Fodor’s puzzle and the semantics of attitude reports

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Abstract  Fodor (1970) came up with the following puzzle: in a context where Adrian has decided what kind of jacket to buy but has no idea that the kind of jacket he wants is just like Malte’s jacket, there is a reading of Adrian wants to buy a jacket like Malte’s which neither the de re nor the de dicto reading render correctly. Based on a review of approaches to Fodor’s puzzle in the literature I argue that none of the proposals in the literature provides a general account of Fodor’s puzzle by providing counterexamples to Kaufmann’s de qualitate approach (Schwager (2009)). Based on a detailed reconstruction of Fodor’s puzzle in an extension of Discourse Representation Theory to the representation of attitudes I raise doubts whether such a general solution exists. Instead, I argue that Fodor’s puzzle points to limitations in current logical form formalisms for the semantic analysis of attitude reports and propose to approach Fodor’s puzzle in a purpose-based account of attitude reports.

Keywords: attitude reports, ambiguity, opacity, discourse representation theory

1 Making sense of attitude reports

1.1 The de re and de dicto sense of attitude reports

This paper is devoted to the different senses of the attitude report in (1).

(1) Adrian wants to buy a jacket like Malte’s.

Basically, there are two senses of Adrian wanting to buy a jacket like Malte’s that (1) can express. These two senses can be distinguished by considering a minimal pair of contexts 1 for (1), as in (2a) and (2b), where one sense evaluates as true in (2a) but false in (2b) and vice versa for the other sense.

1 It is important that the notion of context as I use it in this paper is kept distinct from the notion of an utterance context in the tradition of Kaplan (Kaplan (1977/1989)). Kaplanian utterance contexts only have to do with indexicality. What is definitely not part of utterance contexts thus conceived is the situation that the utterance targets as that which it talks about. Barwise & Perry (1983) gave the notion that targeting a given part of reality as that which is being described in a world-oriented utterance is something that cannot be reconstructed from the uttered sentence as such, but that is nevertheless essential to the question whether the utterance is true or false. They drew the distinction between utterance situations, which play the role as utterance contexts in the Kaplanian sense and
(2)  
  a. Adrian has decided to buy a certain jacket but has no idea that the jacket he wants to buy is like Malte’s.
  
  b. Adrian has not decided which jacket he wants to buy but he wants it to be like Malte’s.

If (1) is interpreted in contexts (2a) and (2b) respectively, Adrian’s desire can be roughly paraphrased as in (3a) and (3b).

(3)  
  a. There is a jacket like Malte’s which Adrian wants to buy.
  
  b. Adrian wants to buy something that is a jacket like Malte’s.

The two distinct senses of (1) – the *de re* (3a) and the *de dicto* (3b) sense – correspond to a structural contrast that emerges in the logical form of (1) from placing the phrase *a jacket like Malte’s* either outside (4a) or inside (4b) the scope of the attitude verb *want*. In the following, I take the term *sense* to refer to a logical form which is assigned to a sentence like (1) from a repertoire of logical forms provided by a certain logical form formalism such as e.g. intensional first-order predicate logic.

(4)  
  a. De re: $(\exists x)\text{jacket}(x) \& \text{like-Malte’s-jacket}(x) \& \text{wants}(\text{Adrian}, \text{buy}(\text{Adrian},x))$
  
  b. De dicto: $\text{wants}(\text{Adrian}, (\exists x)\text{jacket}(x) \& \text{like-Malte’s-jacket}(x) \& \text{buy}(\text{Adrian},x))$

Furthermore, I call situations that discriminate senses of attitude reports in that they render one sense of a sentence true and all other senses false *discriminating contexts*, an example being the distinction between *de re* and *de dicto* established by the situations (2a) and (2b). Because a discriminating context identifies one logical form from a repertoire of possible logical forms of a given sentence such as (1), the amount and type of discriminating contexts for a given sentence is related with the type and expressiveness of the repertoire of logical forms provided by a logical form formalism. The more expressive a logical form formalism is, the more different senses of a given sentence can be identified with discriminating contexts. That is, a coarse-grained logical form formalism will miss many of the subtle differences between senses of a given sentence that discriminating contexts identify in a fine-grained logical form formalism. While it is important to note that a discriminating context requires that one sense of an attitude report is taken as the starting point for the discrimination of other senses it is not necessary to assume that this sense what they refer to as ’Austinian’ situations, the described situation being that part of the world that the utterance is about and without there is no distinguishing between true and false. In the following, the terms *context, situation* or *scenario* refer to what the utterance should be construed as talking about.
is assumed to be the default or unmarked sense. Consequently, the notion of a
discriminating context is independent of whether one adopts the position that “de re
construals are ceteris paribus preferred wherever possible” (Heim 1992: 211) or
endorses the view that “common wisdom certainly has it the other way round: de
dicto readings are the unmarked choice” (Heim 1992: 210).

1.2 Fodor’s puzzle

Consider the context for (1) in (5) proposed by Fodor (1970).

(5) Adrian has decided what kind of jacket to buy but has no idea that the kind of
jacket he wants is just like Malte’s jacket. (Fodor (1970: cf. 229))

There is a natural interpretation of (1) given the context (5) that neither the de re
(4a) nor the de dicto (4b) sense render correctly. The de re sense (4a) is wrong
for this interpretation of (1) because the quantifier (∃x) involved in the phrase a
jacket like Malte’s entails that there is some particular jacket of which it is true that
Adrian wants to buy it. And the de dicto sense (4b) is wrong because it represents
the description like Malte’s jacket as part of the content of Adrian’s desire, which in
the given context it is not. Hence, the context (5) is a discriminating context because
it discriminates between the de re and the de dicto sense of (1) on the one hand and
an additional sense of (1) on the other, which is distinct from both the de re and the
de dicto sense. But what is the logical form of the sense in which (1) is true in (5)
that is neither captured by the logical form of the the de re nor the de dicto sense?
Fodor (1970) showed that under the transitivity of scope relations, not all of the three
conditions (6a) - (6c) imposed on the additional sense of (1) by the discriminating
context (5) can be satisfied by a formula of first-order intensional predicate logic at
once (Fodor (1970: cf. 242)).

(6) a. The noun phrase a jacket like Malte’s must be within the scope of the
existential quantifier introduced by a jacket if its variable is to be co-
referential with the object of Adrian buy . . .

b. The existential quantifier must be within the scope of the verb wants if it is
to express the narrow scope reading.

c. The noun phrase a jacket like Malte’s must be outside the scope of wants
if it is to express the reading which is transparent for descriptive content.

2 Unless indicated different, I adapt all contexts retrieved from the literature on Fodor’s puzzle to one
uniform naming of persons and jacket brands.
Taken together, the existence of a sense of (1) which is distinct from both the *de re* and the *de dicto* sense but which can not be formalized within a logical form formalism that expresses the difference between *de re* and the *de dicto* with the help of scope relationships constitute what I call *Fodor’s puzzle* in the following. Because there is no straightforward logical form to be assigned to (1) in context (5) but only some intuition invoked by the discriminating context, it can be expected that formal approaches to Fodor’s puzzle heavily rely on the discriminating context which is employed to identify the additional sense of (1).

### 1.3 Discriminating senses of Fodor’s puzzle

(7a)-(7c) are paradigmatic examples for contexts that have been suggested in the literature on Fodor’s puzzle.

