Contents

EVIDENCE FOR SINGLE-TYPE SEMANTICS – AN ALTERNATIVE TO e/t-BASED DUAL-TYPE SEMANTICS

Abstract. Partee (2006) conjectures a formal semantics for natural language (hereafter, *single-type semantics*) which interprets CPs and referential DPs in *the same* semantic type: properties of situations. Partee's semantics contrasts with Montague semantics and its recent contenders (dubbed *dual-* or *multi-type semantics*) which assume distinct basic types for the semantic values of referential DPs (i.e. individuals) and CPs (i.e. propositions, truth-values, or sets of assignment functions). Partee's conjecture is motivated by results in event semantics and discourse representation theory which support the indirect uni-directional shiftability between propositions and individuals. However, none of these results supports the *identity* of the types for individuals and propositions. Our paper improves upon the strength and scope of Partee's support for single-type semantics. In particular, it identifies a number of new arguments for the adoption of single-type semantics which display this semantics' greater unificatory and explanatory power. These arguments are based on the ability of single-type semantics to provide a uniform account of the distributional similarities between DP and CP, to explain the truth-evaluability of DP fragments, and to explain semantic inclusion relations between CPs and referential DPs. To further support single-type semantics, we defend it against a number of standard objections.

Keywords Single-type conjecture, type-logical semantics, natural language metaphysics, distributional DP/CP similarities, DP fragments, situated interpretation.

1. Introduction

The semantics of natural language presupposes a rich ontology (cf. Bach 1986a). For example, to provide an interpretation for English, we require the existence of individuals (denoted by, e.g., *Bill*), propositions (cf. *Bill walks*), properties of individuals (cf. *walk*), relations between individuals (cf. *find*), and many other types of objects. Classical type-logical semantics for natural language (e.g. Montague 1970a) tame this zoo of objects by assuming only *two* basic types of objects, viz. individuals and propositions, and constructing all other objects from these primitives via semantic rules like function space formation. As a result of this constructibility, type-logical semantics can explain the compositionality of natural language interpretation (cf. Werning 2005) and can account for the productivity and systematicity of linguistic understanding.

The semantic distinction between individuals and propositions is inherited from Church's Simple Theory of Types (Church 1940) and is witnessed in classical Montague semantics (cf. Montague 1970a, 1973; Gallin 1975), situation semantics (cf. Barwise and Perry 1983; Muskens 1995), property theory (cf. Thomason 1980; Chierchia and Turner 1988), dynamic semantics (cf. Groenendijk and Stokhof 1989, 1991), and discourse representation theory (cf. Kamp 1981; Heim 1982). However, the philosophy behind Church's type theory, i.e. Frege's philosophy of language, assumes an even more parsimonious ontology. In particular, Frege divides the semantic values of linguistic expressions into 'saturated'

objects [*Gegenstände*], which can only serve as semantic *arguments*, and 'unsaturated' *concepts* [*Begriffe*], which serve as semantic *argument-takers*. Since Frege further classifies the semantic values of declarative sentences, i.e. truth-values, as *Gegenstände* (cf. Frege 1891), he clusters individuals and truth-values into a *single* basic type of object.

Montague's semantics for natural language aims to provide a direct formalization of Frege's linguistic ontology (cf. Montague 1970a, p. 217). However, even Montague diverges from Frege's foundational set-up by assuming distinct basic types for individuals (*entities*, type e) and propositions (or *truth-values*, type t).

For reasons of generality, we will hereafter not commit to a particular propositional domain. The type t may thus be associated with truth-values, sets of possible worlds or of world-time pairs, sets of situations, sets of assignment functions, semantically primitive propositions, or other viable candidates for the semantic values of declarative sentences. On all domain choices, the set of propositions forms an algebraic structure (at least a Heyting prealgebra; cf. Pollard 2008). The set of individuals is not always assumed to be structured in this way. Because of the possible absence of an algebraic structure on individuals, we do not identify type-e objects with facts or events. To capture the divide between the types e and t, we assume that the sets of individuals and propositions do not overlap.

The success of Montague semantics and its recent variants has given the e/t-distinction the appeal of an *a priori* necessity. However, the question arises whether this distinction is really *required* for an adequate modeling and explanation of linguistic phenomena or whether it is merely a convenient feature which enables an easy accommodation of these phenomena. Moreover, it may turn out that a semantics based on a single basic type is explanatorily more powerful than a semantics based on the types e and t.

In a 2006 paper on the foundations of natural language semantics, Barbara Partee provides a short informal argument for the adoption of a single basic type. Her argument is based on Carstairs-McCarthy's (1999) claim that the distinction between CPs and referential DPs is a contingent property of natural language syntax and on the assumption of a correspondence between syntactic categories and semantic types (cf. Partee 2006, p. 37). Partee's suggestion about the linguistic type system is summarized below:

Proposition 1 (Single-Type Hypothesis)**.** *The e/t-distinction is <u>in</u>essential for the construction of a rich semantic ontology for natural language. Rich linguistic fragments can be adequately modeled through the use of <u>one</u> basic type of object.*

Partee's assumption of a single basic type corresponds to Frege's adoption of a uniform type for semantic arguments: Just as Frege suggests a classification of the semantic values of declarative sentences (i.e. truth-values) in the interpretive domain of referential DPs (i.e. *Gegenstände*), Partee suggests the classification of propositions as a particular kind of individuals. Just as Partee conjectures the possibility of interpreting natural language in a single-base-type semantics, Frege suggests the possibility of interpreting natural language in an only-*Gegenstands*-based semantics.

The Frege/Partee-view of the linguistic type system contrasts with Montague's implicit assumption that any formal semantics for natural language requires distinct types for individuals and propositions. This assumption is captured below:

Proposition 2 (Dual-Type Hypothesis)**.** *The e/t-distinction is essential for the construction of a rich semantic ontology for natural language. Any adequate model for a rich linguistic fragment requires* (*at least*) *two distinct basic types of objects.*

We will hereafter refer to any formal semantics for natural language which is based on Proposition 1 as a *single-type semantics*, and refer to any formal semantics which is based on Proposition 2 as a *dual-type semantics*.[1]

Since Partee's single-type semantics conjoins Montague's types for individuals and propositions into a single basic type, it counts as basic-type objects both the semantic values of referential DPs (e.g. *Bill*, *the man*; which are traditionally interpreted in the type e) and the values of declarative sentences or complement phrases (e.g. *Bill walks*, *that Bill walks*; which are traditionally interpreted in the type t). For convenience, we will hereafter dub the single basic type 'o'.[2]

From type-o objects, the semantic values of all other linguistic expressions are obtained by the type-forming rule (CT) from Church (1940) (cf. Montague 1973). This rule asserts that the type for functions from objects of one type to objects of another (possibly, the same) type is itself a type:

(CT) *If α and β are types, then $\langle \alpha, \beta \rangle$ is the type for functions from objects of type α to objects of type β.*

From Montague's basic types e and t, this type-forming rule obtains the types for functions from individuals to propositions (i.e. for first-order properties of individuals), $\langle e, t \rangle$, and for functions from individuals to functions from individuals to propositions, $\langle e, \langle e, t \rangle \rangle$ (i.e. for curried binary relations between individuals). Objects of these types serve as the semantic values of common nouns or intransitive verbs (e.g. *man*, *walk*) or, respectively, as the values of extensional transitive verbs (e.g. *find*).

By applying the rule (CT) to the basic type o, single-type semantics obtains the types for functions from basic single-type objects to basic single-type objects, $\langle o, o \rangle$, and for functions from basic single-type objects to functions from basic single-type objects to basic single-type objects, $\langle o, \langle o, o \rangle \rangle$. Since the type o is neutral between Montague's types e and t, we can identify the classes of linguistic expressions which are associated with a particular single-type type by replacing 'e' and 't' by 'o' in the familiar Montagovian types of a linguistic expression. Thus, the type $\langle o, o \rangle$ serves as the single-type type of common nouns and intransitive verbs. The type $\langle o, \langle o, o \rangle \rangle$ serves as the type of extensional transitive verbs.

Partee (2006) supports[3] the introduction of a single basic type with reference to the semantic similarity of CPs and referential DPs. This similarity follows

[1]Since such semantics still assume a hierarchy over the basic type (or types), they should more correctly be described as '*single-* (or *dual-*) *base-type semantics*', or as *hierarchical* (as opposed to *flat*) *single-* (or *dual-*)*type semantics*. Flat single-type semantics will be discussed in Sect. 2.4.

[2]The type o can be analyzed either as a primitive (i.e. non-decomposable) type (e.g. e or t) or as a decomposable complex type (e.g. $\langle e, t \rangle$). The single-type semantics from Partee (2006) and Liefke (2014) both analyze o as a complex type. In the present paper, we adopt Partee and Liefke's move. In particular, we will follow (Liefke 2014, Ch. 8) in analyzing o as the type for functions from situations to (characteristic functions of) sets of situations, $\langle s, \langle s, t \rangle \rangle$ (cf. Sect. 4.2).

[3]Partee does not intend to formulate a strong, coherent argument for single-type semantics. Rather, she only aims to "offer some preliminary sketchy notes" to show "that it might be possible to put together several lines of recent research to come up with a defense of the conceptual possibility of getting along without the e-t distinction [...]" (2006, p. 38).

from the similarity of the standard dual-type values of CPs (i.e. propositions) and indefinite event-denoting DPs (i.e. events), and of event-denoting DPs and concrete, referential DPs (i.e. individuals). These similarities are reflected in the easy shiftability between objects of the above types. They question the strict type difference between the semantic values of the above kinds of expressions.

In particular, Partee supports the semantic similarity of CPs and event-denoting DPs with reference to the event-semantic analysis[4] of declarative sentences (e.g. the analysis of (1a) and (2a) as (1b) and (2b)) and the event-type results of sentential nominalization (e.g. the nominalization of (1a) and (2a) as (1c) and (2c)) (cf. Davidson 1967; Kratzer 1996; Parsons 1985). She supports the similarity between concrete and event-denoting DPs with reference to the possibility of interpreting the same DP as an individual or an event in different linguistic contexts (cf. Bach 1986b; Krifka 1989; Partee 1991). For example, since the verb *last* requires an event-type subject, the DP *the thunderstorm* is interpreted as an event in (3a). Since *fly through* requires a concrete, individual-type object, this DP is interpreted as an individual in (3b).[5]

(1) a. Jones buttered the toast.
b. There is a (past) event of Jones buttering the toast.
c. Jones' buttering the toast

(2) a. You saw a snake yesterday.
b. There is an event of you seeing a snake that happened yesterday.
c. your seeing a snake yesterday

(3) a. [$_{\text{DP}}$The thunderstorm] lasted from early to mid-afternoon.
b. The pilot flew his plane through [$_{\text{DP}}$the thunderstorm].

Examples (1) and (2) are taken from (Partee 2007, p. 3; cf. Davidson 1967) and from (Partee 2006, p. 39; cf. Carstairs-McCarthy 1999, p. 23), respectively. Example (3) is inspired by the discussion from (Partee 2007, p. 4).

Note that Partee's examples do not support the *neutralization* of the distinction between individuals and propositions or the *identification* of the semantic types for CPs and referential DPs, which has been suggested in Proposition 1. Instead, they only support the semantic *similarity* of CPs and individual-denoting DPs (via the semantic similarity of CPs with event-denoting DPs and of event-denoting DPs with individual-denoting DPs). As a result, Partee's examples provide comparatively weak support for single-type semantics. Partee's support is further weakened by its focus on linguistic phenomena (e.g. sentential nominalization, cf. (1), (2)) that witness a shift from propositions to events, and by the by-and-large absence of phenomena that witness a shift in the other direction[6].

[4]This analysis interprets sentences as existentially quantified event descriptions.

[5]The semantic similarity between concrete and event-denoting DPs is further supported by the observation that certain expressions take both concrete and event-denoting DPs as their complements, and allow the coordination of these different kinds of DPs in their complements. This observation is witnessed below:

($\star$) a. [$_{e\text{-DP}}$Pat] annoyed Mary.
b. [$_{v\text{-DP}}$Pat's permanent whining] annoyed Mary.
c. [[$_{e\text{-DP}}$Pat] and [$_{v\text{-DP}}$her permanent whining]] annoyed Mary.

[6]Partee herself admits that "it is not so easy to 'propositionalize' an arbitrary entity" (2007, p. 4).

As a result, Partee's support is not only *indirect* (via the semantic comparison to events), but also *uni-directional*.

This paper improves upon the strength and scope of Partee's support for single-type semantics. In particular, it identifies a number of new arguments for the adoption of single-type semantics which display this semantics' greater unificatory and explanatory power. These arguments are based on the ability of single-type semantics to provide a uniform account of the distributional similarities between DP and CP (cf. *the uniformity argument*; Sect. 2), to give a simple explanation of the truth-evaluability of syntactically isolated referential DPs (cf. *the assertoricity argument*; Sect. 4), and to give an explanation of the semantic relations between CPs and referential DPs (cf. *entailment arguments*; Sect. 6). The uniformity argument provides support for *any* kind of single-type semantics, regardless of its particular analysis of the type o. The assertoricity and entailment arguments provide support for our particular brand of single-type semantics, i.e. *situated single-type semantics*, that analyzes o as the type for functions from contextually specified situations to sets of situations, $\langle s, \langle s, t\rangle\rangle$.

Admittedly, there are also a number of phenomena which can be used to argue *against* single-type semantics. These are phenomena which can be modeled in dual-type semantics, but which seem to resist an easy modeling in single-type semantics. They include the distributional differences between DP and CP, and the semantic difference between CPs and their DP nominalizations of the form *the proposition* $[_{\text{CP}}\ ]$. The latter difference is witnessed by the fact (called the *substitution problem* in (Moltmann 2013)) that many DP/CP-neutral contexts do not allow a meaningful substitution of CPs by their DP nominalizations. Section 3 identifies different strategies for the explanation of distributional DP/CP differences. Section 5 shows that, since CPs are not semantically equivalent with their DP nominalizations in situated single-type semantics, this semantics avoids the substitution problem. The paper closes with a summary of our results and with pointers to future work (Sect. 7).

2. The Uniformity Argument for Single-Type Semantics

Since single-type semantics interprets CPs and referential DPs in the same semantic type, it provides a simple, uniform account of the distributional similarities between DP and CP. These include the ability of DPs and CPs to serve as complements of the same verbs, to be used in specificational constructions, and to provide anaphoric antecedents. The distributional similarities between DP and CP are detailed in Sections 2.1 and 2.2: Section 2.1 identifies expressions that are neutral between taking a DP- or a CP-complement; Section 2.2 identifies constructions that align DPs with CPs. Section 2.3 describes the difficulty of – and the non-uniformity of the traditional techniques for – accommodating DP/CP similarities in dual-type semantics, and observes the simple and uniform accommodation of these similarities in single-type semantics. Section 2.4 presents an empirical overgeneralization argument against single-type semantics and defends the proposed semantics against this argument.

