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Propositions and Attitudes

Abstract: Focussing on the semantics of attitude reports, the paper compares two classic approaches to intensionality. The first one, going back to Frege, treats extensional compositionality as the default and employs constituents' intensions whenever their extensions defy substitution. The second one, suggested by Russell, does with one layer of semantic values and seeks to reduce all intensionality to propositional embedding, thus giving rise to the doctrine of propositionalism. Both approaches can be cast in a type-logical framework, whence the Russellian strategy comes out as a restricted version of the Fregean one. Thus, as Montague argued, the choice between them appears to be a matter of empirical coverage, with Partee's puzzle (about rising temperatures) as a principal witness. However, a theorem due to Kaplan reveals that Fregean analysis can be mimicked within the Russellian framework by way of a coding procedure (called *Russelling*). This still leaves open the possibility that the Fregean approach to intensionality is preferable on meta-theoretic grounds like simplicity or cognitive relevance. The decision between the two approaches thus calls for further descriptive and empirical evidence.

Keywords: Intensionality, attitude reports, propositionalism

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There are two quite different approaches to intensionality, even within possible worlds semantics. One, deriving from Frege's (1892) work and recast in set-theoretic terms by Carnap (1947), Kripke (1963), and especially Montague (1970c), treats intensionality as an add-on to extensional semantics, to be invoked whenever substitution problems arise. The other one, going back to Russell's (1905) criticism of Frege's (1892) approach and taken up by Cresswell (1973), Montague (1970b), and some others, identifies embedded clauses as the sole source of intensionality and eliminates it. The following survey compares the two approaches as applied to attitude reports and relates them to the more general identification of content with truth evaluability – aka propositionalism.

The paper is organised as follows. After briefly introducing attitudes and attitude reports [Sec. 1] and the general strategy of characterising intensionality in terms of propositions [Sec. 2], the two approaches to the compositional interpretation of attitude reports (and intensionality in general) are distinguished in terms of two-sorted types [Sec. 3]. Section 4 then turns to a comparison of the two approaches: in 4.1, differences concerning meaning composition, ontology, and cognitive potential are pointed out, to indicate the significance and scope of the debate; [4.2] then addresses Montague's inconclusive attempts to settle it either by reconstructing Fregean senses in propositionalist terms, or by finding counterexamples to the very possibility of such reconstruction; finally [4.3] brings a classic type-theoretic result by Kaplan to the fore, which appears to resolve the matter once and for all. Alas, it does not, which is pointed out in the final section.

1. Attitudes

This article is mostly concerned with the semantics of attitude reports – certain sentences that report about attitudes. In the absence of a generally accepted definition, an **attitude** may be roughly characterized as a relation that a subject bears towards an abstract idea – the attitude *content*.¹

- (1) a pundit **doubting** *that Scholz will be re-elected*
- (2) a student **craving** *a cigarette*
- (3) a child **dreaming of** *a monster*
- (4) a dog **sensing** *that a cat is in the house*
- (5) a thermometer **indicating** *the temperature*

¹ While dropping the qualification 'propositional' so as to not prejudge the main issue, the term 'attitude' as illustrated in (1)–(6) generalises a usage long established in analytic philosophy; see Goddon & Griffin (2009: 177, esp. fn. 7) for its Russellian origins.

(6) a map **showing** *the location of buildings on RUB campus*

(7) a neighbour **telling you** *a story*

Whenever attitudes are mentioned below, the term is to be understood in the widest sense that includes the whole spectrum from (1) to (7) and much more. Typically, an attitude relates to the subject's beliefs or desires, thereby reflecting her internal state and partly accounting for her behaviour. Slightly stretching this parlance, any suitably designed artefact bears a corresponding attitude to the informational content they convey, thus covering cases like (5) and (6). To be sure, core cases like (1) and (2) differ from fringe attitudes like (6) and (7) in many important ways. Yet for the semantic aspects of attitude reports to be addressed in the following sections it will not make a difference if the attitude reported on is core or fringe. That we will mostly deal with the former is motivated by tradition and the desire to avoid unnecessary distraction caused by terminological hardship.²

While an attitude is a relation that holds between subjects and contents, an *attitude report* is a sentence ascribing an attitude to a subject and specifying its content – like (8), which ascribes (or may be used to ascribe) to the person Mary the attitude of belief directed at the proposition that it is raining:

(8) Mary thinks it's raining.

Far from being a random example, (8) is a:

(TAP) *Typical Attitude Report*
 $x \text{ VS}$

where the *attitude verb* V relates the referent of x to the content of the sentence S . According to semantic folklore, a typical attitude report reports on an attitude holding between a subject and a proposition. To the extent that, in the eye of many a semanticist, a *typical attitude* is one that can be reported by a typical attitude report, attitudes are typically propositional.

2. Propositionalism

Replace 'typically' in the previous sentence by 'necessarily' and you have:³

² In particular, the wide perspective taken here is not meant to deny the importance of the distinction between attitudes *about* content vs. those *with* content for a proper understanding of general propositionalism, as emphasized by Grzankowski (2016: 317ff.) and Forbes (2018).

³ The term 'propositionalism' has been introduced as applying to attitude reports by Grame Forbes (2000: 148), explicitly transferred to attitudes by Michelle Montague (2007), and generalised further by Kristina Liefke (2024: 93f.) and myself (cf. *ibid.*: 94, fn. 8), I believe.

(AP) *Attitudinal Propositionalism*

The content of an attitude is always propositional.