(7)  

a. A store sells some jackets that all look like Malte’s and Adrian does not know anything about Malte. Assume further that Adrian wants one of those jackets and any of them is an option. Romoli & Sudo (2009: cf. 427)

b. Adrian’s desire is to buy some jacket or other, and the only important thing is that it be a Burberry jacket. Unbeknownst to him, Malte’s jacket is one of those as well. von Fintel & Heim (2011: cf. 100)

c. Malte and Adrian do not know each other. Adrian has seen a green Burberry jacket in a catalogue and wants to buy one. Malte happens to own precisely such a green Burberry jacket. Schwager (2009: cf. 395)

At a first glance, it seems as if there is no big difference between the contexts (7a)-(7c). But now have a look at the senses (8a) - (8c) which these contexts discriminate according to the logical forms that are assigned to (1) by the respective authors.

(8)  

a. ad. (7a): $\exists X : \text{coats} - \text{like} - \text{malte}'s(X)$ and Adrian wants to buy one of $X$

b. ad. (7b): Adrian wants$_{w_0}$ $[\lambda w'[a - \text{jacket} - \text{like} - \text{maltes}_{w_0}]\lambda x_1[\text{PRO to buy}_{w,x_1}]]$

c. ad. (7c): For the sake of reporting an attitude, a property that is involved in the content of the attitude that is to be reported (the reported property) can be replaced by a different property (the reporting property) as long as the reported property is a subset of the reporting property at all relevant worlds.

Formally, if $Q$ is the reporting property (*like Malte’s jacket*) and $Q'$ is the reported property:
Attitude_w(x, ⟨P, Q⟩) (where P a structured proposition and Q a property),
iff there is a property Q’ sth. at the w-closest worlds w’ where Q(w’) ≠ ∅:
Q’(w’) ≠ ∅
Q’(w’) ⊆ Q(w’)
Attitude_w(x, λw’P_w’(Q’)) is true.

(8a) says that Adrian stands in a causal relation of acquaintance with a jacket he is
going to buy. The interpretation of like Malte’s jacket is established by the fact that
Adrian’s choice for one of the jackets from the set of jackets like Malte’s doesn’t
matter, because they are all like Malte’s and any jacket that is an option for Adrian is
de facto a jacket like Malte’s. Things are different for (8b). Here, Adrian only stands
in a causal relation of acquaintance with a jacket which is like Malte’s jacket. No
causal relation of acquaintance with a jacket Adrian is going to buy is involved in
(8b). The sense that (8b) assigns to (1), based on the scenario (7b), is that Adrian
wants to buy a jacket like a jacket like Malte’s. Consequently, unlike the sense that
(7a) identifies, the interpretation of like Malte’s jacket depends on Adrian’s choice
in that those jackets Adrian singles out in his desire worlds should be drawn upon
for the judgement of the report to be true. This may sound like a subtly but it is
not: the truth-conditions in (8a) predict that a report of Adrian’s attitude in context
(7b) with (1) is false, because there exists no set of jackets Adrian wants to buy one
of. Accordingly, (8b) makes the right prediction for (1) in (7a) but (8a) makes the
wrong prediction for (1) in (7b).

Next, compare the sense that (8b) assigns to (1) with the sense identified in Kauf-
mann’s proposal (8c) – Schwager (2009) – based on the context (7c). Kaufmann’s
point is that Fodor’s puzzle is not about causal relations of acquaintance with jackets
at all and thus, unlike in the von Fintel & Heim (2011) context there exists no jacket
like Malte’s jacket in the real world to which Adrian or the reporter stand in a causal
relation of acquaintance. Consequently, the senses of (1) that von Fintel & Heim
(2011) and Romoli & Sudo (2009) identified with their contexts are rendered false if
we take (7c) as the scenario in which the logical forms of these senses are evaluated.
In the context (7c), neither is there provided a jacket like Malte’s in the actual world
such that Adrian wants to buy a jacket like this jacket in all of his desire worlds nor is
there provided a set of jackets like Malte’s such that Adrian wants to buy one of them.

All the contexts (7a)-(7c) are discriminating contexts in that they render the de re
and de dicto sense wrong but suggest that there exists a further sense in which (1) is
true. But von Fintel & Heim (2011)’s context does more than just distinguishing a
sense of (1) from the de re and de dicto sense. It also falsifies the sense identified by
Romoli & Sudo (2009). Hence, (7a) and (7b) distinguish a sense of (1) distinct from
de re and de dico but in addition, (7b) shows that the sense (8b) is distinct from de
re, de dico and (8a). Similar considerations hold for Kaufmann’s context. (7c) not only falsifies the de re and de dicto sense but also the senses identified by von Fintel & Heim (2011) and Romoli & Sudo (2009). Accordingly, Kaufmann’s context is a discriminating context that sets apart Kaufmann’s proposal from de re, de dico, (8a) and (8b). If we use the discriminating contexts (7a)-(7c) as contexts for (1), it is nearby to relate the order of discrimination of senses starting from (7a) and ending with (7c) to an increase in generality of senses identified. That is, von Fintel & Heim (2011)’s sense subsumes Romoli & Sudo (2009)’s sense because it evaluates to true in Romoli & Sudo (2009)’s discriminating context. Schwager (2009)’s sense subsumes von Fintel & Heim (2011)’s sense and Romoli & Sudo (2009)’s sense because it evaluates to true in their discriminating contexts as well. This suggests that Schwager (2009)’s approach to Fodor’s puzzle is a general solution to the puzzle.

The review of the literature shows that contexts play a dual role in Fodor’s puzzle. First, they show us that neither of the logical forms that a certain logical form formalism makes available for a sentence like (1) capture between them all the possible readings that the sentence apparently has: a given discriminating context is presented in which the sentence is intuitively true but in which the other two logical forms are both verifiably false. Such contexts show that some other way of identifying the readings of the sentence is needed, which permits the identification of the sense or senses that hold in the given scenario. Once this first point has been established (and this much can be said to have already been accomplished by Fodor), further investigation can take one of two forms: (i) find a more expressive formalism which allows the formulation of one or more logical forms for the sentence that hold in the given scenario and that qualifies a sense or several senses for the sentence (ii) explore more scenarios in which the sentence is intuitively true but the previously proposed logical forms are not, and try to decide whether these identify additional senses to the one or ones identified by the original scenario. In this paper, I attempt to combine both types of further investigation: (a) to develop a formalism in which the sense or senses that have been identified as missing by one or more scenarios thus far contructed for this purpose (b) to see if the new formalism is still missing some senses and (c) to differentiate as far as possible between the different logical forms that the new formalism makes available for the sentence: if a scenario can be found in which the sentence is intuitively true and in which one logical form holds but another does not, then that may be strong evidence that these two logical forms identify distinct senses. In order to have a handy term for the range of senses that have been identified in the setting of Fodor’s puzzle, I refer to senses that are not captured by the de re and the de dicto sense and which are discriminated by contexts of the type proposed by Fodor Fodorian senses.
### 1.4 Outline of the paper

This paper has four closely related goals. Section 2 is concerned with the characterization of the type of ambiguity that is involved in Fodor’s puzzle. Making explicit the relation between a discriminating context and the sense of (1) that it identifies is the second goal of this paper. This is the topic of section 4. I propose that making the relation between discriminating context and sense identification of (1) explicit requires a theory of relations of acquaintance and argue for the use of an extension of Discourse Representation Theory (DRT, Kamp (1984), Kamp & Reyle (1993), Kamp et al. (2011)) to the representation of attitudinal states (sections 3 and appendix A). The third goal of the paper is to show that Kaufmann’s sense of (1) does not capture the full range of Fodorian senses. In section 5, I present a variant of the discriminating context for von Fintel & Heim (2011)’s sense which renders only (8b) true and thus shows that the senses identified by von Fintel & Heim (2011) and Schwager (2009) are as distinct from each other as they are distinct from the de re and de dicto sense. I also present yet another context which discriminates a Fodorian sense of (1) which none of the proposals in the literature captures correctly. Finally, this paper explores some of the general consequences of Fodor’s puzzle for the semantics of attitude reports in section 6.