2.1. **DP/CP-Neutral Constructions.** DP/CP neutrality involves the alternation of CPs with referential DPs as the subject and object of certain verbs, and as the arguments of adjectives and prepositions. We begin our presentation of DP/CP-neutral constructions with expressions that accept both DP and CP *ob-*

jects. DP-biased expressions, which only accept referential DPs (but not CPs) as their subject or object complements, will be discussed in Section 3.

2.1.1. *Constructions with DP/CP-Neutral Objects.* Many transitive verbs are neutral between taking a CP or a referential DP as their object complement (cf. Kim 2008, pp. 121–122; Sag et al. 2003, pp. 341–342). For example, the verb *remember* can combine both with a DP (e.g. with the name *Bill*, in (4a)) and with a CP (e.g. with the phrase *that Bill was waiting for her [i.e. Pat]*, in (4b)). The observed DP/CP neutrality generalizes to factive intentional verbs, including epistemic verbs (e.g. *know*, *prove*, *notice*; cf. (5)) and (arguably factive) perception verbs (e.g. *see*, *hear*, *feel*; cf. (6)). It is further exhibited by quasi-perceptual intentional verbs (e.g. *imagine*, *hallucinate*; cf. (7)), by emotional and evaluative verbs (e.g. *fear*, *hate*, *desire*; cf. (8); *respect*, *admire*, *disdain*; cf. (9)), and by causative verbs (e.g. *enable*, *allow*, *prevent*; cf. (10)).

(4) a. Pat remembered [$_{\text{DP}}$Bill].
b. Pat remembered [$_{\text{CP}}$that Bill was waiting for her].

(5) a. Mary noticed [$_{\text{DP}}$the problem].
b. Mary noticed [$_{\text{CP}}$that Pat did not like Bill].

(6) a. Mary saw [$_{\text{DP}}$Bill].
b. Mary saw [$_{\text{CP}}$that Bill was waiting at the front exit].

(7) a. Bill imagined [$_{\text{DP}}$Pat's embrace].
b. Bill imagined [$_{\text{CP}}$that Pat would hug him].

(8) a. Pat fears [$_{\text{DP}}$Bill].
b. Pat fears [$_{\text{CP}}$that Bill would try to kiss her].

(9) a. Mary respects [$_{\text{DP}}$Pat].
b. Mary respects [$_{\text{CP}}$that Pat wishes to avoid Bill].

(10) a. Mary prevented [$_{\text{DP}}$another mental breakdown].
b. Mary prevented [$_{\text{CP}}$that Pat experienced another mental breakdown].

Notably, DP/CP complement-neutrality is also witnessed by verbs that take a prepositional (rather than a direct) object complement. These verbs include volition verbs (e.g. *hope*, *wish*, *care*; cf. (11)), *say*-verbs (e.g. *complain*, *remark*, *grumble*; cf. (12)), and cognition verbs (e.g. *marvel*, *wonder*, *reason*; cf. (13)).

(11) a. Bill hoped for [$_{\text{DP}}$Pat's sympathy].
b. Bill hoped [$_{\text{CP}}$that Pat would change her mind about him].

(12) a. Mary complained about [$_{\text{DP}}$Pat].
b. Mary complained [$_{\text{CP}}$that Pat did not try to understand Bill].

(13) a. Bill marveled at [$_{\text{DP}}$Pat].
b. Bill marveled [$_{\text{CP}}$that Pat was the prettiest girl he had ever met].

2.1.2. *Constructions with DP/CP-Neutral Subjects.* The DP/CP neutrality of verbal object complements is supplemented by the neutrality of many expressions between taking a CP or a referential DP in subject position (cf. Sag et al. 2003, p. 339; Levin 1989, pp. 38, 76–77; Alrenga 2005; Lohndahl 2014). These expressions include emotional and non-emotional causative verbs (e.g. *frighten*, *anger*, *please*; cf. (14); *destroy*, *foster*, *explain*; cf. (15)), emotional judgement verbs (e.g.

suck, *stink*, *rule*; cf. (16)), emotional evaluation adjectives (e.g. *pleasant*, *lucky*, *unfortunate*; cf. (17)), and cognitive-assessment adjectives (e.g. *interesting*, *amazing*, *strange*; cf. (18)).

(14) a. [$_{DP}$Bill's behavior] frightens Pat.
b. [$_{CP}$That Bill's behavior is getting increasingly unpredictable] frightens Pat.

(15) a. [$_{DP}$Bill] destroyed his friendship with John.
b. [$_{CP}$That Bill suspected John of courting Pat] destroyed his friendship with John.

(16) a. [$_{DP}$Today's weather] sucks.
b. [$_{CP}$That today's weather does not seem to improve] sucks.

(17) a. [$_{DP}$The crash] was unfortunate.
b. [$_{CP}$That the crash was so disastrous] was unfortunate.

(18) a. [$_{DP}$Bill] is strange.
b. [$_{CP}$That Bill is obsessed with Pat] is strange.

2.1.3. *Constructions with DP/CP-Neutral Arguments of Prepositions.* The DP/CP-neutrality of complements is further witnessed by prepositional phrases in languages like German, Dutch, and French. These phrases result from combining a preposition (e.g. German *vor*, *durch* [Engl.: 'of', 'through']) with a DP or from combining a pro-preposition (e.g. *davor*, *dadurch* [Engl.: 'PRO-of', 'PRO-through']) with a CP. The first possibility is witnessed by the German phrases *vor Bill* [Engl.: 'of Bill'] and *durch einen Pfeiler* [Engl.: 'through a beam'] in (19a) and (20a). The second possibility is witnessed by the German phrases *davor, dass Bill sie küssen könnte* [Engl.: '*there*-of that Bill her kiss could', i.e. 'of Bill kissing her'] and *dadurch, dass er einen Pfeiler aufstellte* [Engl.: '*there*-through that he a beam put up', i.e. 'by (him) putting up a beam'] in (19b) and (20b).

(19) a. Pat hat Angst [$_{PP}$vor [$_{DP}$Bill]].
[*literal:* Pat has fear of Bill.]
[*gloss:* Pat is afraid of Bill.]
b. Pat hat Angst [$_{PP}$*da*vor, [$_{CP}$dass Bill sie küssen könnte]].
[*literal:* Pat has fear PRO-of that Bill her kiss could.]
[*gloss:* Pat is afraid of Bill kissing her.]

(20) a. Peter stützte das Dach [$_{PP}$durch [$_{DP}$einen Pfeiler]].
[*literal:* Peter supported the roof through a beam.]
b. Peter stützte das Dach [$_{PP}$*da*durch, [$_{CP}$dass er einen Pfeiler aufstellte]].
[*literal:* Peter supported the roof PRO-through that he a beam put up.]
[*gloss:* Peter supported the roof by putting up a beam.]

This completes our presentation of DP/CP complement-neutral constructions.[7] We next turn to the identification of DP/CP-aligning constructions.

[7]Another interesting DP/CP similarity regards the case-marking of CPs in languages like Spanish, Persian, and Japanse (cf. Contreras 1985; Massam 1985; Plann 1986; Tsai 1993; Luján 1999; Öhl and Lotfi 2006). Luján (1996) even argues for the universality of case-marking of CPs. We leave the evidential relevance of CP case-marking for single-type semantics as a topic for future research.

2.2. **DP/CP-Aligning Constructions.** Constructions aligning DPs with CPs include coordinations, specificational constructions, and cases of proposition anaphora. Below, we discuss each of these constructions in turn.

2.2.1. *Coordination.* Coordination can link DPs as well as CPs (cf. (21), (22)) and can even link DPs *with* CPs. Traditionally, coordination was assumed to be restricted to members of the same syntactic category, which receive an interpretation in the same semantic type (cf. Chomsky 1957, p. 36). However, Sag et al. (1985) have identified a particular type of coordination (called the *coordination of unlike categories*, or the *coordination of unlikes*; cf. Bayer 1996) which links members of *distinct* syntactic categories, including determiner and complement phrases (cf. Sag et al. 1985, pp. 165–167; Bayer 1996, pp. 584– 585, 598–599). The coordination of CPs and referential DPs is exemplified by the results of conjoining the DP- and the CP-complement of the different occurrences of the matrix verbs from (4), (6), and (8) (in (23)–(25)).

(21) Pat fears [[$_{\text{DP}}$Bill] and [$_{\text{DP}}$his impulsiveness]].

(22) Pat fears [[$_{\text{CP}}$that Bill may try to kiss her] and [$_{\text{CP}}$that she will not be able to evade him]].

(23) Pat remembered [[$_{\text{DP}}$Bill] and [$_{\text{CP}}$that he was waiting for her]].

(24) Mary saw [[$_{\text{DP}}$Bill] and [$_{\text{CP}}$that he was waiting at the front exit]].

(25) Pat feared [[$_{\text{DP}}$Bill] and [$_{\text{CP}}$that he would try to kiss her]].

The above discussion has focused on the coordination of DPs and CPs in sentential *object* position. However, DPs can also be coordinated with CPs in *subject* position.[8] Such coordinations are exemplified by the results of conjoining the DP- and the CP-complement of the different occurrences of the verbs from (14), (16), and (17) (in (26)–(28)). The possibility of coordinating unlike sentential subjects is also acknowledged in (Bayer 1996, p. 608; cf. (29)).

(26) [[$_{\text{DP}}$Bill's behavior] and [$_{\text{CP}}$that it is getting increasingly unpredictable]] frightens Pat.

(27) [[$_{\text{DP}}$Today's weather] and [$_{\text{CP}}$that it does not seem to improve]] sucks.

(28) [[$_{\text{DP}}$The crash] and [$_{\text{CP}}$that it was so disastrous]] was unfortunate.

[8]An anonymous reviewer for SALT 2016 has pointed out that, while it is in principle always possible to coordinate an object-position DP with a CP, sentences with *subject*-position DP/CP-coordinations are sometimes deviant, as is witnessed by (†c). The reviewer interprets this fact as disqualifying (26) to (29) as evidence for single-type semantics.

(†) a. [$_{\text{DP}}$Windows 10] sucks.
b. [$_{\text{CP}}$That Qatar hosts the 2022 World Cup] sucks.
c. $^{??}$[[$_{\text{DP}}$Windows 10] and [$_{\text{CP}}$that Qatar hosts the 2022 World Cup]] sucks.

We do not share the reviewer's conclusion. Instead, we suggest to explain the deviance of (†c) through the disjoinedness of the relevant world-parts [or *referential anchors*] w.r.t. which the coordinated subjects are evaluated – here: my computer (which runs Windows 10) and (the relevant part of) Quatar. This explanation is supported by the non-deviance of the similar sentence (‡), in which the referential anchors of the coordinated subjects are *not* disjoined.

(‡) [[$_{\text{DP}}$Windows 10] and [$_{\text{CP}}$that I spent $120 on it]] sucks.

The notion of a referential anchor, and relations between referential anchors, will be discussed in some detail in Sect. 4.1.

(29) [[$_{\text{CP}}$That Himmler appointed Heydrich] and [$_{\text{DP}}$the implications thereof]] frightened many observers.

2.2.2. *Equatives and Specification.* The possibility of aligning DPs with CPs is further witnessed by CP equatives and by specifications. CP equatives are sentences of the form of (31) to (33), which equate the referents of the two expressions flanking *to be* (cf. Stowell 1981; Potts 2002). In contrast to typical equatives (e.g. (30)), whose arguments are both determiner phrases, CP equatives take as their arguments a DP *and a CP*.

(30) [$_{\text{DP}}$The problem] was [$_{\text{DP}}$Pat's dislike of Bill].

(31) [$_{\text{DP}}$The problem] was [$_{\text{CP}}$that Pat did not like Bill].

(32) [$_{\text{DP}}$Mary's guess] was [$_{\text{CP}}$that Bill had been having feelings for Pat for quite a while].

(33) [$_{\text{CP}}$That Bill would try to kiss her] was [$_{\text{DP}}$Pat's biggest fear].

Specifications are constructions of the form of (34) to (36) in which an adverb (paradigmatically, the adverb *namely*) enables the specification of a verb's complement through a second complement. In contrast to the most common kind of specifications, in which the specifying and the specified complement are both members of the same syntactic category (cf. (34)), CP-involving specifications delegate the specification of the DP complement *to a CP*. This possibility is witnessed by (35) and (36).

(34) Mary noticed [$_{\text{DP}}$the problem], namely [$_{\text{DP}}$Pat's dislike of Bill].

(35) Mary noticed [$_{\text{DP}}$the problem], namely [$_{\text{CP}}$that Pat did not like Bill].

(36) [$_{\text{DP}}$Pat's situation], namely [$_{\text{CP}}$that she was being followed by a lunatic] worried Mary.

Note that, while DP/CP coordinations only suggest that the aligned expressions are interpreted *in the same type*, CP equatives and specifications demand that these expressions be interpreted *as the same object* (i.e. that they are co-referential). Equatives and specification thus provide stronger support for single-type semantics than coordination. The co-referentiality of aligned CPs and referential DPs is further witnessed by proposition anaphora.

2.2.3. *Proposition Anaphora.* Anaphoric relations most commonly hold between pronouns and their antecedent *DPs*. However, anaphoric relations can also hold between pronouns and their antecedent *CPs* (cf. Charlow 2012). In (Asher 1993, Ch. 6.4) and (Elbourne 2013, Sect. 10.8), such cases of anaphora are called *proposition anaphora* or *anaphora to propositions*. Proposition anaphora is exemplified by (37) to (39). In particular, in (37), the pronoun *it* is used to refer to the semantic value of the CP *that Bill has feelings for Pat*, thus suggesting the co-referentiality of the two expressions.

(37) Mary believes [$_{\text{CP}}$that Bill has feelings for Pat]. John is certain of [$_{\text{PRO}}$it]$_i$.

(38) If Mary tells Pat [$_{\text{CP}}$that Bill is waiting at the front exit]^i, she must be sure of [$_{\text{PRO}}$it]$_i$.

(39) [$_{\text{CP}}$That Pat was so evasive]^i bothered Bill. [$_{\text{PRO}}$It]$_i$ upset him greatly.

This completes our presentation of the distributional similarities between CPs and referential DPs. We next show how these similarities are accommodated in

dual-type semantics. We will see that this accommodation requires the use of *different* non-standard tools and mechanisms, which prevents a uniform account of these similarities.

2.3. **Dual-Type Accounts of DP/CP Similarities.** Dual-type semantics explain the similarities between CPs and referential DPs through the combination of four strategies: (i) polysemy, (ii) type-shifting, (iii) ellipsis, and (iv) covert syntactic operators. These strategies are briefly described below.

(i) *Polysemy:* Assume that expressions which take complements of different categories are lexically ambiguous;

(ii) *Type-shifting:* Assume an operation at the level of LF that shifts propositions to individuals (or to generalized quantifiers over individuals);

(iii) *Ellipsis:* Assume an elided determiner with a full NP layer that selects for a CP and yields a DP;

(iv) *Covert syntactic operators:* Assume a context-sensitive phonologically null functional head that selects for a CP and yields a DP.