The thesis (AP) presupposes a rough understanding of the term ‘attitude’, along the lines of the previous section. To see what it comes down to, we will put it to the test and see how it fares on the examples (1)–(7). Before doing so, however, a word of clarification is in order. The formulation in (AP) is somewhat pedantic in that it requires attitude contents to be propositional rather than being propositions. This is to exclude a stricter version of propositionalism (attitudinal or otherwise) that would miss the point by identifying propositions with sets of indices (worlds, world-time pairs, ...), as is common in possible worlds semantics, where they are meant to capture the objective content of sentences, as opposed to their subjective content, or epistemic value, that puts them into speaker’s (or, more generally: contextual) perspective. What is common to both kinds of contents is that they ultimately determine a truth value and not, say, an individual (like individual concepts) or a set of individuals (like properties); this truth-value-directedness is what is meant by the term ‘propositional’ in (AP), which thus also covers characters, two-dimensional propositions, diagonals, and what have you.⁴

Inspecting the above examples (1)–(7) in order to see what is at stake in (AP), it immediately turns out that some of them obviously confirm the thesis. Both the allegation the pundit is doubting and the story the neighbour is telling you may be true or false, and so is the presence of a cat that the dog is supposed to be sensing: (1), (4), and (7) are typical attitudes towards propositions. Moreover, following Quine’s (1956) lead, a reformulation of (2) reveals that desires for intentional objects may be construed as propositional: what the craving student is after is something that is not yet the case, viz. that she gets hold of a cigarette to do whatever she wants to do with it – smoke, more likely than not, but not necessarily so. In a similar vein, what the child in (3) is dreaming about is that a monster may be present to do whatever the kid fears it could do to him or her – and thus again something that could have been true but is not. Appropriate paraphrases also help to confirm (AP) in the remaining cases: concerning (5), what the thermometer indicates is that the local temperature has a certain value, which may or may not be so; and as to (6), though the information contained in the map may be cumbersome to express in colloquial English, it amounts to something that may or may not be accurate – that building VZ2 is flanked by VZ1 and VZ3, etc. – and thus once again to something propositional.

Attitudinal propositionalism may be, but need not be, derived as a consequence of a much more general thesis, viz.:

⁴ The distinction between objective and subjective content plays a key role in the motivation of two-dimensional semantics and pragmatics. See Kaplan (1989: 529ff.), proposing characters as subjective contents; Stalnaker (1978), promoting diagonals; Lewis (1979), identifying the latter with properties; and Zimmermann (1991: 178ff.), making connections between the three approaches.

(GP) *General Propositionalism*
All content is propositional.

Thesis (GP) is to be understood as covering all types of content over and above attitude objects, among them the content of perceptions, pictures, and stories. General, and particularly attitudinal, propositionalism may be traced back to the work of W. V. O. Quine (1948; 1956; 1960), who was inspired and motivated by Russell's (1905) theory of descriptions.⁵ General propositionalism has considerable theoretical advantages. One of its most attractive features is that it may exploit the common Boolean nature of propositions (or proposition-like objects) to account for relations between and across different types of content (cf. Liefke 2024: 93). As a case in point, the content of a picture may be described in terms of the visual information gleaned by an implicit observer of the depicted scene, which would be hard if perceptual and pictorial content were of a different kind. We may thus have, alongside (AP), perceptual propositionalism, pictorial propositionalism, and, given that stories are told in words:⁶

(LP⁻) *Linguistic Propositionalism* [to be revised]
All linguistic content is propositional.

In fact, it is again Russell (1905) who may count as the originator of linguistic propositionalism, properly understood. The formulation (AP⁻) gives rise to a reading that identifies contents with Fregean senses or Carnapian intensions. However, in compositional semantics, the propositions expressed by sentences are derived by combining the intensions of their parts, not all of which are themselves propositional. At first blush, then, (LP⁻) appears to be incompatible with standard compositional semantics. But then a more cautious wording, and one still in the spirit of Russell (1905), distinguishes between compositional contributions and *full contents*, restricting linguistic propositionalism to the latter. We will return to this in Section 3.1.

3. Attitude reports

There are two classic approaches to the compositional semantics of attitude reports. The first is the one taken by Frege (1892), treating attitude reports (and other intensional constructions) as exceptions to extensional compositionality. Though it has undergone dramatic modifications

⁵ Cf. Grzankowski (2015: 377), M. Montague (2007: 506f.), and probably others. On account of this close connection to his work and in view of his semantic approach to attitude reports (see below), it is natural to attribute (GP) to Bertrand Russell, as I did in my Bochum talk. However, in view of Russell's shifty views on propositions (cf. Godden & Griffin 2009), which only partly overlap with current semantic accounts, the historical truth on the origins of propositionalism is considerably more complex than I suggested there.

⁶ Liefke (2024: 93f.) gives a more detailed survey. For discussions of perceptual and pictorial propositionalism see Crane (2009) and Zimmermann (2016), respectively.

and transformations over the years, its basic architecture can still be detected in most textbooks and other publications on formal semantics. Modern versions of the rivalling approach, which goes back to Russell's (1905) criticism of Frege's distinction between *Sinn* and *Bedeutung*, have even moved further away from its origin, but still manage to keep its spirit and its core tenets. And though it appears to be slightly less popular with modern semanticists, it has found support from quite a number of prominent researchers. In the following two subsections I will briefly introduce the two approaches, concentrating on typical attitude reports like (8), making many simplifications and glossing over a lot of details.

3.1 ... à la Frege

One of the core features of Fregean semantics is that, even though meanings largely coincide with intensions, meaning composition largely consists in combining extensions.⁷ The first 'largely' is due to matters of context dependence, which will be ignored throughout this paper. The second 'largely' concerns grammatical environments (or 'constructions') that present extensional substitution problems. If replacing a constituent with a co-extensional one can affect the extension of the hosting expression, the position in which they occur is an exception to extensional compositionality in that their host's extension needs to be determined in terms of said constituents' intensions, rather than their extensions:

(C_F) *Fregean Compositionality*

- A. If possible, mother extensions are obtained by (suitably) combining daughter extensions:

$$\text{ext}(X + Y) = \text{ext}(X) \oplus \text{ext}(Y)$$

- B. Otherwise – in *intensional* environments – intensions are called in:

$$\text{ext}(X + Y) = \text{ext}(X) \oplus \text{int}(Y)$$

Here '+' stands for any combination of two expressions on the relevant syntactic level, and '⊕' for the corresponding compositional effect. Though (C_F) suffers from some simplifications, it will suffice for our purposes.⁸

In principle, any kind of syntactic environment might turn out to be sensitive to extensional substitution, whereby in principle, any kind of expression may have to contribute its intension

⁷ As has become customary since at least Montague (1970a), I conflate Frege's (1892) and Carnap's (1947) distinctions between semantic values. See, however, Zimmermann (2022b) for some subtle differences concerning their role in compositional semantics.