### 1.5 Scope of the paper

In order to avoid confusion, I sharply delimit the scope of this paper. This paper is exclusively devoted to the discussion of the attitude report given in (1). As long as the semantics of (1) in the Fodorian setup is not fully understood, it seems a bit too hasty to me to claim that Fodor’s puzzle is of the same type as certain other puzzles which have been observed to arise in the interpretation of conditionals or tensed sentences (Keshet (2011), Schwarz (2012)). That different issues may be relevant there is suggested by the fact that Schwarz (2012) explicitly excludes from discussion discriminating contexts of the type proposed by Schwager (2009). Also, as long as the semantics of Fodor’s original example is not fully understood, we lack the grounds for claiming that Fodor’s puzzle also arises if the original example is modified as in (9) (Keshet (2011: 5)), where the kind-referring term like Malte’s jacket is substituted with the non-kind referring term inexpensive.

(9) Mary wants to buy an inexpensive coat.

This being said, the focus of this paper is narrow with respect to the type of attitude reports that is taken into consideration. But the lesson to be learned from the variety of senses that can be identified with the help of discriminating contexts for one
and the same attitude report is one which directs future research on attitude reports into a direction orthogonal to quick generalizations about Fodor’s puzzle. Fodor’s puzzle not only points to a notion of logical form in which the relation between discriminating contexts and attitude reports can be adequately represented and that is more differentiated than those implicitly or explicitly assumed in the literature cited in this paper, it also points to a type of meaning targeted in the interpretation of ambiguous attitude reports that is hard to reconcile within established formalisms of semantic analysis in which the meaning of attitude reports is defined in terms of the disambiguated truth-conditions expressed by logical forms.

2 The functions of context

Because discriminating contexts guide the discrimination of senses of (1) in the setting of Fodor’s puzzle, the function of discriminating contexts is fundamentally different from the function that contexts play for the de re-de dicto distinction and also from the notion of utterance context in the Kaplanian sense. In principle, the de re-de dicto distinction can be established without reference to any context by simply defining the de re and de dicto sense as two structural variants of the logical form of (1). This means that the de re and de dicto senses can be identified by purely formal means as instances of a structural ambiguity. Context comes into play as a situation of which the only purpose is to resolve the (structural) ambiguity of the attitude report, i.e. to disambiguate between the possible de re and de dicto structures of (1). But the function of context as the situation in which an utterance is interpreted is not the function of discriminating context that is central to Fodor’s puzzle. The core of Fodor’s puzzle is that because structural ambiguity in terms of scope relationships is not able to capture the intended sense of (1) in Fodor’s setting, context plays a very different role in the analysis of attitude reports of the type suggested by Fodor’s puzzle than it does in cases of structural ambiguity. The identification of possible discriminating contexts amounts to the identification of the possible Fodorian senses of (1), which is very different from the identification of possible situations in which a so-identified sense is true. Thus, one and the same context may have two very different functions. First, to discriminate the senses (and consequently the truth-conditions) of an attitude report and second, to evaluate the truth of an attitude report. It is important to keep both functions of context distinct in the analysis of Fodor’s puzzle because the difference between the function of discriminating contexts and situations is what makes the challenge imposed by Fodor’s puzzle different from cases that can be reduced to a structural ambiguity like the de re-de dicto distinction. Put a simple way, a discriminating context identifies an ambiguity and a situation resolves it. The different functions of situations, utterance contexts and discriminating contexts correspond to different notions of context-
dependency. Context-dependency with respect to utterance contexts exemplified e.g. by indexicals is different from context-dependency with respect to discriminating contexts. Utterance-context-dependency pertains to the interpretation of certain constituents in a context, discriminating-context-dependency pertains to the constitution of (the constituents of) an interpretation whereas situation-dependency pertains to the evaluation of an interpretation.

Given the special role of discriminating contexts we need to have at hand formal instruments that allow to make precise the relation between discriminating context and the Fodorian sense it identifies. The review of approaches to Fodor’s puzzle in the literature showed that the differences between senses of (1) compatible with Fodor’s puzzle are due to differences in relations of acquaintance provided by the discriminating context. The insight that relations of acquaintance provided by context are central to the analysis of attitude reports is not new. E.g., in her discussion of the projection of presuppositions in attitude reports Heim (1992) explicitly proposed to break down the scope-based de re-de dicto distinction into a more fine grained analysis at the constituent level and suggested that “there is not really just one de re reading (for a given constituent), but there are many - one for each acquaintance relation that the context might supply. . . . In a way, I am blurring the distinction between de re and de dicto readings. But that may not be such a bad thing.” Heim (1992: 210) Probably not surprising, Heim explicitly related the idea of a constituent-based account of attitude reports to the starting point of the present paper: “It may also make it easier to reconcile the two-way de re/de dicto ambiguity of the standard theory with finer classifications such as the four-way distinctions in Fodor (1970).” Heim (1992: footnote 53, 229). While Heim and other proponents of context-dependent provision of relations of acquaintance remained silent on their formalization, Maier (2009) gives a formal account of belief reports that explicitly argues against a reconstruction of the de re / de dicto ambiguity as a structural ambiguity. Fodor’s puzzle, however, has to my knowledge not been discussed in a light that such proposals focusing on the context-dependency of relations of acquaintance shed on the interpretation of attitude reports.

3 Attitude representation in DRT

The logical form formalism I propose to make use of to represent the different senses my analysis distinguishes is an extension of Discourse Representation Theory (DRT) designed for the representation of attitudinal states (Kamp et al. (2011)). Making explicit the difference that relations of acquaintance make to the interpretation of attitude reports has been a concern for DRT almost right from the start, e.g. in Kamp (1984). For the representation of propositional attitudes and relations of acquaintance with discourse referents, a three-place predicate \( \text{Att} \) is introduced into
the core language of DRT. For the formalization of causal contact with objects and its effect on the status of discourse referents - being directly referential - the DRT extension provides the concept of an external anchor. External anchors represent the acquaintance with an existing object in the real world. In order to distinguish this wide content notion of de re acquaintance with objects from the perceived notion of de re based on quantifier scope relationships (as in (4a)), I call external anchors de-re anchors as opposed to de re scope relationships. In its basic form, an external anchor for a discourse referent \( x \) in an entity \( b \) fixes the reference of \( x \) to the model-theoretic entity \( b \in \text{Discourse} - \text{Universe}: \{\langle x, b \rangle\} \). In the course of this paper, I introduce additional, more complex types of external anchors, e.g. anchors for sets of individuals and properties and anchors for properties of sets of individuals.

From the viewpoint of semantic representation, an external anchor displays a non-representational relation between a discourse referent and an entity. That is, an external anchor for a discourse referent is not part of the mental representation of the agent who entertains a semantic representation in which the so-anchored discourse referent occurs. Consequently, external anchors are not a component of the representation of the mental content which an agent takes as her psychological reality but they are placed outside the scope of the agent’s mental representations. Only an external describer of the agent can make a judgement whether the agent is connected to the object \( b \) via the discourse referent \( x \) that is part of one or more of his mental representations; accordingly, such judgements need to be modelled separately from the describer’s ascriptions of mental reference to the agent. On the other hand the DRT extension assumes that external anchors can affect the truth-conditional content of mental representations entertaining the externally anchored discourse referent \( x \) only if the agent’s mental representation contains an internal anchor for \( x \) which represents the way in which the agents takes herself to be acquainted (causally related) to whatever it is that \( x \) represents to him. An internal anchor takes the form pictured in (10), where \( K \) is a Discourse Representation Structure (DRS) of the acquaintance with \( x \). In some of the DRS representations I present in this paper, the exact specification of the acquaintance representation \( K \) is left open when it doesn’t matter to my arguments.