Strategy (i) is realized by the distinction between differently-typed meanings of the matrix verb, adjective, or preposition (cf. Sag et al. 2003, pp. 341–342; Vogel 1998) and by the identification (through disambiguation) of this expression's 'right' meaning in the relevant linguistic context. Strategy (ii) is realized by the nominalization operator, $^{\cap}$, (cf. Chierchia and Turner 1988; Potts 2002) that takes as arguments elements of type t (i.e. propositions) and produces as values elements of type e (i.e. individuals). Strategy (iii) is realized by prefacing a CP with an elided DP like *the proposition* or *the fact* (cf. Elbourne 2013; Kiparsky and Kiparsky 1970), while Strategy (iv) prefaces a CP with the covert definite determiner Δ (Kastner 2015; cf. Adger and Quer 2001; Takahashi 2010). In the complement of presuppositional verbs like *remember* and *deny*, this determiner combines with a CP and forms a definite DP.

The above shows that Strategies (i) to (iv) operate at different levels of interpretation: While Strategy (i) operates at the level of the *lexicon*, Strategy (ii) operates at the level of compositional *semantics*. Strategies (iii) and (iv) apply – with different degrees of (c)overtness – at the level of *syntax*.

In virtue of the above, the expression *that Bill was waiting for her [i.e. Pat]* from (4b) will be analyzed as a CP by Strategies (i) and (ii), and as a DP by Strategies (iii) and (iv). The result of this analysis will be interpreted as a proposition by Strategy (i) and as an individual by Strategies (ii) to (iv). The different analyses of sentence (4b) are given in (4b)′ to (4b)′′′′ below, where the crucial ingredient is printed in boldface. In (4b)′, 'remember$_2$' is the disambiguated term expressed by the verb *remember* that selects for CP complements. The semantic nature of Strategy (ii) demands that the syntactic structure from (4b) be replaced by its logical form in (4b)′′. In (4b)′′, types are given in subscript.

(4) b′ Pat **remembered$_2$** [$_{\text{CP}}$that Bill was waiting for her].

b′′ $remember_{\langle e,\langle e,t\rangle\rangle}(\boldsymbol{\cap}(waitfor_{\langle e,\langle e,t\rangle\rangle}(pat_e)(bill_e))_t)_{\boldsymbol{e}}(pat_e)$

b′′′ Pat remembered [$_{\text{DP}}$**the fact** [$_{\text{CP}}$that Bill was waiting for her]].

b′′′′ Pat remembered [$_{\text{DP}}$**Δ** [$_{\text{CP}}$that Bill was waiting for her]].

Below, we discuss how the different strategies accommodate the DP/CP similarities from Sections 2.1 and 2.2. This discussion will also identify the modeling inadequacies and/or the explanatory deficiencies of each of these strategies. The latter support the accommodation of the observed DP/CP similarities in a single-type semantics.

We have suggested above that Strategy (i) associates the occurrences of the verb *remember* from (4a) and (4b) with disambiguated terms of the type $\langle \boldsymbol{e}, \langle e, t\rangle\rangle$ and $\langle \boldsymbol{t}, \langle e, t\rangle\rangle$, respectively (and, similarly, for the occurrences of each of the matrix expressions from (5) to (18)). As a result, this strategy succeeds in modeling the pairs of sentences from (4) to (18). A similar observation holds for the different occurrences of the prepositions from (19) and (20) (typed $\langle \boldsymbol{e}, \langle\langle e, t\rangle, \langle e, t\rangle\rangle\rangle$ and $\langle \boldsymbol{t}, \langle\langle e, t\rangle,\ \langle e, t\rangle\rangle\rangle$), such that Strategy (i) also models the pairs of sentences from (19) and (20). Since some variants of this strategy assume the lexical ambiguity of the pronoun *it*, this strategy also accommodates proposition anaphora. The strategy fails for embedded DP/CP coordinations and for DP/CP specifications, which would require multiple type-assignments to *the same* lexical entry.

In contrast to the above, Strategy (ii) explains DP/CP-complement neutrality through the adoption of the nominalization operator $^{\cap}$, or *nom* (cf. Partee 1987). Depending on the preferred ontology for the types e and t in the literature, this operator is analyzed as, e.g.,

- the function from a proposition φ to the individual correlate of the constant function $\lambda x_e.\, \varphi$ (Chierchia 1984; cf. Chierchia and Turner 1988)[9];
- the function from a set of possible worlds φ to the plural individual composed of all and only the worlds in φ (Potts 2002, p. 69);
- the function from a proposition φ (treated as a member of the domain of individuals) to the property of all of φ's properties (Turner 1983);
- the function from a proposition to its associated Landmannian *peg* (Hegarty 2005; cf. Landmann 1984).

The use of the nominalization operator is triggered by the occurrence of a type-mismatch between a predicate and its intuitive argument (in (4b): by a mismatch between the type of the first argument of *remember*, i.e. e, and the type of the CP *that Bill was waiting for her*, i.e. t). By resolving this mismatch, the nominalization operator enables a modeling of the pairs of sentences from (4) to (18) and from (19) to (20). Since embedded DP/CP coordinations[10], DP/CP specifications, and CP equatives also display a type-mismatch, the nominalization operator further models the constructions from Sections 2.2.1 and 2.2.2. Because sentences containing anaphoric CP antecedents (e.g. (37)–(39)) typically do *not* display a type-mismatch, Strategy (ii) is, however, unable to accommodate cases of proposition anaphora.

Strategy (iii) constitutes a syntactic alternative to Strategy (ii) that is inde-

[9]Chierchia and Turner do not address the nominalization of propositions. However, since their nominalization operator maps properties of individuals (type $\langle e, t\rangle$) to their individual correlates (type e) – and since propositions φ can be analyzed as constant properties ($\lambda x_e.\, \varphi$) –, Chierchia and Turner's framework strongly suggests this treatment.

[10]Since coordination is typically restricted to expressions of the same *conjoinable* type (i.e. to a type of the form $\langle \alpha_1, \langle \ldots, \langle \alpha_n, t\rangle\rangle\rangle$; cf. Partee and Rooth 1983), the accommodation of DP/CP coordinations requires a shift to *generalized quantifiers* over individuals (type $\langle\langle e, t\rangle, t\rangle$).

pendent of the observation of a type-mismatch. In particular, this strategy analyzes anaphoric occurrences of the pronoun *it* as an optional reduction of the DP *the proposition* or *the fact* (Elbourne 2013; Kiparsky and Kiparsky 1970) (cf. the analysis of (37) as (37)′). As a result, this strategy enables a largely analogous treatment of anaphora with DPs and with CPs.

(37)′ Mary believes [$_{\text{CP}}$that Bill has feelings for Pat]. John is certain of [$_{\text{DP}}$*this proposition*]/[$_{\text{DP}}$*the proposition* [$_{\text{CP}}$that Bill has feelings for Pat]].

Strategy (iii) is challenged by the difficulty of finding a meaning-preserving DP for some CPs in certain linguistic contexts. For the sentences from (6b), (20b), and (32), this difficulty is illustrated below:

(6) b′. ?? Mary saw [$_{\text{DP}}$*the proposition* [$_{\text{CP}}$that Bill was waiting at the front exit]].

b″. ?? Mary saw [$_{\text{DP}}$*the fact* [$_{\text{CP}}$that Bill was waiting at the front exit]].

(20) b′. ?? Peter stützte das Dach durch [$_{\text{DP}}$*die Proposition*, [$_{\text{CP}}$dass er einen Pfeiler aufstellte]].
[*gloss:* Peter supported the roof through *the proposition* that he put up a beam.]

b″. ?? Peter stützte das Dach durch [$_{\text{DP}}$*die Tatsache*, [$_{\text{CP}}$dass er einen Pfeiler aufstellte]].
[*gloss:* Peter supported the roof through *the fact* that he put up a beam.]

(32) b′. ?? [$_{\text{DP}}$Mary's guess] was [$_{\text{DP}}$*the proposition* [$_{\text{CP}}$that Bill had been having feelings for Pat for quite a while]].

b″. ?? [$_{\text{DP}}$Mary's guess] was [$_{\text{DP}}$*the fact* [$_{\text{CP}}$that Bill had been having feelings for Pat for quite a while]].

In particular, Peter did not support the roof through *the fact* that he put up a beam (cf. (20b)″), but through *a beam* (cf. (20a)). Similarly, Mary did not see *the fact* that Bill was waiting at the front exit (cf. (6b)′) (or *the proposition* that he was waiting at this exit; cf. (6b)″), but *Bill* (as he was waiting at this exit). For the DP/CP complement-neutral verbs *imagine* and *conclude*, an analogous observation is made in (Moltmann 2013, p. 128). The difficulty of finding a suitable DP for some CPs also influences the ability of Strategy (iii) to accommodate embedded DP/CP coordinations. The semantic difference between CPs and their DP nominalizations will receive a detailed discussion in Section 5.

Strategy (iv) is a sophisticated variant of Strategy (iii) that restricts the DP-type interpretation of apparent CPs to the complements of presuppositional verbs like *remember* and *deny*. Since – with the exception of quasi-perceptual verbs like *imagine* – all of the matrix verbs from Section 2.1.1 are presuppositional, Strategy (iv) succeeds in modeling the majority of DP/CP object-neutral constructions and of DP/CP coordinations and specifications that occur in these constructions. Since the determiner Δ also combines with apparent CP *subjects* (Kastner 2015; cf. Ross 1967; Takahashi 2010; Hartman 2012), Strategy (iv) further accommodates expressions that are neutral between taking a DP or a CP *subject*. However, since the use of the determiner Δ is restricted to presuppositional contexts, this strategy fails to accommodate the DP/CP-neutrality of prepositions as well as proposition anaphora.

The merits and problems of the different explanation strategies for the observed DP/CP similarities are summarized in Table 1.

	O comp.	S comp.	P comp.	Coor.	Spec.	Anaph.
Strategy (i)	✓	✓	✓	✗	✗	✓$_{!!}$
Strategy (ii)	✓	✓	✓	✓$_{!!}$	✓	✗
Strategy (iii)	(✗)	(✗)	(✗)	(✗)	(✗)	✓
Strategy (iv)	(✓)	✓	✗	(✓)	(✓)	✗
Single-Type	✓	✓	✓	✓	✓	✓

Table 1. Merits and problems of the explanation strategies for DP/CP similarities. *In the table, '✓$_{!!}$', '(✓)', and '(✗)' abbreviate the need for a particular variant of a strategy, the ability to uniformly accommodate certain subclasses of a similarity, and the restriction to few special cases of a similarity.*

Table 1 shows that none of the above strategies is able to accommodate *all* of the observed DP/CP similarities from Sections 2.1 and 2.2. A general account of these similarities will consequently need to combine different strategies, thus losing its unifomity. In contrast, single-type semantics interprets CPs and referential DPs in the *same* semantic type. As a result, it uniformly captures the distributional similarities between DPs and CPs.[11]

We close this section by sketching an overgeneralization argument against single-type semantics and by defending the proposed semantics against this argument. Further arguments against single-type semantics will be presented and refuted in Sections 3 and 5.

2.4. **The Scope of the Uniformity Argument.** Sections 2.1 and 2.2 have supported the neutralization of the e/t-distinction with reference to a number of distributional similarities between CPs and referential DPs. A critic of our approach might object that the arguments from DP/CP object-neutrality (cf. Sect. 2.1.1) and from coordination (cf. Sect. 2.2.1) generalize to other classes of expressions, including adjective and prepositional phrases. For example, as is witnessed by (40) and (41), *be* and *become* are neutral between taking a DP, an AP, and a PP or, respectively, a DP and an AP as their complement (cf. Sag et al. 1985; Bayer 1996). This neutrality enables the coordination of DPs, APs, and PPs in the complement of *be* (cf. (42)) and the coordination of DPs and APs in the complement of *become* (cf. (43)).

[11]The ability of single-type semantics to directly accommodate all distributional DP/CP similarities obviates the use of Strategies (i) to (iv). However, Kastner (2015) has shown that the DP-analysis of presuppositional clauses (cf. Strategy (iv)) also explains several phenomena at the syntax-semantics interface, including the particular extraction and fronting behavior of these clauses. As a result, it seems desirable to integrate Strategy (iv) with single-type semantics. We expect that single-type semantics allows for such an integration. This is due to the fact that none of the ingredients of Kastner's account (i.e. Heim's file-change semantics, Honcoop's account of presuppositional islands, and Adger and Quer's analysis of unselected embedded questions) relies on a particular interpretation of DPs and CPs, and that the syntactic distinction between CPs and DPs – which is presupposed in Kastner's explanation – is not questioned by single-type semantics. A detailed demonstration of the integrability of Strategy (iv) into single-type semantics is left as a project for future work.

(40) a. Bill is [$_{\text{DP}}$a desperate soul].
b. Bill is [$_{\text{AP}}$relentless].
c. Bill is [$_{\text{PP}}$in need of psychological attention].

(41) a. Pat has become [$_{\text{DP}}$a business shark].
b. Pat has become [$_{\text{AP}}$reckless].

(42) Bill is [[$_{\text{DP}}$a desperate soul] and [$_{\text{AP}}$relentless]/[$_{\text{PP}}$in need of psychological attention].

(43) Pat has become [[$_{\text{DP}}$a business shark] and [$_{\text{AP}}$reckless]].

If the described generalization were to hold, it would weaken the uniformity argument for single-type semantics by questioning two constituent parts of this argument. More drastically, this generalization could be interpreted as suggesting an extension of the uniformity argument to other kinds of expressions aside from DPs and CPs. This extension would recommend a neutralization of the distinction between basic types (i.e. e, t) and certain complex types (here: the type of APs and PPs, $\langle\langle e,t\rangle,\langle e,t\rangle\rangle$). This neutralization, in turn, would collapse parts of Montague's type hierarchy analogously to the untyped lambda calculus (cf. Church 1985; Barendregt 1984; Scott 1980) and would result in a 'flat' single-type semantics that also assigns the type o to APs and PPs.

However, the above generalization is not convincing. This is due to the fact (i) that DP/AP- (or DP/AP/PP-)neutrality is restricted to the complements of copulative verbs and (ii) that the occurrences of the bracketed DPs in (40) to (43) are non-referential (s.t. they are not interpreted in the type e in dual-type semantics). The examples (40) to (43) do, thus, not support a neutralization of the distinction between the types e and $\langle\langle e,t\rangle,\langle e,t\rangle\rangle$.

The non-referentiality of the DP occurrences in (40) to (43) (cf. (ii)) is witnessed by the observation that these occurrences are unable to serve as the antecedents of anaphoric pronouns (cf. the ungrammaticality[12] of (44) and (45)). This contrasts with the referential occurrences of DPs from Sections 2.1 and 2.2, which *can* serve as the antecedents of such pronouns (cf. the grammaticality of (46) and (47)).

(44) *Bill is [$_{\text{DP}}$a desperate soul]^i. [$_{\text{PRO}}$It]$_i$ would do anything to win Pat.

(45) *Pat has become [$_{\text{DP}}$a business shark]^i. Nothing can shy [$_{\text{PRO}}$it]$_i$ away from profit.

(46) Pat remembered [$_{\text{DP}}$Bill]^i. [$_{\text{PRO}}$He]$_i$ had been waiting at the front exit each day over the past week.