⁸ Binarity may be one simplification, and the location of the intensional environment in the right daughter certainly is. Both defects are readily removed; see Zimmermann (2018: 86) for a more general definition of intensional environments. A more delicate point is whether (C_F) actually is what Frege (1892) had in mind, as is usually assumed, e.g., by Montague (1970a: 75f.). See T. Parsons (1981) and Kripke (2008) for pertinent discussion.

to the extension of its mother constituent. The difference between the two cases in (C_F) can be brought out by assigning functional types to the compositional contributions of the constituents. Using Montague's (1970b: 379) by now standard notation for two-sorted types (in the sense of Gallin 1975: 58ff.), we thus obtain:

- (T_F) *Fregean types*
 t and e are Fregean types;
 if *a* and *b* are Fregean types, so is (*ab*);
 and if *c* is a Fregean type, so is (*sc*).

Attitude reports like (8) are the prime examples for clause B of (C_F) . While their subject and predicate conform to extensional compositionality A, the predicate's constituents do not:

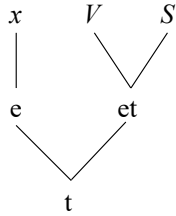
- (AR_F) *Attitude reports: Fregean strategy*
 A. *Predication*

$$\text{ext}([x [V S]]) = \text{ext}([V S])(\text{ext}(x))$$

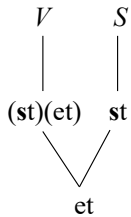
 B. *Clausal complementation*

$$\text{ext}([V S]) = \text{ext}(V)(\text{int}(S))$$

- (9) A. *Predication*



- B. *Clausal Complementation*

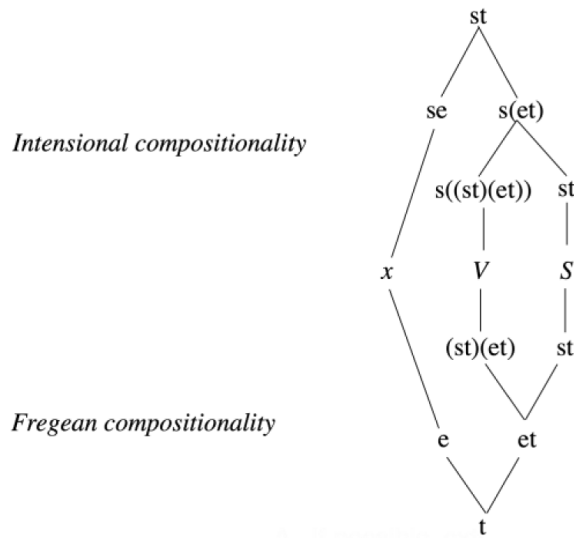


In (9)B, there are two places where intensions enter (marked by boldface **s**, for dramatic effect): following clause B of (AR_F) , the contribution of the complement clause must change its type from *t* to *st*; and in order to interpret the construction by functional application, the type of the sister node needs to be adapted accordingly. While the second step is not strictly necessary for the Fregean architecture (see below), the first step is, creating the subsequent problem of deriving the *intension* of the embedded clause in a compositional manner. The general strategy (C_F) does

not seem to be of any help; for it only concerns the compositional derivation of extensions. It would thus seem that (C_F) reduces Fregean compositionality to intensional compositionality in that the latter is required to spell out the former. Given that the complement clause may itself be of the form (TAP), as illustrated in (10), the full picture of Frege's account of attitude reports turns out to be more complex than (9)B:

(10) John says Mary thinks it's raining.

(CC_F) Clausal complementation: extension and intension



Like (9)B, the lower half of (CC_F) follows the general Fregean strategy (C_F) : extensions of mothers are obtained by combining extensions or intensions of daughters, depending on whether the latter constitute intensional environments. The upper half shows the types of the intensions of all constituents, which are taken to combine compositionally: if meanings behave compositionally, then so must the compositional contributions of complement clauses, i.e., their intensions. Whatever the details of their compositional interaction, for a fully compositional account of meaning, Fregean compositionality needs to be augmented by intensional compositionality:⁹ whenever a clause occurs in an intensional environment, its intension needs to be determined by combining the intensions of its constituents. However, although the intension the complement clause contributes to the extension of the predicate

9 In two-dimensional frameworks, intensional compositionality boils down to a prohibition of monsters (Kaplan 1989: 510). In possible worlds semantics, Fregean compositionality implies intensional compositionality, though not vice versa; see Zimmermann & Sternefeld (2013: 197) and Zimmermann (2018: 282, fn. 8) for pertinent examples. Trading intensions for Fregean senses, intensional compositionality is frequently taken as obvious (e.g. in Kripke 2008: 197, fn. 44), but it is logically independent of Fregean compositionality; cf. Zimmermann (2022b: 167).

is propositional, the intensions of its constituents need not be. The subject of (8) is a case in point: the name *Mary* can hardly be said to have a content that is true or false. This is why care must be taken in formulating linguistic propositionalism. For if linguistic content is meant to cover all intensions, (LP⁻) is a non-starter for the Fregean: given that non-propositional intensions are ubiquitous in intensional compositionality, linguistic propositionalism would be crazy to ban them. Instead, the thesis should be restricted to the contents of expressions that are immediately contributed to the extension of their hosting expressions – in other words the *full* contents of expressions that stand in intensional environments. In attitude reports analyzed along Fregean lines (9)B, the proper contents are the intensions of the embedded clauses, but not those of their constituents. From a Fregean point of view we should thus reformulate (LP⁻):

- (LP) *Linguistic Propositionalism* [revised]
All full intensions are propositional.

Note that the formulation (LP) is compatible with the Fregean approach (C_F)B to intensionality. But it is neither part of this approach nor required by it. In fact, it goes somewhat against its spirit, given that intensional environments *per se*, i.e., those that call for full intensions, need not be clausal embeddings. On the contrary, if all full intensions are propositional, Frege's two-layered architecture turns out to be dispensable. For then attitude reports (and intensional constructions in general) could be analyzed ...

3.2 ... along Russellian lines

Unlike Frege's (1892) *intensionalist* approach,¹⁰ Russell's (1905) can do with one layer of semantic values, which I will refer to as *den[otation]*. Instead of (C_F) and (AP_F) we have:

- (C_R) *Russellian compositionality*
Mother denotations are obtained by (suitably) combining daughter denotations:
 $den(X + Y) = den(X) \oplus den(Y)$
- (AP_R) *Attitude reports: Russellian strategy*
- A. *Predication*
 $den([x [V S]]) = den([V S])(den(x))$
 - B. *Clausal complementation*
 $den([V S]) = den(V)(den(S))$

¹⁰ The term goes back to Larson (2002).