(10) \( \langle [ANCH, x], K \rangle \)

External anchors enter a DRS representing the attitudinal state of an agent as the third argument of the predicate \( \text{Att} \). The first argument of \( \text{Att} \) represents the bearer of the attitude that \( \text{Att} \) is used to describe and the second argument is for descriptions of the attitudinal state that the \( \text{Att} \)-predicate assigns to the bearer. The descriptions occupying the second argument slot of \( \text{Att} \) consist of pairs \( \langle \text{MOD}, K \rangle \), where \( \text{MOD} \) is
an attitudinal mode indicator (whether the attitude represented by the pair $\langle \text{MOD}, K \rangle$ is e.g. a belief, desire or intention) and $K$ is a representation of the content of the attitude. Unanchored discourse referents occurring in attitude descriptions $K$ are evaluated with respect to a non-specific relation of acquaintance. In parallel to external anchors, I use the term *de-dicto* for the relation of acquaintance that unanchored discourse referents in attitude descriptions represent (narrow content) and *de dicto* for a quantifier scope relationship of the type presented in (4b).

The possibility to make relations of acquaintance explicit is my primary reason for choosing DRT as an analysis framework in this paper. But the syntax and semantics of the DRS language that I will be using in this paper differs from other approaches to relations of acquaintance both within the framework of DRT and in direct interpretation approaches. In his DRT-based analysis of attitude reports, Maier (2009) considers only attitude reports involving one attitudinal mode – belief – and proposes a Stalnaker/Lewis style model-theoretic possible world semantics. Similar restrictions apply to work that has been done in direct interpretation frameworks with concept-generators (functions from individuals to individual concepts, cf. Percus & Sauerland (2003)), which does not consider cross-attitudinal referential dependencies. In contrast, the DRSs that I propose for the representation of Fodorian senses of (1) involve complex attitudinal states involving two attitudinal modes, belief and desire. E.g., based on the acquisition of internally and externally anchored discourse referents for two jackets, Adrian may form the belief that both jackets are of the same kind. Based on this belief, Adrian then forms the desire to buy one of these jackets. Adrian’s desire referentially depends on his belief in that the same discourse referents occur in the representation of his ‘belief’ state and in the representation of his ‘desire’ state. Capturing such referential dependencies across attitudinal states of different mode requires a model-theoretic semantics that is more complicated than possible world semantics in that only information states (world-embedding pairs) provide an adequate basis for the evaluation of cross-attitudinal referential dependencies.

There is yet another reason for the use of DRT in this paper. Not only do the approaches in the literature discussed in section 1.3 provide different formulations of the Fodorian sense(s) of (1), they also differ in that they offer different formal frameworks for making the senses they identify explicit. Romoli & Sudo (2009)’s proposal states truth-conditions of (1), von Fintel & Heim (2011) propose a direct interpretation approach of the semantics of (1) and Schwager (2009) uses a conception of meaning that is based on a pragmatics-driven notion of faithful reporting. I have found DRT a helpful framework for comparing these different analyses – for making precise what they have in common as well as how they are different.

The discussion of Fodor’s puzzle in the literature has established that there is quite
a range of different situations in which the subject Adrian can find himself and quite a number of different ‘want’ states he can be in partly on account of those situations, all of which can be truthfully described with (1). The situation of Adrian is elaborated by the first part of Fodor’s discriminating context – Adrian has decided what kind of coat to buy... – but this ‘want’ state of Adrian does not say anything about how Adrian’s want state relates to Malte’s jacket. If Adrian doesn’t know that the jacket he wants to buy is like Malte’s jacket, someone else must know this. As Fodor already remarked: “in this case, obviously the speaker must be the source of the description.” Fodor (1970: 227). The contribution of the reporter is explicated in the second part of Fodor’s discriminating context: ...but has no idea that the kind of coat he wants is just like Malte’s coat. I will sort through the spectrum of Fodorian senses of (1) by first discussing the range of different ‘want’ states that Adrian can be in, given the different scenarios that have been considered, and then considering for each of these possible ‘want’ states what state the reporter must be in in order to be able to use (1) as a truthful description of Adrian’s want.

4 Discriminating Fodorian senses

4.1 Discriminating Adrian’s attitudinal state

I begin with the discussion of the range of scenarios that are compatible with Adrian wanting to buy a certain kind of jacket without having decided which – the first part of Fodor’s context. One end of the spectrum of ‘want’ states of Adrian in the setting of Fodor’s puzzle is based on discriminating contexts in which Adrian has a de-re relation of acquaintance with the object of his desire. There are at least two variants of Adrian’s attitude under the constraints of Fodor’s puzzle which support such a de-re interpretation of the discourse referent which stands for Adrian’s object of desire, both of which are variants of the discriminating context (7a) that Romoli & Sudo (2009) provide. The first case in (11) is where Adrian has seen two jackets. Adrian wants to buy one of them but he has not decided which. Adrian’s ‘want’-state is represented as involving a de-re attitude towards each of the jackets he has seen which together form the set of jackets towards which his desire of buying a jacket is directed.
The second case in (12) is where Adrian has seen too many jackets to keep track of them individually. Adrian wants to buy one of them but he has not decided which. The representation of Adrian’s ‘want’ state in DRS (12) involves an extension of the concept of external anchoring to anchors in collections of one or more objects\(^3\). The star * turns a predicate of individuals into a predicate of sets of individuals.

Another type of ‘want’ state arises in discriminating contexts in which Adrian stands in an acquaintance relation to a jacket like Malte’s but where this jacket is not the actual object of his desire. That is, in situations of the type proposed by von Fintel & Heim (2011) – see (7b) – there are jackets of the type that Adrian wants to buy in the real world, but the jacket that Adrian wants to buy exists only in his desire worlds. (13) gives the representation of Adrian’s ‘want’-state that the discriminating context (7b) of von Fintel & Heim (2011) suggests.

\(^3\) It is not easy to state in general terms what must be the case in order that someone can be said to have such a representation. In many cases the agent must associate some delineating description – such as *the jackets on display in this window* – as well as the kind of contact with one or more elements of the set that could also have given rise to anchored representations for those elements on their own. What form the cognitive difference between plural and singular anchors takes for Adrian is a topic that will not be further discussed in this paper.
Finally, Adrian can be in a 'want' state also in discriminating contexts in which Adrian doesn’t stand in an acquaintance relation to any real jacket or set of jackets at all but where he can be said to stand in some kind of acquaintance relation to a property of jackets. When Adrian is looking through a mail order catalogue, sees a picture of a jacket of a certain brand and make and decides to buy a jacket like the one he has seen, this gives rise to a 'want' state characterized by the DRS in (14). The discriminating context (7c) of Kaufmann, which delineates such a 'want' state of Adrian involves a delicate matter: what is it that pictures reveal to their observers? Once we follow Schwager (2009) and commit to the existence of properties, it seems right in some sufficient manner to take second-order properties to be the kind of information that can be extracted from catalogues displaying jackets, i.e. the second order property of being a 'design' property $DSN$. Adrian’s ‘want’ state then consists in a desire to buy a jacket of a certain brand and make represented as the second order property $DSN$ of being a design property $P$. 