(47) Mary noticed [[$_{\text{CQ}}$the problem]^i and [$_{\text{CP}}$that [$_{\text{PRO}}$it]$_i$ was not easy to solve]].

This completes our presentation – and our first defense – of the uniformity argument for single-type semantics. We will see in the next section how single-type semantics answers a number of arguments that are based on the distributional differences between CPs and referential DPs.

3. Selection Arguments against Single-Type Semantics

The uniformity argument for single-type semantics capitalizes on distributional similarities between CPs and referential DPs. However, there are also a num-

[12]We hereafter use an asterisk, *, to indicate the ungrammaticality of the ensuing expression.

ber of distributional *differences* between CPs and DPs. These are witnessed by linguistic contexts which do *not* allow the grammatical substitution of a referential DP by a CP. Such contexts include the complements of verbs like *pinch* and *elude*, as well as some cases of coordination. Since these contexts *only* select for a referential DP (and not for a CP), we hereafter refer to members of the presented class of arguments as *selection arguments*.

This section details different selection arguments against single-type semantics and develops two single-type responses to these arguments. Below, we first present some distributional differences between DP and CP, which form the basis of the different selection arguments (in Sect. 3.1). We then identify different strategies for refuting these arguments (in Sect. 3.2).

3.1. **DP-Biased Constructions.** Expressions which only accept a referential DP complement include activity verbs (e.g. *pinch*, *devour*, *elude*) and, in some languages (e.g. English), prepositions in prepositional adjuncts (i.e. PPs that do not occupy a verb's thematic role and, hence, do not constitute a prepositional object). The restriction of activity verbs to DP object and subject complements is illustrated by the ungrammaticality of the constructions in (48b) to (50b).

(48) a. Bill pinched [$_{\text{DP}}$Pat].
b. *Bill pinched [$_{\text{CP}}$that Pat was unable to evade him].

(49) a. Pat eluded [$_{\text{DP}}$Bill].
b. *Pat eluded [$_{\text{CP}}$that Bill was following her every move].

(50) a. [$_{\text{DP}}$Bill] pinched Pat.
b. *[$_{\text{CP}}$That Bill was waiting for Pat] pinched Pat.

The restriction of English prepositional adjuncts to DPs is illustrated by the ungrammaticality of the construction in (51b).

(51) a. Peter supported the roof through [$_{\text{DP}}$a beam].
b. *Peter supported the roof through [$_{\text{CP}}$that he put up a beam].

Other languages (e.g. German) *do* allow the alternation of DPs with CPs in prepositional adjuncts under certain conditions (cf. (19b), (20b)). We leave the detailed discussion of DP/CP-alternation in prepositional adjuncts for another occasion.

As a result of their DP-complement bias, the matrix expressions from (48) to (50) do not accept DP/CP-coordinations in their complements. This fact is witnessed by (52) and (53).

(52) *Pat eluded [[$_{\text{DP}}$Bill] and [$_{\text{CP}}$that he was following her every move]].

(53) *[[$_{\text{DP}}$Bill] and [$_{\text{CP}}$that he was waiting for Pat]] pinched Pat.

Notably, at least in English, there do not seem to be any verbs that only select for a *CP* (and not for a DP). Verbs like *hope* and *complain*, in which the CP cannot be directly replaced by a DP on the surface, still exhibit an alternation between CP complements and DPs figuring as a prepositional object (Sect. 2.1.1).

Selection arguments against single-type semantics exploit the ability of dual-type semantics to straightforwardly explain the above DP/CP-differences, and the alleged *in*ability of single-type semantics to explain these differences. This ability (or alleged inability) is supposed to be due to an approximate correspondence between syntactic categories and semantic types in dual-type semantics

and the absence of such a correspondence in single-type semantics.

Traditional dual-type semantics explain the ungrammaticality of (48b) and (49b) with reference to a mismatch between the standard type of the object complement of activity verbs, i.e. e, and the standard type of CPs, i.e. t, such that the semantic values of activity verbs do *not* accept the values of CPs as their arguments. As a result of this mismatch, pairs of DP object-biased verbs and CPs are excluded from the domain of the syntactic merge operation. This also holds for pairs of DP subject-biased verbs and for DP/CP coordinations. The ungrammaticality of (50b), (51b), (52), and (53) thus has an analogous explanation.

Since single-type semantics interprets CPs and referential DPs in the *same* type (s.t. the single-type of activity verbs, $\langle \boldsymbol{o}, \langle o, o\rangle\rangle$, does *not* distinguish between the types of CP- and DP-complements), one might object that this semantics is, thus, unable to explain the ungrammaticality that results from combining a DP-biased verb or preposition with a CP (cf. (48b)–(51b)) or from combining a DP-biased verb with a DP/CP coordination (cf. (52), (53)). These alleged explanatory failures could then be construed as arguments against single-type semantics. For easy reference, we hereafter call these arguments *the argument from complement bias* and *the argument from failed coordination*, respectively. We will show below that these arguments do not withstand scrutiny.

3.2. **Answering the Selection Arguments.** Single-type semantics has at its disposal several strategies for explaining the above-observed DP/CP differences. These strategies use the semantic selection properties of the matrix verb (Strategy 1) and the verb's syntactic subcategorization properties (Strategy 2).

Strategy 1. Strategy 1 aims to explain the ungrammaticality of (48b) to (51b) and (52) to (53) in analogy to the deviance[13] of expressions like (54b) and (55b) to (55d), viz. through a violation of the lexical restrictions on the verbs' arguments: Just as the verb *murder* demands that its subject be a *person* and, thus, cannot be soundly combined with the designator of an *impersonal* individual (in (54b): with the DP *the fox tapeworm*), the verb *pinch* demands a *concrete* object and a *concrete, animate* subject. Hence, this verb cannot be soundly combined with the designator of an *abstract* entity in object position (e.g. with the DP *the problem*; cf. (55b)) or of an *abstract* or *inanimate* entity in subject position (e.g. with the DP *the problem* or *the door*; cf. (55c), (55d)).

(54) a. [$_{\text{DP}}$The mafia boss] murdered the mayor.
b. $^{\#}$[$_{\text{DP}}$The fox tapeworm] murdered the mayor.

(55) a. [$_{\text{DP}}$Bill] pinched [$_{\text{DP}}$Pat].
b. $^{\#}$Bill pinched [$_{\text{DP}}$the problem].
c. $^{\#}$[$_{\text{DP}}$The problem] pinched Pat.
d. $^{\#}$[$_{\text{DP}}$The door] pinched Pat.

Strategy 2. Strategy 2 provides a purely syntactic explanation of the ungrammaticality of (48b) to (51b) and (52) to (53) along the lines of (Montague 1973) (cf. Montague 1970a; Lewis 1970),[14] which is independent of the semantic inter-

[13]We hereafter use a superscript sharp, $^{\#}$, to indicate the semantic deviance of the ensuing expression.

[14]Montague (1973) interprets intransitive verbs (category t/e) and common nouns (category $t/\!/e$) in the type for functions from individuals to propositions, $\langle e, t\rangle$ (or for functions from

pretation of the matrix expression in these examples. This strategy is based on recent attempts at explaining the restriction of English *it*-extraposition in object position (cf. Kim and Sag 2005; Kim 2008; Sag et al. 2003). The strategy classifies verbs into *DP* object complement-biased, *CP* object complement-biased, and DP/CP object complement-*neutral* verbs. By classifying *pinch* and *elude* as members of the first class, this strategy explains the above ungrammaticalities. A generalization of this strategy to subject complements explains the ungrammaticality of (50b) and (53). Since this strategy does not reduce syntactic (i.e. subcategorization) to semantic (i.e. lexical selection) properties (vs. Strategy 1), it also entails that the above sentences are ungrammatical, rather than only semantically deviant.

This completes our support of single-type semantics through distributional DP/CP similarities and our defense of this semantics against arguments from distributional DP/CP differences. We next turn to a different class of arguments for single-type semantics, whose members exploit the particular semantic and illocutionary properties of referential DPs. These arguments include the assertoricity argument for single-type semantics (which uses the ability of single-type semantics to explain the truth-evaluability of free-standing referential DPs) and entailment arguments (which use the ability of this semantics to explain the obtaining of semantic inclusion relations between referential DPs and CPs). We will show that the explanation of these properties in single-type semantics is simpler and more natural than the explanation of these properties in dual-type semantics.

The next two sections will be dedicated to the presentation and defense of the assertoricity argument. The different entailment arguments for single-type semantics will be the topic of Section 6.

4. The Assertoricity Argument for Single-Type Semantics

The assertoricity argument for single-type semantics addresses the illocutionary behavior of a particular sort of non-sentential utterances or *fragments*. The latter are utterances of free-standing DPs[15] like (56a) which are used to express a contextually salient proposition about the DPs' type-e referent (in the context from (56): the proposition (56b)) (cf. Progovac 2013; Stainton 2006; Merchant 2008). For convenience, we hereafter refer to such fragments as *DP fragments*.

The example fragments from (56a) to (58a) are due to Stainton (2006) (cf. Merchant 2008). Their propositional content is paraphrased in (56b) to (58b).

(56) A woman is entering the room. A linguist turns to her friend, gestures towards the door, and says (a).

a. [$_{\text{DP}}$Barbara Partee]

b. [$_{\text{DP}}$Barbara Partee] is the person in the door.

(57) Meera is putting jam on her toast. As she scoops out the jam, she observes "chunks of strawberries". Anita nods, and says (a).

world-time pairs to sets of individuals, $\langle s, \langle e, t\rangle\rangle$). Distributional differences between these categories are exclusively explained through syntax. Montague does not regard this delegation of explanatory power as a defect of his framework. To the contrary: He attributes "the fact that Ajdukiewicz's proposals have not previously led to a successful syntax" to "the failure to pursue the possibility of syntactically splitting categories originally conceived in semantic terms" (cf. *ibid.*, p. 249, fn. 4).

[15]These are proper sentence-constituents which do not have a linguistic antecedent.

a. [$_{\text{DP}}$Rob's mom]

b. [$_{\text{DP}}$Rob's mom] is responsible for the strawberry chunks in the jam.

(58) Someone is trying to recognize a tune. Another person leans in on him and whispers (a).

a. [$_{\text{DP}}$the song of mourning]

b. This is [$_{\text{DP}}$the song of mourning].

In virtue of their propositional interpretation, DP fragments have intuitive truth- and falsity-conditions (cf. Stainton 2006, pp. 8, 56). Thus, in the communicative context from (56), the utterance of (56a) is intuitively true if (56b) is true, and false if (56b) is false.

Dual-type semantics explain the truth-evaluability of DP fragments through non-standard mechanisms like ellipsis (cf. Merchant 2005) or flexible DP-typing (cf. Progovac 2013). Single-type semantics explains this truth-evaluability *without* resort to such special mechanisms. To make this possible, it analyzes o as the type for functions from contextually specified situations (type s)[16] to sets of situations (called *situative propositions*, type $\langle s, t\rangle$). This analysis is motivated by the inability of simpler single-type semantics to give the right truth-conditions for referential DPs and to correctly describe their semantic relation to certain CPs.[17] The ability of single-type semantics to explain the truth-evaluability of DP fragments is, thus, specific to our particular brand of single-type semantics. This contrasts with the simpler, uniform accommodation of the phenomena from Section 2, which is achieved by *any* single-type semantics. Since our particular single-type semantics interprets expressions with reference to a contextually specified situation, we describe this semantics as *situated single-type semantics*.

Before we embark on our explanation of DP truth in situated single-type semantics, we make a brief observation about the reductive achievement of this semantics: Since situated single-type semantics analyzes the type o as a *complex* type (viz. $\langle s, \langle s, t\rangle\rangle$), it identifies individuals and propositions only *indirectly*, i.e. via the introduction of a common reduction base whose elements code objects of both types. This indirect identification is also recommended by Partee (2006), who proposes to analyze the single basic type as the type for properties of situations, $\langle s, t\rangle$. Since the types s and t do not qualify as single-type types – such that we cannot obtain the type $\langle s, \langle s, t\rangle\rangle$ from lower-rank types through the type-forming rule (CT) –, we are still justified in calling $\langle s, \langle s, t\rangle\rangle$ the *basic* single-type type.

Below, we first introduce the notions of situation, contextual specification of a situation, and situative proposition (in Sect. 4.1). We then describe the interpretation of CPs and referential DPs as functions from contextually specified situations to situative propositions (in Sect. 4.2) and give a truth-evaluation procedure for CPs and referential DPs in situated single-type semantics (in Sect. 4.3). Section 4.4 contains an excursus on the situated interpretation of verbal complements. We start with the introduction of situations.

[16]The type s is typically associated with possible worlds or world-time pairs (cf. Montague 1970a, 1970b, 1973). To emphasize the similar role of situations and worlds (both function as contextual/evaluative parameters) – and to prevent the introduction of a new basic type –, we here generalize s to *partial* possible worlds, or (possible) *situations*. This generalization follows the use of the type s in (Muskens 1995).

[17]The analysis of o as the type $\langle s, \langle s, t\rangle\rangle$ is motivated in some detail in (Liefke 2014, Ch. 4).

4.1. **Situations and Situative Propositions.** Situations are informationally incomplete parts of possible worlds (or *partial* possible worlds) which are obtained from possible worlds by first identifying a particular spatio-temporal location in a world (i.e. a *chunk* of a world; cf. Perry 1986) and then reducing the information about the location's individual inhabitants to the contextually salient information about these inhabitants. Below, we first describe the obtaining of spatio-temporal world-parts (in Sect. 4.1.1). Following a discussion of the contextual specification of world-parts (in Sect. 4.1.2), we then describe the process of filtering information about these parts to the contextually salient information about these parts (in Sect. 4.1.3). We close with the introduction of situative propositions (in Sect. 4.1.4).

4.1.1. *From Worlds to World-Parts.* World-parts are parts of possible worlds which are obtained by restricting a particular spatial location in a world to a particular time of the world's history. As a result, world-parts are identified with world-time-location triples of the form $\langle w, z, l\rangle$ (hereafter called *wzl-triples*). In these triples, the constant w identifies a possible world (including its past and future history; cf. Lewis 1986). The constants l (for *location*) and z (for *time*; German *Zeit*) denote regions in space and time, respectively.

Because of their world-like character, world-parts are inhabited by individuals (i.e. the individuals which are present at the particular location in the world at the specified time in the world's history) and are shaped by events (i.e. the events which occur at the world's particular spatio-temporal location). Typically, individuals exhibit different properties at different times and – assuming their spatial mobility – in different locations. We restrict an individual's properties at a world-part to those properties which the individual exemplifies at the world's particular spatio-temporal location. Thus, if the time of the world-part associated with (56) succeeds the time of Partee's arriving on campus, Barbara Partee will not have the property of arriving on campus at this world-part. (At most, she will have the property of *having* arrived on campus – in virtue of her now *being* on campus).