The attribute ‘Russellian’ in (C_R) and (AP_R) ought to be taken with a grain of salt: Russell (1905) insisted on the essentially syncategorematic – and thus arguably: non-compositional – nature of quantifiers, including definite descriptions. Somewhat ironically, though, by treating contributions to propositions as functions, Russell’s approach can be given a compositional reformulation, attributing which to Russell I feel is less misleading than denying the connection in view of its alleged lack of syncategorematicity.¹¹

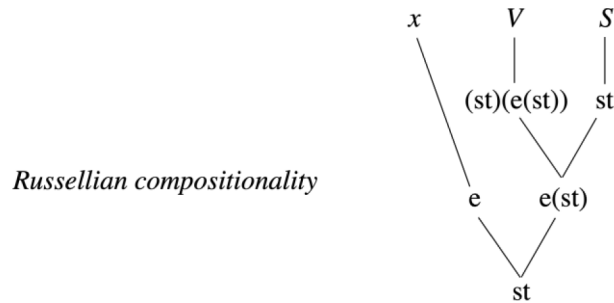
In (AP_R) , the denotation of a referential nominal coincides with its referent, and thus with its Fregean extension: $den(x) = ext(x)$; whereas the denotation of a sentence is the proposition it expresses, and thus its Fregean intension: $den(S) = int(S)$. The denotations of all other constituents are their compositional contributions to the denotations of the expression in which they occur, which can be constructed as functions, starting with the ground types of referents and propositions. We thus obtain the following characterization of the types of Russellian denotations:

- (T_R) *Russellian types*
 st and e are Russellian types;
 if a and b are Russellian types, so is (ab) .

As a consequence, the only Russellian type of the form (sa) is the type (st) of propositions, which are thus the only intensions admitted by (T_R) . Russellian denotations, then, trivially satisfy (LP) .

In analogy with Frege’s strategy $(C_F)A$ applied to denotations in lieu of extensions, the Russellian denotations of the predicate $V+S$ and the attitude verb V can then be constructed as their compositional contributions: the former assigns the proposition expressed by the report to the denotation of the subject (the attitude bearer); while the latter assigns the predicate denotation to the proposition expressed by the complement clause. Denotations being the only game in town, no B-clause as in (C_F) is needed, whereby a far less complex picture of the compositionality of attitude reports than the Fregean (CC_F) emerges:

- (CC_R) *Clausal complementation: denotation*



¹¹ Even more eclectically, ever since Montague (1970c), it has become quite common in formal semantics to reformulate Russell’s theory of descriptions within a two-layered Fregean framework.

By the very construction of the functional contributions of the verbal constituents, meaning composition in attitude reports proceeds exclusively by functional application, as (C_R) would have it.

4. Frege vs. Russell

The fact that the Russellian strategy can do with one layer of semantic values (denotation) and one compositional operation (application) suggests that it is superior to the Fregean approach with its extensions and intensions and the distinction between the two cases in (C_F) . However, a closer comparison of the two overall frameworks reveals that things are not so simple.

4.1 Differences

The most obvious difference between the Fregean and the Russellian approach to attitude reports is purely cosmetic: while both give a compositional account of the proposition expressed by a report, (CC_F) also derives its truth value. However, sense determines reference,¹² and thus propositions truth values; the latter are therefore, if not present, then at least implicit in the Russellian analysis. Indeed, given that propositions are both intensions and denotations of sentences, one might expect intensional and denotational compositionality to proceed along parallel lines. This expectation is borne out by the types in (CC_R) and the upper half of (CC_F) , tabularly presented in (Tab1), for easier comparison:

Table 1: Types in attitude reports

Constituent	intension	denotation
Subject (x)	se	e
Attitude verb (V)	$s((st)(et))$	$(st)(e(st))$
Sentence/clause (S)	st	st
Predicate ($V S$)	$s(et)$	$e(st)$
Sentence ($x V S$)	st	st

The types of main and embedded clauses are the same on both accounts; of the remaining types, two are pairwise isomorphic, differing only in the order of their arguments: the predicate intension is a binary relation between worlds and individuals, and the denotation is its converse; in the same vein, the intensions of attitude verbs can be construed as ternary relations between worlds, propositions, and individuals, and their denotations are also converses, taking the world

¹² As pointed out in Textor (2011: 33), this slogan is ‘frequently attributed to Frege’ and ‘central to Frege’s theory’ but apparently apocryphal.

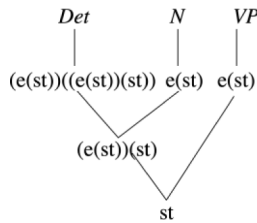
argument last instead of first.¹³ So the only substantive difference is in the referential subject, where again, it would seem, all advantages lie with the Russellian denotations (individuals), given that they are less complex than Fregean intensions (individual concepts).

However, appearances are deceiving. Both the near parallelism between intensional and denotational compositionality and the slight complexity advantage of the latter are due to idiosyncrasies of the construction. In fact, if directly referential subjects like personal pronouns or proper names give way to definite descriptions as in (12), they will contribute more to propositional content than their referent and thus require a more complex denotation types than plain e . However, rather than having them contribute their Fregean intension, whose type (se) is beyond the hierarchy (T_R), Russell proposed to assimilate them to quantificational nominals as in (11), which combine with predicate denotations of type $e(st)$.¹⁴ By the same token, assuming predicative denotations of type $e(st)$ for their restrictors, the definite article comes out as patterning with quantificational determiners in that it relates two predicate contents. So the composition of denotations in (11) and (12) runs parallel, viz., as indicated in (13):

(11) Every meteorologist thinks it's raining.

(12) The boss thinks it's raining.

(13) *Denotations of quantifying subjects*



Quantification being extensional, the Fregean analysis, by comparison, proceeds by combining extensions corresponding to $(C_p)A$. The resulting intensional types turn out to be considerably less complex, as can be gleaned from (Tab2):

The Fregean column in (Tab2) concerns intensions, while compositionality is explained in terms of even less complex extensions, which however only deliver truth values, not propositions. As a result, the compositional interaction of intensions is somewhat more involved than the compositionality of denotations by functional application.¹⁵ At the end of the day, then, Russellian

¹³ Of course, all this presupposes a construal of Boolean types (= those ending in t) as Schönfinkeled relations.