(13)

(14)
4.2 Reporting Adrian’s attitude

The range of semantic representations of ‘want’ states of Adrian compatible with Fodor’s discriminating context is of course only half of the story which we need to tell. In their present form, the DRSs representing the ‘want’ states in (11)-(14) aren’t by themselves enough to represent the truth-conditions of (1), for the DRSs say nothing about the relationship between the jacket Adrian wants to buy and Malte’s jacket. But the question how the two are related varies between the cases we have thus far considered. In (11) and (12) the jackets between which Adrian’s choice is mutual – either or any of these jackets will do – the relation must hold between these jackets and Malte’s jacket. And the reporter of Adrian’s attitude must be aware of this in order to make a justified use of (1). In (13) the jacket \( j_1 \) with which Adrian is acquainted must in fact be like Malte’s (it could even be Malte’s jacket) and the reporter must be aware of that. And in (14) the conditions expressed by \( P(j) \) must be satisfied by Malte’s jacket, or at least a sufficient number of them must be, and that must be known by the reporter.

Because I explicitly and separately take into account the contribution of the reporter, the logical forms proposed for Fodorian senses of (1) in this paper differ importantly from the logical forms that have been proposed in the literature. That is, if (1) is taken to be an attitude report, i.e. an utterance or sentence that is communicated by a reporter and interpreted by a hearer, the reporter’s belief about Adrian and Adrian’s jacket must explicitly surface in the logical form of (1). As a matter of fact, for if the reporter is not aware of the way in which Adrian’s jacket is like Malte’s, (1) can not be a report that she makes. But the decision to include the reporter’s contribution in the logical form of (1) raises a fundamental methodological problem. The \( Att \)-Predicate is identified with a discourse referent for a state \( s \) (the attitudinal state represented by \( Att \)) and a discourse referent \( x \) for the bearer of the attitudinal state. These discourse referents are introduced in the universe of a main DRS \( K \) of which the attitude description with the \( Att \)-Predicate occurs as a condition. But what is the status of the main DRS \( K \), i.e. whose representation of what interpretation of (1) does it depict? According to the conception that “discourse representations can be regarded as the mental representations which hearers form in response to the verbal inputs they receive” (Kamp 1984: 5), \( K \) represents the DRS that a hearer forms in response to (1). But from this point of view, it stands to question whether and how Fodorian senses of (1) can be retrieved from an utterance of (1). Given the fact that only discriminating context guides the assignment of a logical form to (1), it is impossible for the hearer of (1) to reconstruct a Fodorian sense of (1) as the meaning intended by the speaker of (1) without the provision of context. But once the discriminating context is available to the hearer, there seems to be no need for the reporter to communicate (1), as all the information contained in (1) has already
been provided to the hearer via the context story. I will explicitly address this issue in section 6. For now, I propose to mitigate the tension between logical forms and interpretation of (1) in that I avoid an explicit commitment to the main DRS being a hearer’s reconstruction of the meaning of (1) intended by the reporter. I rather want the main DRS to be considered a reconstruction of the truth-conditions of (1) as a description of a certain situation that comprises just the kind of situation in which Adrian and the reporter find themselves and which can be truthfully described with (1). Put another way: the main DRSs captures the truth-conditions that are implied by a justified assertion of (1) in a certain situation without any commitment to whether, how and under which circumstances these truth-conditions can be recovered by an interpreter of (1) who is not aware of the discriminating context of (1). I think that this abstract view on DRSs as constraints on possible verifying embeddings of (1) is much in the spirit of what previous proposals in the literature intended to achieve: making explicit the set of clearly distinct truth-conditions that (1) can express in different contexts.

Fodor’s puzzle is so well engineered because the link between Adrian’s attitude, the reporter’s contribution and the discriminating context is linguistically expressed by means of the word like. It is in the ways in which likeness surfaces in the report of Adrian’s attitude in a given situation that the central role of discriminating contexts is made explicit. By distinguishing attitudinal states of Adrian, the different discriminating contexts also distinguish the different ways in which the object of his desire can be like Malte’s jacket. Consequently, the Fodorian senses of (1) that are identified in the literature are not only different with respect to the attitudinal state of Adrian but also with respect to the sense in which the object of Adrian’s desire is like Malte’s jacket.

If Adrian has a de-re attitude towards certain jackets as in (11) and (12), there is a straightforward way of relating Adrian’s desire to Malte’s jacket such that (1) is true. In those cases where Adrian’s object of desire is externally anchored Adrian’s attitude does not involve any condition of likeness, but the reporter is responsible for the selection of those features relevant to the like-condition with respect to Malte’s jacket and the set of jackets that she perceives as the set of options for Adrian. One intriguing feature of such de facto interpretations of likeness is that the reporter’s justification for her claim of likeness may involve completely different properties of jackets than those that Adrian has actually selected as relevant to his buy. Any jacket that Adrian is going to buy will be like Malte’s, if all of the jackets that are options for his buy are like Malte’s jacket. This presupposes that the reporter has, like Adrian, a direct access to what the set X of jackets is one of which Adrian wants to obtain. This set must be ‘common ground’ to Adrian and the reporter, in that both have an anchored representation for it. It is on the basis of her access to X that the reporter may be able to recognize that all jackets belonging to it are like Malte’s
jacket in some way; and if that is so than her utterance of (1) is justified. But –
this is the point – these properties that the reporter takes the members of X to share with Malte’s jacket need not have anything to do with the properties that Adrian recognizes the members of X to have and that form the reason for his wanting to buy one of them. (15a) and (15b) give DRS representations of (1) that result from Adrian’s ‘want’ states represented in (11) and (12).

\[
(15) \begin{align*}
\text{a. } & \\
& \begin{cases}
  s_0, s_1, a, w, m, n \\
  n \subseteq s_1 \\
  s_0 < s_1 \\
  adrian(a) \\
  reporter(w) \\
  malte(m) \\
  s_0 : Att \
  a, & \\
  \{ \langle \text{ANCH, } j_1, K \rangle, \\
  \langle \text{ANCH, } j_2, K \rangle \\
  \langle \text{BEL, } \text{jacket}(j_1) \rangle, \\
  \langle \text{jacket}(j_2) \rangle \\
  \langle \text{DES, } n < e \\
  e : \text{buy}(a, j_1) \lor e : \text{buy}(a, j_2) \rangle \\
  \langle \text{ANCH, } j_3, K_1 \rangle, \\
  \langle \text{ANCH, } j_4, K_2 \rangle \}
  \}\end{cases} \\
\end{align*}
\]
The 'want' state of Adrian identified by the von Fintel & Heim (2011) discriminating context, where Adrian wants to buy a jacket like the jacket he has seen, is compatible with two distinct discriminating contexts. Depending on whether Adrian has seen Malte’s jacket or a jacket like Malte’s, the contribution of the reporter and thus the truth-conditions of the report are quite different. Consider first the case where Adrian has seen Malte’s jacket and wants to buy a similar jacket. Thus, for (1) to be true all that is required is that Adrian’s desire specifies the jacket he wants to buy as like this one where this one stands for the jacket he has seen (which as a matter of fact is Malte’s jacket). It may be that Adrian has observed certain properties of Malte’s jacket that are the reason for wanting to buy such a jacket, but that is not really important so long as he is prepared to say, or think I want one like that one. In order for the reporter to use (1) in order to report Adrian’s desire, he must of course realize that the jacket that has brought Adrian’s desire about is in fact Malte’s jacket and she must be aware that Adrian is also acquainted with this jacket and has the desire described (to buy one like it). In fact, for such scenarios where Adrian has seen Malte’s jacket, it is enough for the reporter to know that the jacket that triggered Adrian’s desire is e.g. hanging on Malte’s coat-rack in order to acquire a belief that it is Malte’s jacket that Adrian has seen. I will further explore this case in section 5 as problematic to Kaufmann’s proposal. The DRS representing the Fodorian sense of (1) in which Adrian has seen Malte’s jacket and wants to buy a similar one is given in (16).
Things are different for de-re sources of Adrian’s desire if it is not Malte’s jacket which Adrian has seen but some jacket like Malte’s. On the basis of the existing jacket which triggers Adrian’s desire, the reporter infers that the jacket Adrian wants to buy is like Malte’s jacket because Malte’s jacket is like the jacket which triggered Adrian’s desire. Thus, there are two likeness relations involved in the DRS representation (17) of this scenario: (i) that between the jacket Adrian has seen and the one he wants to buy – that relation that determines the target of his desired purchase as resembling the jacket he has seen in certain respects – and (ii) that between Malte’s jacket and the one Adrian has seen. One question that now arises is whether these two likeness relations add up to a likeness between Malte’s jacket and the jacket Adrian wants to buy, i.e. if the relative product of the two likeness relations again qualifies as a relation of likeness. That need not be the case if the likeness between the jacket Adrian wants to buy and the one he has seen is a very different kind of likeness than the actual likeness between the one he has seen and the one that belongs to Malte. If we replace like in (1) by is made by the same firm as this problem disappears. It seems clear that for (1) to be fine in relation to this scenario, the two likenesses do add up to a likeness between Malte’s jacket and the kind of jacket Adrian wants to buy. And of course, if the reporter is to be justified in uttering (1) in this situation, this would require that she is also acquainted with the jacket Adrian has seen, that she realizes that the jacket he wants to buy should be, according to him, like this jacket in certain ways, that this jacket Adrian has seen is like Malte’s jacket in certain ways and that the two likenesses do make the jacket Adrian wants to buy sufficiently like Malte’s jacket to justify (1) as a description of
Kaufmann disagrees with “the assumption that sentences like (1) are about actual jackets” Schwager (2009: 397, numbering adopted). In her discriminating context, where Adrian’s desire rests on a jacket he has seen in a catalogue, the likeness of the jacket Adrian wants to buy and Malte’s jacket can not be judged via some de-re jacket (i.e. an actually existing jacket). Consequently, Kaufmann proposes to base the analysis of like on the implication of de-re properties according to a principle of de qualitate property replacement which is given in (18).

