true at the circumstances determined by C.[25] But this is wholly uninformative and it satisfies the aim of pairing sentences with their truth conditions in an extremely shallow way.

Finally, irrespective of what architecture TCP prefers, if the derivation of truth-conditions essentially involves attributing intentions, beliefs and practical reasoning to conversational partners, it is not at all clear why TCP needs compositionality. Again, compositionality is desirable because it promises to deliver rules which are an effective procedure for calculating the semantic values of complex expressions such that executing the procedure requires no imagination or cleverness, but is a matter of merely following instructions carefully. But, obviously, this is not the case with the attribution intentions and beliefs or the reconstruction of practical reasoning. Letting the composition function take context as an extra argument might not be against the letter of compositionality, but it is against its spirit.

[25] TCP might point out that there are limits on what propositions a sentence can express, because there are limits on how much one can tinker with the meaning of sentences: even if a sentence can express indefinitely many propositions, it can express any proposition. This, though, doesn't make its analysis of (1) more informative.

5 Conclusions

It is fair to conclude that weak compositionality offers no way out from the skeptical challenge concerning the possibility of a systematic semantics of natural languages. True, weak compositionality shows that, formally, there is no incompatibility between radical context-sensitivity and *some* version of compositional interpretation of complex expressions. But this is far from being enough. We're interested in compositionality because of the explanatory benefits it promises to bring. I argued that we have good reasons to doubt that weak-compositionality delivers these benefits, if we accept the existence of radical forms of context-sensitivity.

One such benefit is that compositionality ensures that there are rules by which theories can derive the truth-conditions of natural language sentences from the meaning of simple expressions. But if one is convinced that natural language expressions are radically context-sensitive, then weak compositionality won't help with this. Acceptance of radical context-sensitivity amounts to accepting that there are elements in the content of sentences that are not determined by the lexical and syntactic properties of sentences themselves, but are provided through pragmatic functions. Unless we are given a procedure that matches at the outset each possible context of utterance with its associated pragmatic function, weakly compositional theories can't systematically derive truth-conditions. As yet, no theory has provided such procedure. I suggested, moreover, that for someone who accepts underdetermination, as TCP theorists do, there are good reasons to doubt that such rules or procedures can be given, for they require that the theorist be able to tell ahead of time each and all of the facts that might turn out relevant for the interpretation of a sentence.

Given the central position that weak-compositionality occupies in truth-conditional pragmatics these arguments cast doubt over the viability of the entire project. If weak-compositionality fails to provide the explanatory benefits that we expect from compositionality, it is doubtful that TCP can deliver on its advertising claim, namely doing what formal semantic theories aimed but allegedly failed to do: offer a systematic account of our linguistic competence. This, of course, is not to say that radical contextualists, like Searle (1978) or Travis (1997), are right. A systematic account of natural languages might still be possible. But if one accepts that there are contextual ingredients in the truth-conditions of sentences which are provided through free pragmatic functions (i.e. are not linguistically mandated), weak-compositionality is not going to help in providing such an account.

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