4.1.2. *The Contextual Specification of World-Parts.* We have previously assumed that world-parts are immediately given. However, in everyday life, world-parts are typically specified indirectly via a communicative context. This context can take the form of the utterance context (e.g. me speaking here and now), of an ostensive context (e.g. the linguist's gesturing towards the open door in (56)), or of a (potentially fictional) discourse context (e.g. the Sherlock Holmes novels): If the communicative context is the utterance context *simpliciter*, the world-part is associated with the time and location of the utterance in the actual world (i.e. with the *wzl*-triple $\langle @, \text{now}_@, \text{here}_@\rangle$).[18] If the communicative context is an ostension, the world-part is associated with the *wzl*-triple which is the spatio-temporal target of the ostension[19] (for (56): with the triple $\langle @, z_@, \text{in-the-door}_@\rangle$). If the communicative context is a discourse context, the world-part is associated with the *wzl*-triple which consists of the world, time, and location of the discourse (for

[18]Following standard convention, we hereafter let '@' denote the actual world.

[19]These targets need not share the time of the ostension. For example, when listening to a recording of *Rigoletto*, the mental ostension accompanying a speaker's utterance of the name *Caruso* can be used to identify a *wzl*-triple whose time-element is a certain interval in 1903 during which Caruso sang in the recorded performance of *Rigoletto*.

the Sherlock Holmes novels: with the triple $\langle w_7, \text{late-19th-century}_{w_7}, \text{London}_{w_7}\rangle$, where w_7 is the fictional world created by Sir Arthur Conan Doyle). We will hereafter describe the indirect specification of world-parts via a communicative context as a *contextual specification*, and call world-parts which are identified with contextually specified *wzl*-triples *contextually specified world-parts*.

4.1.3. *Situations as Informationally Incomplete World-Parts.* Section 4.1.1 has introduced world-parts as 'total' objects: in some sense, world-parts are just small worlds which share some of the population of a 'larger' (i.e. spatially or temporally more extended) world. The individual inhabitants of these small worlds have all the properties which they exhibit at the relevant spatio-temporal location of the larger world. However, the participants in a communicative context typically only command *some* information about the world-parts which are specified by these contexts. This is the typical or (perceptually) salient information about the targeted world-part (e.g. the information that Barbara is standing in the door in (56)) or information which has been introduced in the previous discourse.

We identify the typical or salient information in a communicative context via the salience function $\mathcal{S}$. This function applies to communicative contexts to yield the contextually salient information about the world-parts which are specified by these contexts. This information includes information about the identity of the inhabitants of the specified world-part and information about the properties of these inhabitants. For example, for the context from (56), the function $\mathcal{S}$ yields the information that the world-part $\langle @, \text{now}_@, \text{here}_@\rangle$ is inhabited by Barbara, that Barbara is standing in the door of @ at the time $\text{now}_@$ and – as we will hereafter assume – that she is wearing a red sweater $\text{here}_@$ and $\text{now}_@$.[20] The value of $\mathcal{S}$ for the above context will not include any information about $\langle @, \text{now}_@, \text{here}_@\rangle$ which is not shared by the context's communicative participants (e.g. the information that Barbara is wearing a gold necklace $\text{here}_@$ and $\text{now}_@$).

We identify the values of the salience function with *situations*. Since the salience function identifies situations on the basis of communicative contexts, we say that situations (like world-parts) are *contextually specified*. Since the world-parts which are specified by communicative contexts ground situations in a world, time, and space, we call these world-parts the *referential anchors* of situations.

The partial nature of situations induces an ordering on the set of situations. In particular, a situation σ_2 *includes* a situation σ_1, i.e. $\sigma_1 \sqsubseteq \sigma_2$, if σ_2 contains the information about all individuals, events, and their properties about which σ_1 contains information. In virtue of our definition of situations, this condition requires that the location l_2 and/or time z_2 of the referential anchor of σ_2 includes the location l_1 and/or time z_1 of the referential anchor of σ_1 (s.t. l_2 maintains or expands the perimeters of l_1[21] and/or z_2 starts before or simultaneously with z_1 and ends after or simultaneously with z_1[22]), where the referential anchors of σ_1 and σ_2 are parts of the same world. We call any situation which includes a situation an *extension* of that situation, and identify the *maximal extension* of a sit-

[20]The specificity of these properties suggests that they are particulars (i.e. tropes), rather than universals (i.e. 'traditional' properties).

[21]In this way, the German Empire spatially includes itself, the Kingdom of Bavaria, and Prussia.

[22]In this way, World War I temporally includes itself, the assassination of Franz Ferdinand of Austria, the German march on Paris, and the final armistice.

uation with the world containing the situation's anchor. A situation which is extended by another situation is called a *part* of its extending situation.

In virtue of the above, every ordering of situations has a bottom element (called *the 'empty' situation*; denoted '†') and a top element (called *a maximal situation*; some world denoted by 'w'). Thus, it holds for every situation σ that $\dagger \sqsubseteq \sigma \sqsubseteq w$. Since situations are exclusively characterized in terms of information about their referential anchor's inhabitants, we assume a single empty situation. Since different situations contain different information about the same individuals, we assume multiple maximal situations (i.e. possible worlds).

This completes our description of contextually specified situations. We next turn to the introduction of situative propositions.

4.1.4. *Situative Propositions.* Situative propositions are functions from situations to the truth-values *true* and *false*. Since situative propositions are, thus, characteristic functions of sets of situations,[23] we will sometimes describe situative propositions as *sets* of situations, and refer to the members of these sets as the *elements* of the situative proposition. Situative propositions are analogues of Lewis' (1986) *propositions* (cf. Kripke 1963; Stalnaker 1976; Montague 1970a), which are sets of possible worlds. In virtue of the above, situative propositions generalize Lewisian propositions: all Lewisian propositions are situative propositions, but not the other way around.

4.2. **DP- and CP-Interpretations.** We next describe the interpretation of CPs and referential DPs in the type for functions from contextually specified situations to situative propositions (in Sect. 4.2.1, 4.2.2). To further specify situated single-type semantics, we also describe the interpretations of simple existentials (e.g. $[_{\text{DP}}\ ]$ *exists*) in this semantics (in Sect. 4.2.3). The different interpretations will be compared though the use of a concrete example in Section 4.2.4.

We start with the situated single-type interpretation of ordinary (i.e. non-existential) CPs.

4.2.1. *The Interpretation of CPs.* In situated single-type semantics, CPs are interpreted as functions of type $\langle s, \langle s, t\rangle\rangle$, which send contextually specified situations to situative propositions. Consider a simple sentence like *Bill walks*: This sentence is typically uttered in a communicative context (e.g. the sentence's utterance context) which specifies a situation (here: the situation σ_0). This situation serves as the *argument* of the interpretation of the sentence *Bill walks* in situated single-type semantics.

The *value* of the interpretation of the sentence *Bill walks* in situated single-type semantics is a situative proposition. In what follows, we will use denotation brackets, $[\![\cdot]\!]$, as a notational device for the interpretation of linguistic expressions in situated single-type semantics. The value of *Bill walks* for the argument σ_0 will thus be denoted by '$[\![\text{Bill walks}]\!](\sigma_0)$'. This value is a set of situations in which Bill walks. However, to give the right truth-conditions for referential DPs – and to correctly describe the semantic relation between DPs and certain CPs (cf.

[23]To obtain Russell's (1905) truth-conditions for sentences containing non-denoting DPs (s.t. the sentences *The present King of France is bald* and *The present King of France is* <u>*not*</u> *bald* are both evaluated 'false'), we forgo the introduction of a third truth-value, *neither true nor false*, which is often assumed in situational generalizations of possible world semantics (e.g. Muskens 1995). The truth-conditions for the above sentences are discussed in detail in Sect. 4.3.

Sect. 6) –, this set may not be identified with the set of *all* situations in which Bill walks. Rather, it needs to be restricted to a proper subset of this set whose members are *extensions* of the situation σ_0 (cf. Sect. 4.1.3). This restriction ensures that all individuals and events which populate σ_0 will also populate the members of $[\![\text{Bill walks}]\!](\sigma_0)$ and that all individual-inhabitants of σ_0 which populate an extension of σ_0 have their σ_0-properties at this extension. This restriction excludes as members of $[\![\text{Bill walks}]\!](\sigma_0)$ situations whose anchoring world is non-identical with the maximal extension of σ_0 (i.e. with @) or whose referential anchor's time or location does not include the time or location (i.e. $\text{now}_@$ or $\text{here}_@$) of the referential anchor of σ_0. Situations of some other world in which Bill's counterpart walks, or situations in which Bill walks at a time which precedes the time of σ_0's referential anchor, are examples of such situations.

The set of the above-described extensions of σ_0 is captured in [1]. Below, σ is a variable over situations.

[1] $\{\sigma \mid \sigma_0 \sqsubseteq \sigma \text{ and Bill walks in } \sigma\}$

[2] $= \{\sigma \mid \sigma_0 \sqsubseteq \sigma \text{ and Bill is an inhabitant of } \sigma \text{ and Bill walks in } \sigma\}$

In [1], the restriction of σ_0-extensions to situations in which Bill walks updates the shared information about the argument situation by the information encoded in the sentence *Bill walks*.[24] This update enables a meaningful interpretation of this sentence at situations which do not already contain the information that Bill walks (s.t. Bill neither walks nor does not walk in these situations). Since *walk* is an extensional predicate (s.t. Bill can only walk in σ if he is an inhabitant of σ), [1] is equivalent to [2]. We will see below that the inhabitation requirement on the elements of situative propositions will also play a role in the interpretation of referential DPs in situated single-type semantics.

4.2.2. *The Interpretation of Referential DPs.* Our interpretation of declarative sentences already suggests a strategy for the interpretation of referential DPs in situated single-type semantics: Like sentences, DPs (e.g. the name *Bill*) are interpreted as functions from contextually specified situations (here: the situation σ_0) to sets of extensions of these situations, i.e. they are interpreted in the type $\langle s, \langle s, t\rangle\rangle$. To give the right truth-conditions for the DP *Bill* – and to correctly describe its semantic relation to CPs like *Bill walks* –, we identify the set $[\![\text{Bill}]\!](\sigma_0)$ with the set of σ_0-extensions which are inhabited by Bill (in [3]).

[3] $\{\sigma \mid \sigma_0 \sqsubseteq \sigma \text{ and Bill is an inhabitant of } \sigma\}$

In [3], the restriction to Bill-inhabited situations covers the case in which Bill is not already an inhabitant of σ_0. This restriction ensures that the result of applying the interpretation of *Bill* to the argument σ_0 is specific to Bill, rather than to some other individual which happens to inhabit σ_0. The restriction to extensions

[24]Situated single-type semantics largely evades the problem of updates via incompatible information. This problem concerns the fact that a situation's update by a sentence which is *false* in this situation will yield the empty set of situations, such that the values of all false sentences in this situation will be the same. The informationally incomplete nature of situations solves the above problem for a large class of sentences. In particular, since situated single-type semantics identifies contextually specified situations with structures that contain only the typical or salient information about the targeted world-part, situations will only be incompatible with sentences which question the presupposed knowledge, the presented visual scene, or the established common ground. But utterances of such sentences are rather uncommon.

of σ_0 ensures that Bill has his properties from σ_0 in all members of $[\![\text{Bill}]\!](\sigma_0)$.

In virtue of the above, the following propositions hold for the situated single-type interpretations of CPs and referential DPs:

Proposition 3. *At each contextually specified situation, the situated single-type interpretation of a referential DP* is a superset of *the situated single-type interpretation of each upward-entailing CP*[25] *containing the DP.*

Proposition 4. *At a contextually specified situation at which an upward-entailing CP containing a referential DP* is true*, the situated single-type interpretation of the DP* is identical to *the situated single-type interpretation of the CP.*

The truth-evaluability of DP fragments (cf. Sect. 4.3) is a consequence of Proposition 4. The obtaining of semantic relations between DPs and CPs (cf. Sect. 6) is a consequence of both of the above propositions.

4.2.3. *The Interpretation of Simple Existentials.* The interpretation of the name *Bill* from [3] suggests that referential DPs (e.g. *Bill*) have the same interpretation as simple existential CPs containing these DPs (here: as the CP *Bill exists*). However, the semantic equivalence of DPs and their containing existentials would have some undesirable consequences. For example, if this equivalence were to hold, situated single-type semantics would counterintuitively predict that, in the context from (56) (copied below), (56c) would make the same conversational contribution as (56a).[26]

(56) A woman is entering the room. A linguist turns to her friend, gestures towards the door, and says (a).

a. [$_{\text{DP}}$Barbara Partee]

c. [$_{\text{CP}}$Barbara Partee exists].

Situated single-type semantics avoids this problem by interpreting simple existentials as (otherwise unrestricted) situative propositions whose elements are inhabited by the DP's type-e referent. This is achieved by interpreting the verb *exist* as a function from type-$\langle s, \langle s, t\rangle\rangle$ objects (i.e. the DP's single-type interpretation) to the function from contextually specified situations to the value of the DP's interpretation at the empty situation, †. This function is given in [4]. The value of the sentence *Bill exists* at some situation – which is obtained by taking the value of applying the single-type interpretation of *exist* to the single-type interpretation of the name *Bill* – is given in [5]. In [4], σ is a variable over situations (as above). The variable π ranges over objects of type $\langle s, \langle s, t\rangle\rangle$.

[4] $$\left\{\langle \pi, \langle \sigma, \pi(\dagger)\rangle\rangle \mid \sigma \in D_s \text{ and } \pi \in D_{\langle s, \langle s,t\rangle\rangle}\right\}$$

[5] $$[\![\text{Bill exists}]\!](\sigma_0) \quad = \quad \{\sigma \mid \text{Bill is an inhabitant of } \sigma\}$$

As a result of this single-type interpretation of the verb *exist*, an existential's interpretation at a situation will not contain any other information about the DP's referent (besides the referent's inhabitance of the situation) which is contained in the interpretation of the DP at this situation. This fact gives rise to the following proposition:

[25]We expect that this inclusion of interpretations holds for all upward-entailing contexts containing the DP (e.g. for the sentence *Bill walks*), but will eventually not hold for downward-entailing contexts (e.g. for *Bill does not walk*, *Nobody walks*, or *If Bill walks, Mary runs*).

[26]We owe this example to an anonymous referee for the *Journal of Semantics*.

Proposition 5. *At each contextually specified situation, the situated single-type interpretation of a referential DP* is a subset of *the situated single-type interpretation of a simple existential containing the DP. At the empty situation* † *or at a situation which only contains the existential's lexical information, the DP's interpretation* is identical to *the interpretation of the existential.*

Our particular interpretation of the verb *exists* is supported by the special role of simple existentials in philosophical and scientific discourse and by their sparsity in ordinary discourse. We will see in Section 5.3 that DP shells like *the proposition* $[_{\text{CP}}\ \ ]$ have a similar interpretation.

4.2.4. *Example.* We illustrate the difference between the single-type interpretations of referential DPs, of 'ordinary' CPs, and of simple existentials by means of an example. This example will also show how our interpretation of CPs and referential DPs in situated single-type semantics explains the truth-evaluability of DP fragments. Our example uses the DP *Barbara Partee* (i.e. (56a)) and the CPs *Barbara Partee is the person in the door* (i.e. (56b)) and *Barbara Partee exists* (i.e. (56c)). We hereafter use 'σ_0' as the constant for the situation which is specified by the linguist's ostensive gesture towards the door through which Barbara is entering the room (cf. (56)). This gesture identifies the *wzl*-triple $\langle @, z_@, \text{in-the-door}_@\rangle$. Since we assume that Barbara has the salient properties of being the person in the door and of wearing a red sweater in the ostensively specified location of the actual world at the current time, Barbara is in the door and is wearing a red sweater in σ_0.