(18) “For the sake of reporting an attitude, a property that is involved in the content of the attitude that is to be reported (the reported property) can be replaced by a different property (the reporting property) as long as the reported property is a subset of the reporting property at all relevant worlds.” Schwager (2009: 409)

Given this principle, Kaufmann’s Fodorian sense of (1) pertains to the relation between properties of jackets Adrian wants to buy and properties that Malte’s jacket
has. Instead of a relation of acquaintance with an object and its properties, it is just a
relation of properties which links the reporter’s conceptualization of Malte’s jacket
with Adrian’s conception of the jacket he desires. Kaufmann defines this relation as
a form of intensional inclusion, as spelled out in (19) below. The definition is part
of Kaufmann’s analysis of (1), which is inspired by her catalogue scenario but is
meant to apply to (1) in general. The formalization is given in (19), where Q is the
reporting property, Q’ is the reported property and P is a structured proposition.

(19)  \[ \text{Attitude}_w(x, \langle P, Q \rangle), \text{iff there is a property } Q' \text{ sth. at the } w-\text{closest worlds } w' \text{ where } Q(w') \neq \emptyset: \]

• \[ Q'(w') \neq \emptyset \]
• \[ Q'(w') \subseteq Q(w') \]
• \[ \text{Attitude}_w(x, \lambda w' P_{w'}(Q')) \text{ is true.} \]

(20) gives the DRS for (1) in Kaufmann’s discriminating context (7c). (20) represents
the Fodorian sense of (1) where Adrian has seen a jacket in a catalogue and wants to
buy a similar one and the reporter judges that the jacket from the catalogue is just
like Malte’s because he believes that the properties that he perceives of the jacket in
the catalogue are a subset of the properties of Malte’s jacket.
It may be argued that pictures in a catalogue suggest the existence of the jackets which are pictured - actually this is what a catalogue is about - but the following example (21) by Schwager (2009: 400) makes explicit that a report of the type of (1) does not require the existence of jackets but only the existence of a reported property in order to be true.

(21) Mary is looking at the Burj Dubai, which has 191 floors and is currently the highest building in the world. Also, no other building has more floors. Mary doesn’t know this. She also doesn’t know how many floors Burj Dubai has. Mary’s self-reported attitude is “Wow, I want to buy a building that’s even one floor higher!”

(22) Mary wants to buy a building with (at least) 192 floors.

Kaufmann claims that even if Mary desires a contradiction\(^4\) in context (21), Mary’s

\(^4\) “This amounts to saying that Mary desires a contradiction.” Schwager (2009: 400), where contradictory desires are desires which can not be realized from the viewpoint of an external observer but are consistent from the viewpoint of the agent of the desire as long as the agent does not know that her desire can not be realized.
desire is consistent and (22) is a \textit{faithful} way of reporting Mary’s desire. Obviously, in the Burj Dubai case (21) we can not rely on an analysis of likeness involving the comparison of objects but have to take into account properties in the way that Kaufmann proposes.

5 Counterexamples to Kaufmann’s \textit{de qualitate}

Kaufmann claims that her approach of Fodorian senses is a general solution that makes the right predictions in every scenario that is compliant with the constraints of Fodor’s puzzle. In this section I present two types of counterexamples to Kaufmann’s \textit{de qualitate} analysis to which properties are central in two respects. First, the reported property $Q'$ must exist in the actual world, i.e. it must not have an empty extension.\(^5\) Second, the reported property must be a subset of the reporting property in all relevant worlds ($Q'(w') \subseteq Q(w')$). Both these requirements on properties are necessary conditions to the truth of an attitude report of a Fodorian sense in the semantics that Kaufmann proposes. In the next two sections I discuss scenarios in which (1) is true albeit (i) the reported property is not a subset of the reporting property (i.e. $Q'(w') \not\subseteq Q(w')$) or (ii) the reported property $Q'$ is empty in the actual world because there is no such property $Q'$ \textit{de re}.

5.1 The wardrobe case

Reconsider the variant of von Fintel & Heim (2011)’s discriminating context where the reporter acquires the belief that the jacket Adrian has seen is Malte’s jacket but does so on the basis of non-intrinsic properties of Malte’s jacket, e.g. its hanging in Malte’s wardrobe. The DRS for this Fodorian sense of (1) was given in (16). Kaufmann’s approach is based on the assumption that both the reporter and Adrian consider only intrinsic properties of jackets but not extrinsic properties. But this is not necessarily the case. One of my arguments for the use of DRT as an adequate tool for the exploration of Fodorian sense and the use of an information-state based attitudinal semantics was that the language with the $Att$-predicate is able to represent combinations of propositional attitudes of distinct modes (e.g. a belief and a desire) and with referentially dependent contents. This distinction becomes relevant for contexts in which Adrian has seen Malte’s jacket. It is unlikely to assume that

\(^5\) Kaufmann makes this explicit by introducing a \textit{de re} second order existentially quantified variable for the reported property $Q$: “…there is a property $Q'$ …” Schwager (2009: 409). In order to render this quantification true, $Q'$ must be assigned a value in the actual world. In this paper, I make the simplifying assumption that a property $Q$ exists in world $w$ iff in $w$ the extension of $Q$ is not empty and thus remain silent on philosophical issues pertaining e.g. to the identity criteria of properties across worlds.
Adrian’s desire to buy a certain jacket would rest upon extrinsic and accidental properties of jackets which are hard to duplicate in the buy of a jacket. Actually, I am not sure how to phrase Adrian’s desire to buy a certain kind of jacket based just on extrinsic properties of the kind of jacket he has in mind, but (23) is an attempt to explicate such a strange desire.