¹⁴ I deliberately ignore a host of largely orthogonal issues making up the Frege-Russell debate, and in particular Russell's motivation concerning empty descriptions.

¹⁵ As pointed out in Zimmermann (2022b), the reduction of intensional to extensional compositionality only works for Carnap's (1947) intensions, not for Frege's senses.

Table 2: Types in definites and quantifying nominals

Constituent	intension	denotation
Definite article	$s((et)e)$	$(e(st))((e(st))(st))$
Definite description	se	$(e(st))(st)$
Quantifying determiner	$s((et)((et)t))$	$(e(st))((e(st))(st))$
Quantifying nominal	$s((et)t)$	$(e(st))(st)$

denotations are considerably more complex than even Fregean intensions. So one difference between the two approaches lies in the location of complexity in meaning composition:

(I) *Complexity in meaning composition*

Where the Fregean strategy has relatively simple semantic values interacting in a (possibly) complex way, the Russellian approach has (possibly) complex semantic values interacting in a simple way.

Underlying difference (I) there are the two approaches to intensionality – Fregean compositionality (C_F) vs. linguistic propositionalism (LP), which in turn are reflected in two different type hierarchies, viz., Fregean extensions and intensions (T_F) vs. Russellian denotation (T_R). Obviously, the latter are more restrictive, leaving out all types in which an ‘s’ does not occur immediately before a ‘t’. In particular:

(II) *Iterated intensionality*

The Fregean types include a hierarchy of indirect senses – types sa , $s(sa)$, $s(s(sa))$, etc., for any Fregean type a , whereas the Russellian approach does not even allow for propositional concepts of type $s(st)$.

Appearances to the contrary notwithstanding, the mere assumption of a hierarchy of ever more complex, not necessarily humanly graspable indirect senses strikes me as no more problematic than, say, the hierarchy of first-order; second-order; third-order; etc. properties whose types $(e(st))$; $(e(st))(st)$; $((e(st))(st))(st)$; etc. are all Russellian. On the other hand, since propositional concepts have proved to be useful both in semantics (Groenendijk & Stokhof 1982) and pragmatics (Stalnaker 1978), their exclusion may necessitate work-arounds that could be avoided by liberalising (T_R).

While (I) and (II) focus on the role of semantic values within compositional semantics, more fundamental differences between the two frameworks under scrutiny emerge once their impact outside semantic theory is considered, and particularly how they relate to cognitive aspects of informational content.¹⁶ As pointed out above, the Russellian type hierarchy (T_R) gives rise to

¹⁶ See Zimmermann (2012) for more about the external and internal roles of semantic values.

linguistic propositionalism, given that the only intensions it hosts are propositions. The Fregean hierarchy (T_p), on the other hand, allows for informational content that is not capable of being true or false but serves as a way of presenting objects other than truth values (Frege 1892: 26). To be sure, the hierarchy as such is compatible with linguistic propositionalism; after all, not all types need to be instantiated by extensions (or intensions) of a given language – or any language, for that matter, and it so it might happen that only Russellian types are. If so, however, there would be no obvious explanation of this gap – short of resorting to a Russellian framework.¹⁷ Hence, while the Russellian approach implies linguistic propositionalism, the Fregean approach leans towards its contrary and instead suggests a different cognitively relevant connection that is rarely explicitly addressed (as far as I am aware) but nonetheless rather obvious: that there are two kinds of meaning composition. For at the heart of Fregean compositionality, there is a fundamental distinction between those operations and values that concern reference and truth values and those that concern informational content. In fact, semantics textbooks within the (broadly) Fregean tradition usually start with the extensional compositionality of predication, quantification, and Boolean connectives before moving on to attitude reports and other intensional constructions, thereby presenting extensional compositionality as easier to grasp than the intricacies of intensionality and logical space. Indeed, there is something to be said for a complexity gap between extensional and intensional semantics: the former requires fewer types and operations, and a large part of intensional compositionality is defined in terms of a canonical reduction to extensional semantics. However, whether the complexity gap is merely a matter of theory-internal representation or whether it reflects a cognitively relevant difference is up to empirical research.¹⁸ For the record, we may add the following difference in (admittedly speculative) theory-external repercussions:

(III) *Intensionality and cognition*

The two Fregean layers are based on a possibly cognitively relevant distinction between extensional and intensional semantic operations; the domain of Russellian denotations naturally gives rise to linguistic propositionalism.

Just like the Fregean approach is compatible with propositionalism, nothing in the Russellian set-up militates against the thesis that operations involving intensions are more complex than purely extensional ones. On the surface, this would appear to be an almost baseless and unsupported assumption. It would be nigh baseless because there are no compositional operations on intensions other than propositions so that said thesis would collapse into a claim about clausal embedding – and one that is unmotivated in the Russellian one-layered framework: propositions are compositionally ubiquitous (even underlying all Boolean operations), and the only totally extensional types (those without any *s*) are the simple ones (= those containing *e* as the only

¹⁷ See Larson (2002: 258ff.) for similar worries concerning a stronger version of linguistic propositionalism.

¹⁸ See, e.g., Pyllkänen *et al.* (2011) for a pertinent perspective on cognition and compositionality, and Pyllkänen (2019) for a critical and somewhat pessimistic outlook.

basic type).¹⁹ A more promising way of defining intensionality in a Russellian environment is to apply it to the image of van Benthem's (1995: 156ff.) strategy of intensionalization that replaces all *t* occurring in extensional types by (*st*); but then this procedure would be little more than an infiltration of the Russellian framework with Fregean types in disguise.

The observations (I)–(III) all rest on the difference between the two type hierarchies (T_F) and (T_R). Since the former (Fregean) includes the latter (Russellian), the question arises as to whether, or to what extent, compositional semantics could do without the additional types offered by (T_F):

(PQ[−]) *Propositionalist question* [to be revised]

Can compositional semantics be based on Russellian types?

Long after the historic debate between Frege and Russell, the question had (apparently independently) bothered two pioneers of modern semantics: Richard Montague and David Kaplan. While the former gave more than one answer, the latter seemed to have settled it by type-logical reasoning. Both angles will be addressed in the following two sections.