The value of our interpretation of the DP fragment *Barbara Partee* for the argument σ_0 is given in [6]:

$$
\begin{aligned}
[6] \qquad & \{\sigma \mid \sigma_0 \sqsubseteq \sigma \text{ and Barbara is an inhabitant of } \sigma\} \\
= \quad & \{\sigma \mid \text{Barbara is an inhabitant of } \sigma, \\
& \qquad \text{is the person in the door in } \sigma\text{, and is wearing a red sweater in } \sigma\}
\end{aligned}
$$

To give a concrete example for the situative proposition from [6], we consider the interpretation of the DP fragment *Barbara Partee* in a universe consisting of three situations, σ_0, σ_1, and σ_2, and two individuals: Barbara (abbreviated b) and Angelika (abbreviated a). We assume that σ_1 is a proper extension of σ_2 and that σ_0 and σ_2 do not stand in an inclusion relation. We further assume that Barbara inhabits the situations σ_0 and σ_1, that Angelika inhabits the situations σ_1 and σ_2, that Barbara is in the door (Db) in σ_0 and σ_1, that Barbara is wearing a red sweater (Rb) in σ_0, and that Angelika is next to the door (Na) and is wearing a blue t-shirt (Ba) in σ_1 and σ_2 (cf. Fig. 1).

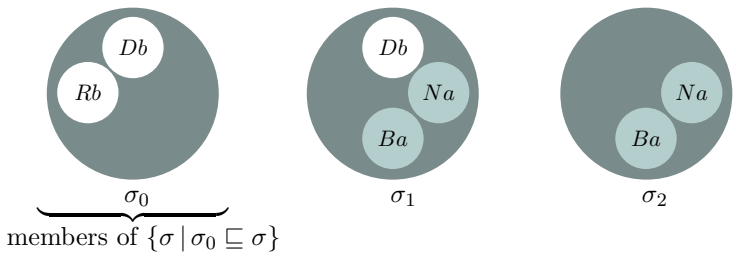

FIGURE 1. The value of the DP *Barbara Partee* at σ_0.

Then, since σ_0 is only included in itself (s.t. Barbara has all of her σ_0-properties only in σ_0, and in none of the other situations), the application of the single-type interpretation of the DP *Barbara Partee* to σ_0 yields the singleton set $\{\sigma_0\}$ (underbraced in Fig. 1).

The value of the single-type interpretation of the CP *Barbara Partee is the person in the door* at the situation σ_0 is given in [7]:

[7] $\{\sigma \mid \sigma_0 \sqsubseteq \sigma$ and Barbara is an inhabitant of σ and
Barbara is the person in the door in $\sigma\}$
$= \{\sigma \mid$ Barbara is an inhabitant of σ,
is the person in the door in σ, and is wearing a red sweater in $\sigma\}$

Notably, since Barbara already has the property of being the person in the door in σ_0, the utterance of the CP *Barbara Partee is the person in the door* in the context of the linguist's ostensive gesture from (56) does not update the available information about σ_0 (s.t. [7] is equivalent to [6]). Situated single-type semantics thus identifies the value of the interpretation of (56b) for the argument σ_0 with the value of the interpretation of (56a) for σ_0 (i.e. $[\![$Barbara Partee is the person in the door$]\!](\sigma_0) = [\![$Barbara Partee$]\!](\sigma_0)$).

We next turn to the interpretation of the CP *Barbara Partee exists* (cf. (56c)). At σ_0, this CP is interpreted as [8]:

[8] $\{\sigma \mid$ Barbara is an inhabitant of $\sigma\}$

Since the situation σ_1 from the above example is also an element of [8] (s.t. (56c) is interpreted-at-σ_0 as $\{\sigma_0, \sigma_1\}$), the interpretation of (56c) at σ_0 is a superset of the interpretations of (56a) and (56b) at σ_0. This containment of interpretations (and the associated lower information content of (56c) in comparison to (56a) and (56b)) explains the difference between the conversational contribution of (56a) (or (56b)) and (56c).

We finish our example with an observation about the roles of ostension and of the 'expansion' of a referential DP to a full CP: Notably, in the communicative context from (56), the gestural accompaniment of the linguist's utterance of the DP fragment *Barbara Partee* serves the same purpose as the combination of the DP's utterance with the utterance of the VP *is the person in the door*: the identification of (the salient inhabitant of) the relevant world-part. Like the linguist's attribution of the property 'is the person in the door', her gesture directs her friend's attention to the contextually most salient aspect of the world (here: to the person standing in the frame). This fact explains why (56a) shares the truth- and falsity-conditions of (56b).

4.3. **DP- and CP-Evaluations.** Our previous considerations have assumed that CPs and referential DPs can be true or false in situated single-type semantics. However, since CPs do not have their usual type in this semantics (i.e. they are interpreted as functions from situations to situative propositions, rather than as classical Lewisian propositions), we cannot identify a CP's truth-value at a world with the value of the CP's interpretation at this world.

To evaluate the truth or falsity of a CP or DP p which is interpreted at a contextually specified situation σ in situated single-type semantics, we check whether the world-part of evaluation w is a member of the interpretation-at-σ of p (i.e. whether $w \in [\![p]\!](\sigma)$). The truth-conditions for CPs and referential DPs in

situated single-type semantics are given below:

Definition 1 (Truth at a world-part)**.** *In situated single-type semantics, a CP or DP p which is interpreted at a situation σ is* true *at the world-part w if $w \in [\![p]\!](\sigma)$. The CP or DP p is* false *at w if $w \notin [\![p]\!](\sigma)$.*

As a result of Definition 1 and of the interpretation of CPs and DPs from Section 4.2, situated single-type semantics assigns the value 'false' to all CPs (e.g. (59a), (59b)) whose subject DPs do not have a referent in the world of evaluation. This is due to the fact that all members of these CPs' situated interpretation – but not the world-part of evaluation – are inhabited by the individual associated with the DP.

(59) a. [$_{\text{DP}}$The present King of France] is bald.
b. [$_{\text{DP}}$The present King of France] is not bald.

Notably, the truth-conditions for CPs in situated single-type semantics are stricter than the truth-conditions for CPs in classical Lewis-style semantics. This is due to the fact that the interpretation-at-a-situation of a CP in situated single-type semantics also contains information that is contained in the interpreting situation. Consider the evaluation of the interpretation-at-σ_0 of the sentence *Barbara Partee is the person in the door* (i.e. (56b)) at a world, w_1, in which Barbara is the person in the door, but in which she is wearing a *blue* sweater (and not a red sweater, as in σ_0): Since Barbara is wearing a *red* sweater in all members of the interpretation-at-σ_0 of (56b), w_1 will not be a member of this interpretation. The CP (56b) will thus be judged 'false' at w_1.

The notion of truth *simpliciter* (cf. Def. 2) relaxes the above truth-conditions for CPs and DPs. To do this, it identifies the world-part of evaluation with the referential anchor of the situation at which p is interpreted. Since every situation has a *unique* referential anchor, the identification of a CP's or DP's interpreting situation σ obviates the further specification of its world-part of evaluation, w. In Definition 2, we can thus omit the relativization of truth (or falsity) to a world-part w so long as we identify w with the referential anchor of σ.

Definition 2 (Truth *simpliciter*)**.** *In situated single-type semantics, a CP or DP p which is interpreted at a situation σ is* true *if it holds for the referential anchor, w, of σ that $w \in [\![p]\!](\sigma)$. The CP or DP p is* false *if $w \notin [\![p]\!](\sigma)$.*

With the truth-conditions for CPs and referential DPs in place, we next turn to the situation-specific interpretation of verbal complements. The latter will enable the interpretation of embedded CPs and DPs in situated single-type semantics and will prepare our account of entailment arguments for this semantics.

4.4. **The Situated Interpretation of Verbal Complements.** Our previous presentation has assumed the situation-*general* interpretation of embedded DPs and CPs. Thus, when it occurs as a constituent of the CP *Bill walks*, the name *Bill* is interpreted as the type-$\langle s, \langle s, t\rangle\rangle$ function which updates the information of the argument-situation by the information that Bill is an inhabitant of that situation. The CP *Bill walks* is interpreted as the type-$\langle s, \langle s, t\rangle\rangle$ function which updates the information of the argument-situation by the information that Bill walks. However, a more complete semantic treatment of these two phrases also takes into consideration the case in which these phrases occur in a wider linguistic context, e.g. in an intentional context (cf. Sect. 2.1.1).

The *situation-specific* interpretation (or the *situated* interpretation) of DPs and CPs in intentional contexts is made necessary by the possibility of interpreting a DP or CP at a situation which is different from the argument-situation of the DP or CP's embedding sentence. Consider the following variant of (4b):

(60) Pat remembered [$_{\text{CP}}$that Bill *had been waiting* for her].

This sentence attributes the property of remembering that Bill has been waiting for Pat (at some point in the past) to Pat. However, the content of Pat's remembering is likely not exhausted by the fact that Bill has been waiting for her (i.e. it is not the lexical information of the CP *that Bill had been waiting for Pat*): Depending on the particular situation which Pat is remembering, the content of Pat's remembering will include other information about Bill (e.g. that he was wearing his favorite Hawaiian shirt, or that he was shuffling his feet; cf. Cheng and Werning 2016). This information need not correspond to the information about the argument-situation of the interpretation of (60). For example, it is consistent for Bill to be wearing his lumberjack shirt in Pat's remembering situation and to be wearing his favorite Hawaiian shirt in the remembered situation.

To capture the situation-specific interpretation of CPs in the above context, we apply the CP's single-type interpretation to a contextually chosen situation. The context-specific choice of situation is implemented by an indefinite choice function. This function selects a specific, possibly non-unique, situation dependent on the argument-situation of the CP's embedding sentence. The dependence of the selected situation on the embedding sentence's argument-situation is demanded by the fact that different remembering-situations of the same agent which feature the same remembered object may have a different content. Thus, while Pat's remembering that Bill was waiting for her may only involve her remembering that Bill was wearing his favorite Hawaiian shirt in one situation, her remembering this fact in another situation may instead involve her remembering that Bill was shuffling his feet.

The single-type interpretation of situated complement-embedding expressions is illustrated in [9]. Here, σ_0 is Pat's *remembering situation*, i.e. the situation at which the embedding sentence, (60), is interpreted. The object of Pat's remembering at σ_0 (i.e. Pat's *remembered situation*) is a situation σ_1 in which Bill has been waiting for Pat, which extends some situation $f(D_s)$. In the classification of the remembered situation, f is a choice function[27] that chooses some situation from the set of situations, D_s.

[9] $$\begin{aligned} & [\![\text{Pat remembered that Bill had been waiting for her}]\!](\sigma_0) \\ = \; & \{\sigma \mid \sigma_0 \sqsubseteq \sigma \text{ and, in } \sigma, \text{ Pat remembers some } \sigma_1 \text{ s.t.} \\ & \qquad \sigma_1 \in [\![\text{Bill has been waiting for Pat}]\!](f(D_s))\} \end{aligned}$$

In [9], the content of Pat's remembering includes more information about Bill than the information that he has been waiting for Pat. For example, if – as we assume – Bill is saliently wearing his favorite Hawaiian shirt in σ_1, Pat will remember this fact in σ_0. This is in line with our intuitions about the content of Pat's remembering in σ_0.

[27]This function may be constrained by pragmatic factors that are dependent on the matrix verb (for *remember*: by the restriction to situations that precede the situation σ_0 in time). These constraints will be taken up in Section 5.3.

The neutrality of some verbs between a CP- and a DP-complement (cf. Sect. 2.1.1) may lead us to expect that referential DPs also receive a situation-specific interpretation in the context of these verbs. This is indeed the case. In particular, for the sentence *Pat remembered Bill* (cf. (4a)), the content of Pat's remembering may – depending on Pat's particular remembering situation – include non-trivial information about Bill which need not correspond to the information about the argument-situation of the sentence *Pat remembered Bill*.

We will see in Section 6 that the situation-specific interpretation of CPs and referential DPs in situated single-type semantics explains the intuitive semantic relations which obtain between some CPs and referential DPs.

This completes our presentation of the assertoricity argument for situated single-type semantics. We close this section by outlining an overgeneralization argument against situated single-type semantics, which is based on the truth-evaluability of other (non-CP or -DP) expressions. We then defend situated single-type semantics against this argument.

4.5. **The Scope of the Assertoricity Argument.** Our previous considerations have supported situated single-type semantics with reference to the assertoric function of DP fragments. However, assertoricity is also a property of non-sentential utterances of expressions from *other* syntactic categories, including adjective and prepositional phrases. For example, in the context from (61), the PP (61a) has the truth- and falsity-conditions of the CP (61b). In the context from (62), the AP (62a) has the truth- and falsity-conditions of the CP (62b) (cf. Stainton 2006).

(61) Sanjay and Silvia are loading up a van. When he sees that Silvia is looking for a missing table leg, Sanjay says (a).
  a. [$_{\text{PP}}$on the stoop]
  b. The missing table leg is [$_{\text{PP}}$on the stoop].

(62) Ray holds up a pen and utters (a).
  a. [$_{\text{AP}}$purchased at Walmart]
  b. This pen has been [$_{\text{AP}}$purchased at Walmart].

A critic of our approach might use the identical truth-conditions of the members of the pairs of phrases from (61) and (62) to argue for a generalization of the assertoricity argument from the traditional types of referential DPs to the types of DPs, APs, and PPs. This generalization could, in turn, be used to question the force of the assertoricity argument as an argument for single-type semantics, or to support the neutralization of the distinction between the above types (as in Sect. 2.4).

However, this generalization is questioned by the special status of DP fragments among the different kinds of non-sentential utterances: In contrast to the assertoric interpretation of non-sentential occurrences of APs and PPs, the assertoric interpretation of DP fragments only has very limited contextual requirements. For example, in virtue of Barbara's salient standing in the door in the situation described by the linguist's ostensive gesture from (56), this gesture provides all information that is required for the assertoric interpretation of (56a) (i.e. the information that Barbara is the person in the door).

This differs from the assertoric interpretations of (61a) and (62a), which require either the availability of a more detailed context (for (61): a context containing information about the identity of the missing object) or the provision of further, extra-contextual, information (here: the information that, in the visual situation from (61) – which only includes Silvia looking for *something* –, Silvia is, in fact, looking for the table leg). This requirement is due to the interpretation of APs and PPs as relations between properties of individuals and to the possible existence of multiple witnesses of these properties. For example, in (61), the stoop may be cluttered with any number of objects, or may display another, more salient, object (e.g. a box of nails) that instantiates the property denoted by (61a). The ambiguity of (61a) between (61b) and (61c) in this context requires the object's further sortal specification.

(61) c. The box of nails is [$_{\text{PP}}$on the stoop].