(23) I want to buy a jacket hanging in my wardrobe just like the jacket is hanging in the wardrobe over there.

Kaufmann’s assumption about Fodorian senses and intrinsic properties is intuitively right for desires and what Adrian has in mind for his buy is probably that the jacket should be green like the jacket hanging in the wardrobe over there. But, no similar restriction on intrinsic properties holds for the acquisition of beliefs about belongings. A property extrinsic to a jacket is totally natural in judging to whom it belongs as e.g. in (24)

(24) I believe that this is Malte’s jacket because it is hanging in his wardrobe.

Taken together, the case under consideration is exemplified by the scenario in (25).

(25) Adrian is standing in front of a wardrobe located in room number three. He sees a green Burberry jacket hanging in that wardrobe. Later, Adrian tells Fritz: “I want to buy a jacket which is of the same kind and make as the jacket hanging in the wardrobe that is located in room number three”. Fritz knows that room number three is Malte’s room. He believes that the jacket that Adrian has seen belongs to Malte because he saw a jacket hanging in Malte’s wardrobe but he did not recognize the make and brand of the jacket hanging in Malte’s wardrobe. Fritz truthfully reports Adrian’s desire as “Adrian wants to buy a jacket like Malte’s”.

In Kaufmann’s Burj-Dubai scenario, the reported property is being one floor higher than Burj-Dubai and the reporting property is has 192 floors. The point about Kaufmann’s semantics for Fodorian senses (19) is that the reported property is a subset of the reporting property at all relevant worlds including the actual world. For the sake of simplicity, assume that the reported property in the wardrobe scenario (25) is a green jacket. Assume further that the reporting property is hangs in Malte’s wardrobe. According to Kaufmann’s inclusion principle the report of Adrian’s desire with (1) would be true iff the reported property green is a subset of and thus implies the reporting property hanging in Malte’s wardrobe in all relevant worlds. This is certainly not the case because it would require that in those worlds where green and hang in Malte’s wardrobe are not empty, all green objects hang in Malte’s wardrobe.
Given that Kaufmann doesn’t endorse to such an absurd commitment, she would predict (1) to be false albeit it is true. Kaufmann’s approach does not recognize the fact that the relation of acquaintance of the reporter with Malte’s jacket must not be related to Adrian’s relation of acquaintance in terms of inclusion of intrinsic properties of jackets and that no relation between the properties that are relevant to Adrian and those that are relevant to the reporter is required to exist besides the fact that they are properties of the same jacket. That is, Kaufmann is mislead in her refusal that “sentences like (1) are about actual jackets” (Schwager (2009: 397, numbering adopted)) because in the wardrobe scenario the reporting and the reported property are related only via an actual jacket and not via inclusion of these properties. However, von Fintel & Heim (2011) make the right predictions for the extrinsic property case. According to (8b), a report of the wardrobe situation with (1) evaluates to true. If we adhere to the principle of discriminating contexts, the extrinsic property context discriminates the von Fintel & Heim (2011) sense as a genuine sense of (1) in that it renders all other senses, including Kaufmann’s sense, false. So there are at least two Fodorian senses of (1) which can be clearly distinguished from each other and from the de re and the de dicto sense; the sense identified in the wardrobe scenario and Kaufmann’s sense identified with the catalogue scenario.

For the sake of convenience, the DRS representation of the scenario just outlined, where Adrian’s desire is based on intrinsic properties of jackets but the reporter’s judgement is based on extrinsic properties of jackets is repeated below in (16).

\[
\begin{align*}
\text{s}_0: & \text{Att} \langle a, \text{DES}, e: buy(a, j_2), n < e \rangle \\
\text{s}_1: & \text{Att} \langle w, \text{BEL}, j_3, belongs - to(m, j_3) \rangle \\
\end{align*}
\]
5.2 The Adidas case

In Kaufmann’s Burj-Dubai setting, Mary is epistemically limited in that she is not able to infer that her desire is – I adopt Kaufmann’s terminology – contradictory. Contradictory, because there exists no building which is one floor higher than Burj-Dubai that can be bought in the actual world (but only in her desire worlds). However, the property of being one floor higher than Burj-Dubai – the reported property – exists and it is the existence of this property which is a necessary condition to Kaufmann’s replacement principle. A discriminative context which identifies a sense of (1) which is not captured by Kaufmann’s proposal (and also by none of the other proposals discussed in this paper) negates the de-re existence of the reported property while maintaining faithfulness of the report. This is for example the case if the reported property is not assigned a value in the actual world but only in Adrian’s desire worlds. This is what the scenario in (26) suggests.

(26) Adrian has seen a jacket which has three stripes on its sleeves and wants to buy such a jacket. However, he has read that Adidas uses child labour in the production of its jackets, so the additional condition for his purchase is that the jacket is not from Adidas. If Adrian does not know that Adidas is the brand with the three stripes, he has a desire that he would paraphrase as “I want to buy a jacket from the brand with the three stripes but not from Adidas.” Fritz hears Adrian’s utterance and as he has seen Malte’s jacket which has three stripes and as he also knows about the problem with child labour and Adidas he believes that Malte would never buy a jacket which is made by children. Fritz also doesn’t know that Adidas is the brand with the three stripes. He reports Adrian’s desire as “Adrian wants to buy a jacket like Malte’s”.

Because Adidas is the brand with three stripes in the actual world, in the formal semantics we can not make use of Kaufmann’s replacement principle: the property of being a jacket from the brand with the three stripes but not from Adidas does exist only in Adrian’s desire worlds and thus the necessary condition for Kaufmann’s semantics – the de-re existence of the reported property – is not fulfilled. If there would exist a property from the brand with the three stripes but not from Adidas de re, then in the extensional expression ‘there exists a property of being a jacket from the brand with the three stripes but not from Adidas’ we would be able to substitute ‘brand with the three stripes’ for ‘Adidas’ salva veritate. But this leads to a contradiction where no value is assigned to the reported property variable $Q'$. Because contradictory properties, i.e. properties to which the empty set is assigned in the actual world, entail any reporting property, it is that Kaufmann requires the de-re existence of the reported property variable $Q'$, i.e. that a value is assigned to
Q′ in the actual world. But this requirement predicts that (1) under scenario (26) is false because the reported property Q′ is empty in the actual world.

If (26) is used as a context it renders the sense that von Fintel & Heim (2011) identified false, too. There is no jacket like Malte’s in the actual world that Adrian wants to buy in all of his desire worlds but jackets like Malte’s that Adrian wants to buy exist only in Fritz’ belief worlds. The point is that (26) explicitly denies that Adrian wants to buy a jacket which is like Malte’s jacket in the actual world from the perspective of an external observer. That is, von Fintel & Heim (2011)’s approach of Adrian’s desire presupposes that the characterization of Adrian’s desire in (1) can be given in terms of what Malte’s jacket is like in the real world. But this is not right for the Adidas case. The point is that Adrian can realize his desire by buying a jacket from Adidas in the actual world without wanting to buy a jacket of Adidas in his desire worlds just in case he is misled about the jacket he is buying in the actual world.

Romoli & Sudo (2009)’s proposal comes with an even stronger de re commitment than von Fintel & Heim (2011) and Schwager (2009). Not only the reporter’s contribution to (1) is based on a de-re relation of acquaintance, but also the options that make up Adrian’s desire. Because in (26) no set of jackets exists in the actual world Adrian wants to buy one of, Romoli & Sudo (2009) predict that (1) in scenario (26) is false albeit it is true.