4.2 Montague

Among the three fragments of English described in Montague's classic papers, the one in his *English as a formal language* (= Montague 1970b, aka *EFL*) stands out for at least two reasons: unlike the other two (Montague 1970c; 1973), its interpretation is not presented by way of a compositional translation into type logic but directly defined by a recursive specification of (model-dependent) semantic values; and these values are (assignment-dependent) Russellian denotations, not (assignment-dependent) intensions, as in the other two papers. Montague comments the latter decision by:

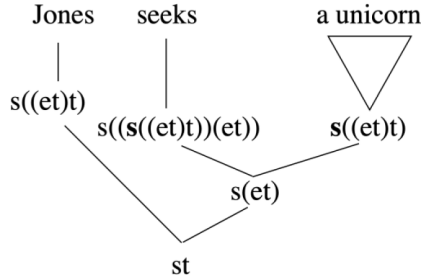
Montague's first answer

It is wrong to maintain – as Frege possibly did in Frege (1892) – that an analysis of ordinary English (or German) requires a notion of intension as well as one of extension. The fact that we have been able to do with denotation alone depends on two novelties of our treatment – Russell's theory of descriptions [...] and his decision to regard sentences as denoting propositions rather than truth values.²⁰

Indeed, the types of the non-Russellian intensions invoked in celebrated analyses in the Fregean tradition turn out to be isomorphic to Russellian types. The surface-compositional treatment of intensional transitives is a case in point:

¹⁹ Mostly for the sake of formal elegance and simplicity, some reconstructions of the Russellian types include *t* (as basic) and thus all totally extensional types, though; we will see an example in Section 4.3.

²⁰ This is a slightly edited quotation from Montague (1970b: 218f.). In the original, Montague translated Frege's (1892) *Sinn* and *Bedeutung* as *sense* and *denotation* and claimed Russell's theory of descriptions for himself.

(14) *Intensional transitives, Montagovian style*

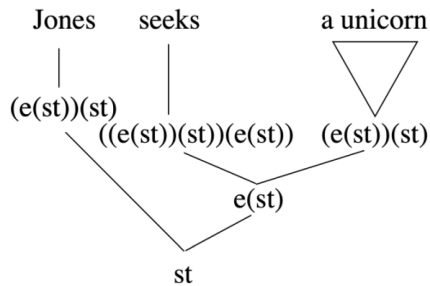
The types in (14) are essentially those of the intensions assigned to the constituents according to Montague (1973), apart from a simplification to which we will get in due course. The boldface **s** is meant to highlight the intensionality of the construction: the *extension* of the verb (obtained by applying the intension to a given index) takes the *intension* of the object as its argument. The subject is a proper name and might thus have an intension of type *se*, as in (Tab1), but has instead been Montague-lifted to the worst case of a quantifier. Obviously, none of the types in (14) is Russellian but then none of them is far from being so either. For the Russellian denotations of nominal quantifiers *Q* – like subject and object in (14) – are of type $(e(st))(st)$ and can be obtained from *Q*'s intensions of type $s((et)t)$, as in (15):²¹

$$(15) \quad den(Q)(F)(i) = int(Q)(i)(\lambda x. F(x)(i)),$$

where *i* and *F* are objects of type *s* and $e(st)$, and 'x' ranges over individuals. Using (15) as a guideline, the intension of the verb *V* in (14) can be recast in Russellian terms too:

$$(16) \quad den(V)(O)(x)(i) = 1 \text{ iff for some } Q \text{ of type } s((et)t): \\ int(V)(i)(Q)(x) = 1 \text{ and } O = [\lambda F. \lambda k. Q(i)(\lambda x. F(x)(i))],$$

where *O*, *x*, and *i* are of type $(e(st))(st)$, *e*, and *s*, and 'F' ranges over objects of type $e(st)$. On the basis of (15) and (16), an alternative to (14) emerges that meets both the Russellian compositionality standards (C_R) and the type restrictions (T_R):

(17) *Intensional transitives, Russellian style*

²¹ I am indebted to Edgar Onea for spotting and fixing an error in an earlier formulation of (15) and (16).

As a tedious but straightforward calculation reveals, the denotations determined according to (15) and (16) and combined as in (17) add up to the same proposition as do the intensions in (14). More importantly, this equivalence is independent of the specific lexical material and also applies to quantificational subjects, referential objects, as well as other intensional transitives, including type-shifted extensional ones. In other words, Montague's intensionalist interpretation of intensional transitives can be mimicked within the Russellian, propositionalist framework. Though this particular construction is not part of Montague's (1970b) fragment of English on which the above quotation comments, it is not unlikely that it is included in 'the larger portions of English' and 'wider extensions' that do not require that 'one abandon the essential features of the treatment above' alluded to a couple of pages later.²² Nevertheless, in his next publication, Montague backpedalled from *Yes, we can* to *Maybe not*:

Montague's second answer

I should like, however, to withdraw my emphasis [...] on the possibility of doing without a distinction between intension and extension.²³

Speculating about the reasons for this change of mind, I think it may have to do with a phenomenon that was not addressed before Montague (1973: 239), where it was characterised 'as an interesting puzzle due to Barbara Hall Partee involving a kind of intensionality not previously observed by philosophers', viz. the invalidity of the inference from (18)a. and (18)b. to (18)c., aka *Partee's Paradox*:

- (18) a. The temperature is ninety.
- b. The temperature rises.
- c. Ninety rises.

It is not the intensionality of the subject position as such that creates the difficulty here. For, in line with Montague (1973: 222), the invalidity of the following inference can be explained in terms of the same kind of intensionality as in (14):

- (19) a. The unicorns are the centaurs.
- b. The five-legged unicorn appears to have returned.
- c. The five-legged centaur appears to have returned.

The first two premisses of (19) may well be true even in an actual situation, and thus in the absence of any unicorns or centaurs. The difference between the two types of intensionality lies in the scope of the determiner: the fact that its existential impact is annihilated in (19)b. and

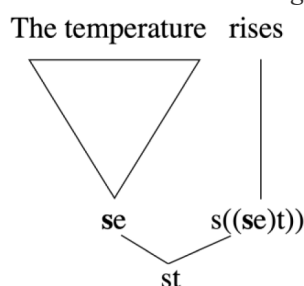
²² Montague (1970b: 221, remark #10). One reason why intensional transitives would have played a role in the extensions of the *EFL* fragment is that their intensionalist treatment had already been indicated in Montague (1969: 177) and was probably developed around the same time; however, I understand from Ivano Caponigro's (pc) report that the philological evidence is far from conclusive.