Admittedly, the identity of the 'intended' object is much less ambiguous in the case of (62). However, it is easy to imagine contexts (e.g. a discussion about places to buy pen refills) – consistent with the immediate communicative context – in which the property from (62a) has a different witness than the one from (62b). In these contexts, (62a) makes a different conversational contribution than (62b). This contrasts with the assertoric interpretation of (56a), which (given an adequatly accurate ostension) always makes the same contribution.

This completes our answer to the overgeneralization argument from non-DP fragments. We close this section by indicating another, higher-level, argument for the special status of the DP/CP relation and against the neutralization of the distinction between the semantic types of APs and PPs. This argument relies on the large number of syntactic and semantic DP/CP similarities (viz. the ability of DPs and CPs to co-occur in numerous syntactic positions, and the ability of DPs to be truth-evaluable and to enter into semantic inclusion relations with CPs; cf. Sect. 6), and on the small number of similarities between DPs and APs and PPs.

We next show how situated single-type semantics answers arguments that are based on the difficulty of substituting a CP by the DP *the proposition* [$_{\text{CP}}$]. Because of the particular role of CP/DP substitutions in these arguments, we hereafter refer to members of this class of arguments as *substitution arguments*.

5. Substitution Arguments against Single-Type Semantics

Substitution arguments against single-type semantics include two arguments that are based on the substitution problem from (Prior 1971) (cf. Bach 1997; Moltmann 2013) and the objectivization effect from (Moltmann 2013). These arguments regard the fact that the replacement of a verb's CP complement by a DP denoting the proposition expressed by the CP often creates a semantically deviant (non-synonymous) sentence (cf. the substitution problem) or changes the reading of the complemented verb (cf. the objectivization effect). In Kastner (2015), DPs of the form *the proposition* [$_{\text{CP}}$] are called *overt definite presuppositionals*. To avoid the presuppositional focus of Kastner's work and to emphasize our restriction to the DP shell *the proposition*, we will hereafter refer to expressions of this kind as *overt propositional CP nominalizations*, or as *propositional CP nominalizations*.

Below, we discuss the two substitution arguments in turn (in Sect. 5.1, 5.2), beginning with the argument from the substitution problem. We then show how situated single-type semantics solves the two problems (in Sect. 5.3). We will see that this solution rests on the particular single-type interpretation of the DP shell *the proposition*, which is reminiscent of the interpretation of the verb *exist* from Section 4.2.3.

5.1. **The Substitution Problem.** The substitution problem is illustrated by the pairs of sentences from (63) to (65).

(63) a. Bill thinks [$_{\text{CP}}$that Pat is avoiding him].
b. $^{??}$Bill thinks [$_{\text{DP}}$the proposition [$_{\text{CP}}$that Pat is avoiding him]].

(64) a. Pat feared [$_{\text{CP}}$that Bill would try to kiss her].
b. $^{??}$Pat feared [$_{\text{DP}}$the proposition [$_{\text{CP}}$that Bill would try to kiss her]].

(65) a. Mary noticed [$_{\text{CP}}$that Pat did not like Bill].
b. $^{??}$Mary noticed [$_{\text{DP}}$the proposition [$_{\text{CP}}$that Pat did not like Bill]].

In particular, while (65a) asserts an obtaining of the 'notice'-relation between Mary and the *fact* that Pat does not like Bill, (65b) asserts the obtaining of this relation between Mary and the *proposition* that Pat does not like Bill. As a result, the complements of the verb *notice* from (65a) and (65b) have a different meaning.

The difference in meaning between a CP and its propositional nominalization is also witnessed by the different conversational contributions of (56b) and (56d) in the context from (56):

(56) A woman is entering the room. A linguist turns to her friend, gestures towards the door, and says (b).
b. [$_{\text{CP}}$Barbara Partee is the person in the door].
d. $^{??}$[$_{\text{DP}}$the proposition [$_{\text{CP}}$that Barbara Partee is the person in the door]]

The semantic difference between the members of (63) to (65), and between (56b) and (56d), is further witnessed by the fact that the second member of each of these pairs is semantically deviant or (even) infelicitous in many contexts.[28] For example, while it is easy to imagine conditions under which the sentences (56b) and (65a) are true, many of the conditions under which (56d) or (65b) are true will be rather contrived (cf. Moltmann 2003, p. 82).

5.2. **The Objectivization Effect.** The objectivization effect regarding propositional CP nominalizations (cf. Moltmann 2003, pp. 86–89; 2013, pp. 131–132) is a particular case of the substitution problem. It differs from most instances of this problem with respect to the semantic naturalness (or felicity) of the resulting sentence: In the case of the objectivization effect, the substitution of a CP complement by its propositional nominalization does *not* yield a semantically deviant or infelicitous sentence. Rather, the substitution changes the reading of the matrix verb to a reading in which the proposition denoted by the CP no longer acts as the *content* of the attitude expressed by the verb. Instead, the proposition becomes the *subject* of the attitude (i.e. the *object* towards which the attitude is directed).

[28]This is indicated by the question marks preceding (63b) to (65b) and (56d).

The described change of verb meaning is illustrated by the pairs of sentences from (66) to (68).

(66) a. Pat remembered [$_{\text{CP}}$that Bill was waiting for her].
b. Pat remembered [$_{\text{DP}}$the proposition [$_{\text{CP}}$that Bill was waiting for her]].

(67) a. Bill imagined [$_{\text{CP}}$that Pat would hug him].
b. Bill imagined [$_{\text{DP}}$the proposition [$_{\text{CP}}$that Pat would hug him]].

(68) a. Mary expects [$_{\text{CP}}$that Pat will avoid Bill at any cost].
b. Mary expects [$_{\text{DP}}$the proposition [$_{\text{CP}}$that Pat will avoid Bill at any cost]].

In the context from (66), the DP *the proposition that Bill was waiting for her [i.e. Pat]* (cf. (66b)) plays a fundamentally different semantic role from the CP *that Bill was waiting for her* (cf. (66a)): While (66a) reports Pat's memory about a concrete situation, i.e. a situation in which Bill was waiting for her (cf. [9]), (66b) reports Pat's memory about an abstract object, i.e. the proposition 'that Bill was waiting for Pat' (cf. Moltmann 2003, p. 87).

5.3. **Answering the Substitution Arguments.** The possibility of using the above problems as arguments against situated single-type semantics presupposes that the interpretations of CP complements be equivalent with the interpretations of the CP's propositional nominalizations in this semantics. This equivalence – and the resulting substitutability of CPs by the described DPs in all linguistic contexts – would then predict that the phrases' embedding sentences from (63) to (68) make the same conversational contribution.

However, as has been suggested in Section 4.2.3, this equivalence does not hold. This is due to the informationally rich single-type interpretation of ordinary, non-existential, CPs at a situation (which also contains all other information that is available at this situation) and the informationally poor single-type interpretation of DPs of the form *the proposition* [$_{\text{CP}}$] at this situation (which only contains the CP's lexical information).

The poor interpretation of propositional CP nominalizations is obtained through the particular interpretation of the DP shell *the proposition*[29] (analogous to the interpretation of the verb *exist*). In situated single-type semantics, this shell is interpreted as a function from type-$\langle s, \langle s, t\rangle\rangle$ objects (here: the single-type interpretation of the CP) to the function from contextually specified situations to the value of the CP's interpretation at the empty situation, † (cf. [4], copied for convenience below).

[4] $$\big\{\langle \pi, \langle \sigma, \pi(\dagger)\rangle\rangle \mid \sigma \in D_s \text{ and } \pi \in D_{\langle s,\langle s,t\rangle\rangle}\big\}$$

The particular interpretation of the DP shell *the proposition* enables the interpretation of (56d) as [10]. Since 'being the person in the door' is an extensional property, [10] is equivalent to [11].

[10] $$\big\{\big\langle \sigma', \{\sigma \mid \text{Barbara is the person in the door in } \sigma\}\big\rangle \mid \sigma, \sigma' \in D_s\big\}$$

[11] $$= \big\{\big\langle \sigma', \{\sigma \mid \text{Barbara is an inhabitant of } \sigma \text{ and is the person in the door in } \sigma'\}\big\rangle \mid \sigma, \sigma' \in D_s\big\}$$

[29]For reasons of space, we here neglect the interpretation of other CP nominalizations (e.g. *the fact* [$_{\text{CP}}$], or *the possibility* [$_{\text{CP}}$]), which have different semantic properties.

In the example universe from Section 4.2.4 (cf. Fig. 1), the interpretation of (56d) at the situation σ_0 is instantiated by the set $\{\sigma_0, \sigma_1\}$.[30] This contrasts with the interpretation of (56b) at σ_0, which is only instantiated by the singleton set $\{\sigma_0\}$ (cf. Sect. 4.2.4). The above motivates the following proposition:

Proposition 6. *At each contextually specified situation, the situated single-type interpretation of a propositional nominalization of an upward-entailing CP containing a referential DP* is a superset of *the situated single-type interpretation of the CP and* is a proper subset of *the situated single-type interpretation of a simple existential containing the DP. At the empty situation † or at a situation which only contains the lexical information of the CP, the interpretation of the nominalization* is identical to *the interpretation of the CP.*

The difference between the interpretations of CPs and their propositional nominalizations in situated single-type semantics explains the difference in the conversational contribution of each of the members from (63) to (68). The objectivization effect is further explained by the fact that a CP's interpretation-at-a-situation is associated with (the information encoded in) a *situation* (cf. Sect. 4.4), while the interpretation-at-a-situation of the CP's propositional nominalization is associated with the CP's lexical information (i.e. with a propositional *object*). Association with a situation and with a propositional object then motivate the role of the attitude's *content* or, respectively, of the attitude's *object*.

We have noted above that the replacement of the DP shell *the proposition* by an alternative shell (e.g. *the fact*, or *the possibility*) restores some of the equivalences from Section 5.1. For example, in contrast to (64b) and (66b), (64c) and (66c), below, *do* make the same contribution as (64a) and (66a) (cf. Moltmann 2003, pp. 83–84; Moltmann 2013, pp. 124, 151).

(64) c. Pat feared [$_{\text{DP}}$*the possibility* [$_{\text{CP}}$that Bill would try to kiss her]].

(66) c. Pat remembered [$_{\text{DP}}$*the fact* [$_{\text{CP}}$that Bill was waiting for her]].

Moltmann (2013) conjectures that past-oriented factive verbs like *remember* allow their CP complements to be replaced by the DP *the fact* [$_{\text{CP}}$], while negative future-oriented verbs like *fear* tolerate that their CP complement be replaced by the DP *the possibility* [$_{\text{CP}}$] (p. 128). Her conjecture suggests[31] an effect of the identity of the complement-taking verb on the interpretation of the complement (s.t. the CP is interpreted as a proposition-type object, a fact-type object, or a possibility-type object).

In situated single-type semantics, this effect is captured by pragmatic constraints on the choice function f that selects the complement's interpreting situation (cf. Sect. 4.4). These constraints are imposed by the verb that takes the complement as its argument. For example, the verb *remember* restricts the choice function to situations that temporally *precede* the interpreting situation of the sentence containing this verb; the verb *fear* restricts this function to situations that may temporally *follow* the interpreting situation of the sentence containing

[30]Note that, in the above example, (56d) has the same situation-specific interpretation as the CP *Barbara Partee exists* (i.e. (56c)). However, this identity is only incidental: in an alternative universe in which Barbara is only wearing a red sweater in σ_1, (56d) is interpreted as the singleton set $\{\sigma_0\}$ at σ_1, while (56c) is still interpreted as the set $\{\sigma_0, \sigma_1\}$.

[31]For reasons expounded in (Moltmann 2003) (cf. Moltmann 2013), Moltmann does, however, not endorse such an effect.

this verb. These restrictions explain the possibility of replacing the CP by the DP *the fact* [$_{\text{CP}}$] in (66a) (in the case of precedence; cf. (66c)) and of replacing the CP by the DP *the possibility* [$_{\text{CP}}$] in (64a) (in the case of postcedence; cf. (64c)). Inversely, these restrictions explain the impossibility of replacing the CP by the DP *the possibility* [$_{\text{CP}}$] in (66a) (cf. (66d)) and of replacing the CP by the DP *the possibility* [$_{\text{CP}}$] in (64a) (cf. (64d)).

(64) d. ??Pat feared [$_{\text{DP}}$*the fact* [$_{\text{CP}}$that Bill would try to kiss her]].

(66) d. ??Pat remembered [$_{\text{DP}}$*the possibility* [$_{\text{CP}}$that Bill was waiting for her]].

We leave the detailed development of the interpretation of the above DP shells as a topic for future research.

This completes our presentation and defense of the assertoricity argument for situated single-type semantics. We next present a third series of arguments for this semantics, which is based on the ability of situated single-type semantics to explain the semantic relations between CPs and referential DPs. Because of the prominent role of entailment[32] among the different semantic relations in these arguments, we refer to members of this class of arguments as *entailment arguments.*

6. Entailment Arguments for Single-Type Semantics

Entailment arguments for single-type semantics contain the argument from fragments (cf. Sect. 6.1) and the argument from neutral contexts (cf. Sect. 6.2). The first argument is based on the observation that DP fragments intuitively stand in mutual semantic inclusion (or *equivalence*) relations to their associated CPs in the situation specified by the communicative context, such that the replacement of a DP fragment by its associated CP does not change the conversational contribution of the utterance in this context. The second argument is based on the observation that, in some linguistic contexts, embedded occurrences of DPs also enter into semantic inclusion relations with their containing CPs. This happens in the context of DP/CP complement-neutral verbs and prepositions (cf. Sect. 2.1) and in the context of DP/CP coordinations (cf. Sect. 2.2.1). Below, we discuss these arguments in turn, beginning with the argument from fragments.

6.1. **The Argument from Fragments.** We have noted in Section 4 that utterances of DP fragments in a given communicative context share the truth- and falsity-conditions of their associated CPs. The propositional interpretation of DP fragments further explains the obtaining of intuitive equivalence relations between DP fragments and CPs, such that DP fragments more generally display the semantic behavior of CPs. The obtaining of such relations is witnessed by the fact that, in the context from (56) (i.e. the linguist commenting her gesture towards the door), the replacement of the DP *Barbara Partee* (i.e. (56a)) by the CP *Barbara Partee is the person in the door* (i.e. (56b)) preserves the linguist's conversational contribution.