²³ Montague (1970a: 347, fn.), again terminologically adapted to avoid confusion.

c. (but not in (18)b. or c.) indicates that it is outscoped by *appear*. And indeed, this is what an analysis along the lines of (14) would come down to; see Zimmermann (2022a: 176ff.) for some details. Moreover, Partee's Paradox is not confined to subjects and can also be observed with the object position of, say, *raise*.

On the face of it, (18)a. looks like an equation and (18)b. appears to be a predication. According to logical folklore, (i) equations state the identity of the referents of their terms and (ii) predications attribute properties to them. In the case of (18), however, this cannot be; for otherwise the weird conclusion (18)c. would go through. Hence one assumption about the semantic status of the premises has to give. Montague opted for (ii) and analysed (18)b. as an attribution of a property to what might be called the *core intension* of the subject, which in the case of a definite description coincides with its referent as it depends on the subject – a function of the prototypical non-Russellian type *se*.²⁴ Hence the extension of *rise* – and by generalising to the worst case: of any verb – gets assigned type *s((se)t)*, which is also non-Russellian. This leaves open the possibility to get outscoped by the *extension* of the subject DP – which is what happens both in (18), where uniqueness applies to the core intension, and with other quantifiers. Rather than going into these interesting details, let us merely note that the main difference between Partee's Paradox and other types of intensionality consists in the appeal to non-Russellian types for its solution, which according to Montague (1973) looks as follows:²⁵

(20) *Partee's Paradox: Montague's solution*



4.3 Russelling

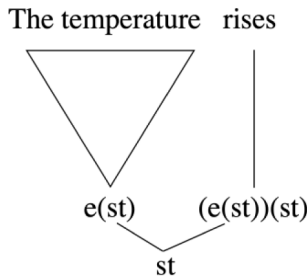
Though the intension types of the immediate constituents in (20) are not even up to isomorphism Russellian, they both naturally embed into the propositionalist type hierarchy (T_R): being functions from indices to individuals, individual concepts may be Schönfinkeled, whence any

²⁴ The term alludes to Löbner's (1979: 20) *Kernintensionalität* ['core intensionality'].

²⁵ ... again ignoring the Montague lifting of the subject, which needs to apply after Fregean intensionalisation. Montague's (1973) solution has not remained uncontested. Most famously, Anil Gupta had found a bug reported in the textbook by Dowty *et al.* (1981: 284f.). See Janssen (1984), Löbner (2021) and Hansen (2016) for more on this. The topic is also addressed in some of the literature on concealed questions; cf. Romero (2006). In any case, as far as I know, the non-Russellian aspects of Partee's Paradox never came under attack.

object f of type se is represented by its *graph* f^* of type $s(et)$: $f^* = \lambda y. \lambda w. \vdash f(w) = y \rightarrow$.²⁶ Keeping the spirit of this representation, the extension of the predicate in (20) can then be rendered by (the characteristic function of) the set of all graphs f^* of its members f . As a result, we arrive at the following Russellian alternative to (20):

(21) *Partee's Paradox: Russellian solution*



In an obvious sense, (20) and (21) are equivalent: they agree on the proposition expressed by the sentence, of which both give a compositional account in terms of contributions that stand in a one-one correspondence to the constituents' intensions. The disagreement between them only concerns the specifics of these contributions, which might seem purely theory-internal. Whether they really are depends on how semantic theory is supposed to relate to other modules of grammar and cognition (Zimmermann 2012). According to a narrow view of semantics as accounting for the truth conditions of sentences *and nothing more*, there is no substantial disagreement between (20) and (21). However, on a wider understanding, the two accounts might be argued to disagree on the ontology underlying the object language. Applying Quine's (1948) ontological criterion, the decision is whether quantification over the subject position of *rise* commits speakers to individual concepts or to their graphs. The difference seems negligible or even illusory, thus confirming the impression that (20) and (21) do come down to the same thing.

Reformulations like (17) and (21) are far from being anecdotal. In fact, David Kaplan showed that all of the Fregean type hierarchy can be recast in propositionalist terms by recourse to a type-logical technique that has come to be known as *Russelling*.²⁷

Concepts of entities of type (s,a) can be represented by functions from (possible) entities of type a to propositions. [...] The result of applying this reduction to entities of successively higher intensional types is that we can ultimately represent all of the entities of the [Fregean type hierarchy] within the sub-ontology whose types are just e , t , st , and (ab)

²⁶ Cf. Liefke (2024: 102). 'w' and 'y' range over objects of types s and e and '...' denotes the truth value of the statement '...'. The converse $\lambda w. \lambda y. \vdash f(w) = y \rightarrow$ would work just as well, but the Russellian version is more suited for current purposes, apart from being more widespread (if for independent reasons).

²⁷ Kaplan (1975: 728f.), notation adapted; the term alludes to the title of the paper. Both accounts include a type of truth values as Russellian.

for any types a and b which are already included. In this development, the only basic intensional entities that remain are the propositions.

Kaplan's proof remains unpublished but was recapitulated by Charles Parsons (1982: 316ff.). At its heart is the type shift indicated in the above quotation; each Fregean type a as defined in (T_F) gets assigned a Russellian type a^+ from the sub-hierarchy in (T_R) , as follows:

$$\begin{aligned}
 (TS_K) \quad & \text{Kaplan's shift} \\
 & t^+ = t; \\
 & e^+ = e; \\
 & (ab)^+ = \begin{cases} (st) & \text{if } (ab) = (st); \\ (a^+b^+) & \text{if } a \neq s; \\ (b^+(st)) & \text{if } a = s \text{ and } b \neq t. \end{cases}
 \end{aligned}$$

The shift can be interpreted by type-wise embeddings, which however cannot be defined in purely logical terms. For the purposes at hand, this is excusable, since only intension types of the form (sb) need to be considered, for which $(sb)^+$ does contain logical embeddings. The appendix presents a somewhat better-behaved (but also slightly more complex) alternative to (TS_K) , which comes with a fully definable family of embeddings.