We have suggested above that dual-type semantics explain the equivalence of CPs and DP fragments in a given context via ellipsis (cf. Merchant 2005)

[32]To avoid generalizing the term *entailment* to include the semantic relation between pairs of expressions from distinct syntactic categories, we here call the relation of truth-implication (s.t. q-interpreted-at-σ is true whenever p-interpreted-at-σ is true) *semantic inclusion (of q in p).*

or flexible DP-typing (cf. Progovac 2013). In contrast, situated single-type semantics explains this relation *without* resort to such mechanisms.[33] In particular, since this semantics identifies the interpretation of a referential DP at a contextually specified situation with the interpretation-at-this-situation of upward-entailing CPs containing the DP which are true in this situation (cf. Prop. 4), DP fragments will, at some situations, be single-type equivalent to such CPs. For convenience, we will hereafter refer to the equivalence between the *values* of single-type interpretations at a contextually specified situation σ_0 as ***contextual*** *equivalence* (***at*** $\boldsymbol{\sigma_0}$), or as $\boldsymbol{\sigma_0}$*-equivalence.*

In virtue of the above, the contextual equivalence of CPs and DP fragments has a simpler explanation in (situated) single- than in dual-type semantics. However, there are even a number of phenomena which *resist* an analysis through non-standard mechanisms in dual-type semantics, such that they *only* have an explanation in single-type semantics. These phenomena concern the semantic inclusion properties of embedded occurrences of referential DPs, whose particular interpretation in the relevant context is *not* triggered by a mismatch between the verb- (or preposition-) and argument-types. In particular, since the standard type of referential DPs matches the standard type of prepositional complements, e, the interpretation of PPs like *durch einen Pfeiler* (cf. (20a)) does not solicit a shift in the meaning of the DP *ein*(*en*) *Pfeiler*. Yet, in the described context, the DP is equivalent to the CP *dass Peter einen Pfeiler aufstellt*, as we will see below.

6.2. **The Argument from Neutral Contexts.** We have seen in the previous section that DP fragments stand in a mutual semantic inclusion relation to their associated CPs in a given communicative context, such that the replacement of a DP fragment by its associated CP preserves the relevant linguistic contribution in this context. The inclusion properties of DP fragments are shared by some embedded (i.e. non-fragment) occurrences of referential DPs, which allow their meaning-preserving substitution by a CP in the contexts from Sections 2.1 and 2.2.1. The replacement of the DP *ein*(*en*) *Pfeiler* by the CP *dass er [i.e. Peter] einen Pfeiler aufstellte* in the context of the expression *Peter stützte das Dach durch* (cf. (20)) is an example of such substitutions. Meaning-preserving DP/CP substitutions at certain argument-situations are further exemplified by the replacement of the DP *Bill* by the CP *that Bill had been waiting for her [i.e. Pat]* in the context of the expression *Pat remembered* (cf. (4), (60)).

The equivalence between the members of the above DP/CP pairs is supported by the intuitive redundancy which results from coordinating the complements of the different occurrences of *remember* from (4a) and (60) (in (69); cf. (23)) or of the (pro-)preposition (*da-*)*vor* from (20) (in (70)), and by the difficulty of negating *only one* (but not the other) conjunct in these coordinations (cf. (74), (72)).

(69) Pat remembered [$_{\text{DP}}$Bill] and [$_{\text{CP}}$that he had been waiting for her].

(70) Peter stützte das Dach [$_{\text{PP}}$durch [$_{\text{DP}}$einen Pfeiler]] und [$_{\text{PP}}$dadurch, [$_{\text{CP}}$dass er einen Pfeiler aufstellte]].

[33]Note that, like the ability of single-type semantics to explain the truth-evaluability of DP-fragments (cf. Sect. 4), the ability of single-type semantics to explain the contextual equivalence of CPs and DP fragments is specific to our particular brand of single-type semantics, i.e. situated single-type semantics. In Sect. 6.2, we will make a similar observation for the ability of single-type semantics to explain the semantic inclusion relations between CPs and non-fragment DPs.

[*gloss:* Peter supported the roof through a beam and by putting up a beam.]

Consider the DP/CP coordination from (70): The described feeling of redundancy with respect to this coordination is brought about by the fact that the semantic information of the phrase *dass er [i.e. Peter] einen Pfeiler aufstellte* intuitively already contains the information of the phrase *ein*(*en*) *Pfeiler*, such that the CP semantically *includes* the DP. Since its installation (by Peter) is further the *only* relevant information about the beam in most standard contexts (s.t. the DP also includes the CP), the bracketed DP and the CP from (70) are semantically equivalent.

The semantic inclusion of the DP in the CP from (70) is further supported by the possibility of replacing the coordinator *und* in (70) by the specifier *nämlich* [Engl.: *viz.*, or *namely*] (in (71)) and by the difficulty of negating only the DP conjunct[34] (but not the CP conjunct) in (70) (in (72a)).

(71) Peter stützte das Dach [$_{\text{PP}}$durch [$_{\text{DP}}$einen Pfeiler]]; *nämlich* [$_{\text{PP}}$dadurch, [$_{\text{CP}}$dass er einen Pfeiler aufstellte]].

[*gloss:* Peter supported the roof through a beam, *viz.* by putting up a beam.]

(72) a. # Peter stützte das Dach *nicht* [$_{\text{PP}}$durch [$_{\text{DP}}$einen Pfeiler]], sondern [$_{\text{PP}}$dadurch, [$_{\text{CP}}$dass er einen Pfeiler aufstellte]].

[*gloss:* Peter did *not* support the roof through a beam, but by putting up a beam.]

b. ?? Peter stützte das Dach [$_{\text{PP}}$durch [$_{\text{DP}}$einen Pfeiler]], aber *nicht* [$_{\text{PP}}$dadurch, [$_{\text{CP}}$dass er einen Pfeiler aufstellte]].

[*gloss:* Peter supported the roof through a beam, but *not* by putting up a beam.]

In particular, since the beam is (trivially) the salient instrument in the installation of a beam, the information that Peter did *not* support the roof *through* a beam is incompatible with the information that he supported the roof *by putting up* a beam (cf. (72a)).

The semantic inclusion of the CP- in the *DP*-conjunct of the coordination from (70) is supported by the difficulty of negating only the CP conjunct (but not the DP conjunct) in (70) (in (72b)). In particular, since the *installation of* a beam is the only typical (or standard) way of supporting a roof *through* a beam, the information that Peter did *not* support the roof *by putting up* a beam is incompatible with the information that he supported the roof *through* a beam. In virtue of this fact, the CP conjunct of the coordination from (70) is semantically included in the coordination's DP conjunct *in all typical* (*or standard*) *contexts*. The context-generality of the semantic inclusion of the DP in the CP (cf. (71), (72a)) then ensures the conjuncts' equivalence in all standard contexts.

In contrast to the conjuncts of the coordination from (70), the conjuncts of the coordination from (69) are only equivalent *in some special contexts*. This is due to the fact that the DP *Bill* only semantically includes the CP *that Bill had*

[34]Since the negation of referential DPs is unavailable in most languages (including German and English), we negate instead the first occurrence of the matrix verb.

been waiting for her [i.e. Pat] in contexts (e.g. Pat's remembered situation σ_4 from Sect. 4.4) in which Bill's waiting for Pat is a salient property of Bill.[35] The context-specificity of the inclusion of the CP in the DP then effects the context-specificity of the equivalence. Since Bill is (trivially) the agent in Bill's waiting for Pat (s.t. the semantic information of the phrase *that Bill had been waiting for her [i.e. Pat]* always contains the information of the name *Bill*), the semantic inclusion of the DP in the CP holds in all contexts, as for the conjuncts from (70).

The (context-)general inclusion of the DP *Bill* in the CP *that Bill had been waiting for her [i.e. Pat]* is further supported by the possibility (analogous to (71)) of replacing the coordinator *and* in (69) by the specifier *viz.* (in (73)) and by the difficulty (analogous to (72a)) of negating only the DP conjunct in (69) (in (74a)).

(73) Pat remembered [$_{\text{DP}}$Bill], *viz.* [$_{\text{CP}}$that he had been waiting for her].

(74) a. $^{\#}$ Pat *did not* remember [$_{\text{DP}}$Bill], but remembered [$_{\text{CP}}$that he had been waiting for her].

b. $^{??}$ Pat remembered [$_{\text{DP}}$Bill], but *did not* remember [$_{\text{CP}}$that he had been waiting for her].

The context-specific inclusion of the CP *that Bill had been waiting for Pat* in the DP *Bill* is supported by the fact that the negation of the CP conjunct in (69) (in (74b)) is only difficult in certain contexts in which Bill's waiting for Pat is a salient property of Bill. The negation of the CP is semantically consistent in contexts in which Bill's waiting for Pat is *not* a salient property of Bill. This fact is captured by the superscript question marks preceding (74b).

We have noted in the introduction to this section that the semantic inclusion properties of embedded DPs resist an explanation in dual-type semantics. This is due to the fact that the DPs' embedding contexts do not display any obvious type mismatches which would motivate an e-to-t or t-to-e shift (cf. Strategy (ii) from Sect. 2.3), that the (pro-)preposition *(da-)vor* is not presuppositional (s.t. it does not introduce the determiner Δ; cf. Strategy (iv)), and that the CP *dass er einen Pfeiler aufstellte* (cf. (70)) lacks a meaning-preserving overt DP shell (cf. Strategy (iii); (20b)$'$, (20b)$''$ in Sect. 2.3).

Since situated single-type semantics interprets referential DPs in the type of CPs, $\langle s, \langle s, t\rangle\rangle$, it explains the semantic inclusion properties of referential DPs. In this semantics, the semantic inclusion (or entailment) between expressions at a particular situation σ_0 is defined via the inclusion relation between the values of the expressions' interpretations *at that situation* (for the conjuncts from (69): by the inclusion relation between the sets of situations from [12] and [13]). The *general* semantic inclusion between two expressions is defined via the (pointwise) inclusion between the values of the expressions' interpretations *for each situation-argument*. For convenience, we hereafter refer to the inclusion relation between the values of single-type interpretations at a contextually specified situation σ_0 as ***contextual*** *inclusion* (***at*** $\boldsymbol{\sigma_0}$), or as $\boldsymbol{\sigma_0}$*-inclusion* (analogous to the notion of σ_0-equivalence from Sect. 6.1), and refer to the inclusion relation between the interpretations' values across all contextually specifiable situations as ***general*** *inclu-*

[35]These contexts need not be identical to the situation which serves as the argument of the interpretation of (69) (cf. Sect. 4.4). However, since different intentional acts (e.g. remembering) have different targets, the choice of these contexts still depends on this situation.

sion, or simply as *(semantic) inclusion*.

[12] $\{\sigma \mid \sigma_0 \sqsubseteq \sigma$ and Bill is an inhabitant of $\sigma\}$

[13] $\{\sigma \mid \sigma_0 \sqsubseteq \sigma$ and Bill is an inhabitant of σ and Bill has been waiting for Pat in $\sigma\}$

The general inclusion of a DP in a CP is witnessed by the expressions *Bill* and *that Bill had been waiting for her [i.e. Pat]* from (69) and by the expressions *ein* (*-en*) *Pfeiler* and *dass er [i.e. Peter] einen Pfeiler aufstellte* from (70). The obtaining of this relation is ensured by the existential presupposition of the matrix verb in the CPs from (69) and (70) (s.t., if somebody is waiting for someone in a situation, this somebody – though not necessarily this someone – is an inhabitant of that situation). Since the support of roofs *through* a beam typically lies in the *installation of* a beam (s.t., if somebody supports a roof through a beam in a situation, (s)he supports the roof by putting up a beam in that situation), the conjuncts of the coordination from (70) also witness the general inclusion of the CP in the DP.

The contextual inclusion of a CP in a DP is witnessed by the conjuncts of the coordination from (69). In particular, if Bill has the property of waiting for Pat in the contextually determined situation, the interpretation of the CP *that Bill is waiting for Pat* in that situation will include the interpretation of the DP *Bill*. The failure of this inclusion at situations in which Bill does not saliently have the property of waiting for Pat (s.t. the interpretation of the DP in these situations properly includes the interpretation of the CP) makes the described inclusion relation a context- (or situation-)dependent relation.

Notably, the discussed inclusion relations between DPs and CPs are independent of the fact that the DP and CP occur in the complement of a DP/CP-neutral verb or (pro-)preposition. The DP's and CP's embedding context is merely a linguistic device which helps display the relevant semantic relation. The use of this device is made necessary by the fact that speakers' judgements about equivalence are typically restricted to CPs. It is enabled by the compositionality of natural language interpretation and by the identity of the embedding contexts of the complements of the two sentences from (4) and (20).

This completes our presentation of arguments for the adoption of a situated single-type semantics. We close our paper with a summary of the different support for single-type semantics and with pointers to future work.

7. Conclusion

In this paper, we have provided different arguments for the adoption of a single-type semantics – in particular, for the adoption of *situated* single-type semantics. These arguments include the ability of situated single-type semantics to provide a uniform account of the distributional similarities between CPs and referential DPs, to explain the truth-evaluability of DP fragments, and to explain the semantic relations between CPs and DPs. The arguments all capitalize on the ability of single-type semantics to model the above phenomena without the use of non-standard syntactic or semantic mechanisms. The presented arguments improve upon the strength and scope of Partee's original argument for single-type semantics: Instead of only supporting the indirect uni-directional shiftability between propositions and individuals, they challenge the semantic distinction between propositions and individuals. Since our arguments further draw on differ-

ent kinds of phenomena (esp. on syntactic vs. semantic/illocutionary phenomena) and are directed at different goals (unification vs. explanation), they further provide more diverse support for single-type semantics than Partee's argument.

Our considerations in this paper have focused on phenomena which illustrate the advantages of situated single-type semantics over traditional dual-typed semantics. However, we have also identified several phenomena whose accommodation seems to pose a *challenge* for situated single-type semantics. These include distributional differences between DP and CP, the difficulty of meaningfully replacing a CP by the phrase *the proposition* $[_{\text{CP}}\ ]$ in many linguistic contexts, and the seeming possibility of generalizing the arguments from distributional DP/CP similarities and from DP assertoricity to other kinds of expressions besides DPs or CPs. Our paper has identified a number of strategies that answer the associated arguments against single-type semantics. These strategies use established ways of distinguishing (syntactic or semantic) subcategories.

The existence of strong support for situated single-type semantics suggests that this semantics can be used as a formal theory of meaning for natural language. For the familiar fragment of English from (Montague 1973) (often called *the PTQ-fragment*), this suggestion is implemented in (Liefke 2014, Ch. 8). However, since this fragment lacks DP/CP complement-neutral verbs and prepositions, specificational constructions, proposition anaphora, and DP-fragments, this implementation does not very well showcase the merits of situated single-type semantics. The single-type interpretation of a proper extension of the PTQ-fragment by these expressions – which compensates for the above problem – will be a project for future work. This work will also include an explicit proof that situated single-type semantics preserves the modeling and explanatory power of dual-type semantics and that it supports the accepted predictions about entailment.

For reasons of scope, we have limited our considerations in this paper to *empirically*-informed support for situated single-type semantics. However, there are also other kinds of support for this semantics. These include *formal* support (which regards the possibility of constructing situated single-type models; cf. Liefke 2014, Ch. 8), *philosophical* support (which regards the ability of situated single-type semantics to solve open problems in the philosophy of language; cf. Liefke and Bowker forthcoming), and *methodological* support (which regards the use of situated single-type semantics in simplifying – and in identifying relations[36] between – different type-logical semantics). We expect that the identification of such relations will answer a number of questions about the salience of Montague's linguistic ontology, that it will yield insight into the requirements on minimal models for (certain fragments of) natural language, and that it will contribute to a better understanding of the linguistic type system.

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[36]These relations include the semantics' relative consistency and their (mutual) reducibility.

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