5. Conclusion

By type-shifting non-Russellian intensions, then, any Fregean analysis can be transformed into an equivalent Russellian one. Thus Kaplan's theorem seems to justify Montague's first answer to the propositionalism question. However, all this Russelling comes with a price: the types arrived at by applying the shift in (TS_K) are at least as complex as those of their Fregean input. In fact, the above comparisons showed that they are often much more complex.²⁸ Russelling may thus be seen as an instance of generalizing to the worst case, obtaining (type) complexity sacrificing Fregean simplicity on the altar of Russellian uniformity. While this may be a legitimate aim, it can hardly serve as a motivation for, let alone a justification of, propositionalism: nominal quantification, intensional transitives, Partee's Paradox, etc. can all be dealt with in Russellian terms, but they come out as redundant reformulations of the Fregean originals. It thus seems that the propositionalist question was not well put. Indeed, Montague's later withdrawal appears to have addressed a slightly different and arguably more relevant question:

²⁸ Here 'complexity' is used in the naïve sense relating to the number of letters in a type. But then more sophisticated and generally accepted measures – like Weicker's (2019: 42ff.) – confirm this impression. As Edgar Onea pointed out to me, Kaplan's shift sometimes leads to unnecessarily complex results, as in the case of individual properties $(s(et))$, where it produces the second-order properties $((et)(st))$ rather than the straightforward converses $(e(st))$.

(PQ) *Propositionalist question* [revised]

Should compositional semantics be based on Russellian types?

Just like Russelling to the worst case indicates a positive answer to the original question, a lowest type perspective points in the opposite direction when it comes to answering the updated version. Any semantic analysis involving non-Russellian types that requires heavy type lifting to fit into the propositionalist framework, adds *prima facie* plausibility to the Fregean intensionalist account. In this connection Montague's solution to Partee's Paradox is of particular interest because it requires type complexity that is not solely due to the reorganisation of index-dependence – moving *s* to the far right. But apart from doubts as to the adequacy of that approach, it remains to be seen whether there are any comparably demanding cases.

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Appendix

Russelling: 2 Approaches

Kaplan's type shift (TS_K) can be used to represent (or 'code') all objects of the Fregean types (T_F) by objects of Russellian types in (T_R). As is obvious from (TS_K), the latter are more inclusive than the Russellian hierarchy (T_R) in that they cover all extensional (= *s*-free) types. For the present purpose, we will therefore extend the Russellian types:

(T_R^+) *Enhanced Russellian types*

st, *e* and *t* are Russellian types;

if *a* and *b* are Russellian types, so is (*ab*).

The following alternative is slightly more complicated but has certain advantages to be addressed in due course.²⁹

$$\begin{aligned}
 (\text{TS}_a) \quad & \text{Alternative shift} \\
 & t^* = t; \\
 & e^* = e; \\
 & (ab)^* = \begin{cases} (a^*b^*) & \text{if } a = a^* \text{ or } b^* \text{ is Boolean (or both);} \\ (a^*(b^*t)) & \text{otherwise;} \end{cases} \\
 & (st)^* = (st); \\
 & (s(ab))^* = (a^*(sb)^*); \\
 & (s(sb))^* = ((sb)^*(st)).
 \end{aligned}$$

The shift (TS_a) can be interpreted by closed terms κ_a of two-sorted type theory that denote one-one functions of type (aa^*) . As a case in point, if $a = (bc)$, where $b = b^*$, κ_a is the term $(\lambda f(\lambda x \kappa_c(f(x))))$, where ' f ' and ' x ' are variables of types a and b . The (messy) details of the construction as well as selected proofs will be provided on request by email to the author.

No such family of type-logical terms can be supplied for Kaplan's shift (TS_K) . This can be shown by using standard model-theoretic techniques, associating each Fregean type a with a domain D_a based on arbitrary non-empty ground domains D_e and D_s . Here are the pertinent definitions:³⁰

(22) *Definitions*

A *permutation* is a family of bijections $\pi_a \in D_{aa}$ such that, for any types a and b and any $f \in D_{ab}$: $\pi_{ab}(f) = \{(\pi_a(x), \pi_b(y)) \mid f(x) = y\}$.
 If a is a type and $x \in D_a$, x is *a-invariant* iff $\pi_a(x) = x$, for any permutation π . a is *logical* iff any domain D_a contains at least one *a-invariant* object. If a and b are types, a is *embeddable into b* iff for any D_a and D_b (based on the same ground domains) there is an *ab-invariant* one-one function.

The idea is that permutations only mess around with the identity of the individuals and worlds but preserve the functional or 'logical structure' imposed by the type hierarchy. Even if we stay agnostic as to the precise relation between invariance and logicity (in a pre-theoretic sense), we have to acknowledge the fact that there is a connection with type-logical definability:

²⁹ In (TS_a) , ' a ' and ' b ' are meant to range over Fregean types only; in particular, $a \neq s \neq b$. Applied to a type, 'Boolean' means that its rightmost letter (ignoring parentheses) is a 't'. – The shift was developed in cooperation with Kristina Liefke; the comparison with (TS_K) reported below is my own contribution.

³⁰ The notions pertaining to invariance can be traced back to Lindenbaum & Tarski (1936); see van Benthem (1989: 317ff.) for a formulation in the current framework. Kaplan (and likewise C. Parsons 1982) were chiefly concerned with type-logical *expressivity* in terms of *truth-conditions*, and not so much with compositionality and term-wise correspondence, which may be one reason why they did not address questions of invariance and *term-definability*.

*Lemma*³¹

Any closed type-logical term of some type a and devoid of any non-logical constants denotes an a -invariant object; in particular, a is logical.

One consequence of the lemma is that all types (aa^*) turn out to be logical, given that (TS_a) is interpreted by closed type-logical terms without constants. This feature distinguishes the alternative shift from Kaplan's; for not all types of the form (aa^*) are logical:

Observation

$((se)e) ((se)e)^+$ is not logical.

Given that $((se)e)^+ = ((e(st))e)$, the non-logicality observed above can be shown by adapting an argument from van Benthem (1989: 319) to the two-sorted case. Again, the details are provided on request.

The observation has no bearing on the propositionalist reduction of Fregean types, which only concerns intensions, i.e., objects of types of the form (s,a) . In fact, a somewhat involved argument establishes the following result:

Theorem

If a is any Fregean type, (sa) is embeddable into $(sa)^+$.

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³¹ See, e.g., van Benthem (1995: 9f.).

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