Given that none of the proposals in the literature provides adequate truth-conditions for Fritz’ report, how should we approach truth-conditions for Fritz’ report in order to decide whether (26) is a discriminating context or not? The source of uncertainty about the right answer to this question is that just like in the Burj-Dubai case, Adrian’s desire is contradictory but consistent only from the perspective of an omniscient observer: there is no property of a jacket in the actual world that could fulfill his desire, just as there is no building in the Burj-Dubai example that could fulfill Mary’s desire. Kaufmann elegantly avoids an explicit answer to the question whether the report in the Burj-Dubai example is true or false. Instead, she introduces new terminology: she calls the report in the Burj-Dubai example a faithful report (probably instead of a truthful report), where faithful obviously is intended to capture the intuition that the Burj-Dubai context is compatible with Mary having consistent desires even if the desire itself is contradictory from the viewpoint of an omniscient observer (cf. Schwager (2009: 400)). Unfortunately, Kaufmann does

\[6\] Note that contradictory desires (i.e. desires that can not be realized from the viewpoint of an external observer) are different from inconsistent desires as discussed e.g. by Heim (1992). An inconsistent desire arises in cases where the agent of the desire knows that the desire can not be realized. In the contexts under discussion in this paper, Adrian believes that his desire can be realized but an external observer may notice that his desire can not be realized.
not give a definition of the term *faithful*. My take on faithfulness is the following: the basic reason why Mary’s and Adrian’s desires are contradictory but consistent is that both agents are epistemically limited, and so is Fritz: they are not able to infer the contradiction that their desires res believes involve. Hence, Fritz’ report is true when judged on the basis of the information that Adrian and Fritz possess. As long as they (and we) don’t know that Adidas is the brand with the three stripes in the real world, Adrian can even buy a jacket from Adidas while still believing that this buy realizes his consistent yet contradictory desire. But, and this is what I take to be crucial to faithful reporting, even if we take into account the information that Adrian and Fritz do not possess, namely that Adidas is the brand with the three stripes in the actual world, Fritz’ report is still true. Because if Adrian buys a jacket of which he doesn’t know that it is from Adidas then Adrian’s jacket is like Malte’s in the real world and consequently, Fritz’ report is true. As long as Adrian and the reporter can not infer or learn that Adidas is the brand with the three stripes in the actual world, faithful reports of Fodorian senses do not change their truth-value under omniscience, and similar considerations hold for the Burj-Dubai example. In other words, the judgement of contradictory desires is not affected by information that is available only to external observers of the desire. In contrast, truthful reports of Fodorian senses change their truth-value under omniscience. Consider e.g. the situation proposed by Romoli & Sudo (2009). If the reporter is mislead in her belief that all jackets that Adrian has as options for his buy are like Malte’s, then the truth-value of the attitude report changes from the point of view of an omniscient observer because then it is not true that Adrian wants to buy a jacket like Malte’s.

Concluding, as (26) identifies a true Fodorian sense of (1) which all of the analyses discussed in this paper render false, (26) is a discriminating context. But how does (26) guide us towards the formalization of the sense of (1) which we take to be true if (26) is taken as the situation in which (1) is interpreted? (26) obviously involves the sharing of mental contents across agents and this sharing rests upon a connection which isn’t mediated through externally anchored objects or externally anchored properties, but it concerns the intentionality of attitudes themselves. Intuitively, what we want to say about the way in which the discourse referent that the reporter uses to predicate it as being like Malte’s jacket and the discourse referent which represents the object of Adrian’s desire is the following: whatever the value is that Adrian’s attitude assigns to his discourse referent for the jacket he wants to buy, it will be picked up by the reporter. Such cases of shared reference are reminiscent of what is called ’vicarious’ anchoring in DRT (see e.g. Kamp & Bende-Farkas (2006)), a modified version of which I adopt in this paper as ’intentional’ anchors.

7 Note that the von Fintel & Heim (2011) approach would still predict Fritz’ report to be false, because Adrian’s buying a jacket from Adidas does not require that he wants to buy a jacket from Adidas.
Intentional anchors take the form in (27), where \( v \) is a discourse referent and \( y_z \) a discourse referent stemming from an attitude which is entertained by an agent \( z \). A model-theoretic semantics for intentional anchors is developed in section A.3.7.

(27) \( \langle v, y_z \rangle \)

(28) gives a representation of the sense of (1) identified with the discriminative context (26). The reporter forms a belief involving a discourse referent which is introduced in the attitude ascription to Adrian.

6 Reflections about Fodor’s puzzle

In the previous sections, I discussed a representative range of proposals for logical forms of Fodorian senses of (1) that are true of situations in which Adrian wants to buy a jacket of a certain kind and only the reporter knows that this kind of jacket is just like Malte’s. I showed that none of the proposals in the literature predicts the
correct truth-conditions of (1) if Fodor’s initial situation is spelled out in some more
detail. In fact, I identified at least three distinct Fodorian senses of (1): the sense
identified by Kaufmann’s catalogue scenario, the sense identified by the wardrobe
scenario and the sense identified by the Adidas scenario. The question which this
finding raises is whether the Fodorian senses of (1) can be unified under one general
logical form.

One option to unify Fodorian senses is to develop one single, probably heavily
underspecified logical form of (1) which, when applied to an input context, gives
us the right truth-conditions for (1). Applying the underspecification strategy to
Fodorian senses would require that we are able to identify a common ground of
Fodorian senses of (1) which is independent of discriminating context. But this
paper showed that no Fodorian sense exists independent of its discriminating context
because the discriminating context of a Fodorian sense is prior to its logical form
in that it determines the type and amount of constituents of the logical form. This
sets apart the type of context-dependency involved in the identification of Fodorian
senses with discriminating contexts from the context-dependency involved in e.g. the
interpretation of indexicals in utterance contexts: discriminating context determines
the logical form of a linguistic expression as a whole, whereas utterance context
determines the interpretation of constituents of a given logical form, where the
logical form is invariant throughout different utterance contexts. Consequently, no
underspecification of the logical form of Fodorian senses is possible independent of
context.

Another way to the identification of a uniform analysis for Fodorian senses is to
follow ideas brought up in connection with another type of non-structural ambiguity,
the interpretation of so-called Hob-Nob-Pronouns⁸. van Rooy & Zimmermann
(1996) conclude that if non-structural ambiguities such as the intentional identity
interpretation of Hob-Nob pronouns “were merely one of several possible readings,
it would be hard to explain why one does not think of it if the sentence is uttered out
of the blue”. Instead, van Rooy & Zimmermann (1996) propose that there is a default
reading – the de re reading of a Hob-Nob-Pronoun – and that “all other readings
only become available if there is reason to rule out this literal reading. Inspection of
[...] examples [...] shows that they only seem to work fine when accompanied by a

⁸ Hob-Nob-Pronouns have their name from the example (29) with which (Geach 1967: 627) introduced
the problem.

(29) Hob thinks a witch has blighted Rob’s mare and Nob wonders whether she (the same witch)
killed Cob’s sow.

The problem that (29) exemplifies is that in a context where it is not presupposed that witches do
exist, neither the de re nor the de dicto analysis of (29) gives the right truth-conditions, so there must
be an additional reading of (29) of which its exact truth-conditions are subject to debate.
longer text setting up the background that eliminates all unwelcome reading” van Rooy & Zimmermann (1996: 134). I am skeptical that the idea of a default sense of an attitude report which is overwritten by context applies to Fodor’s puzzle. This is again because of the pivotal role of discriminating contexts: the question for a default Fodorian sense of (1) is inherently connected to the type of discriminating context which is used to spell out the supposed default sense. Thus, the postulation of a default Fodorian sense would require to identify a default discriminating context and it is not obvious to me how and whether criteria for the default status of one specific discriminating context should be defined.

Both options outlined above, the specification of underspecified representations in context and default interpretation with context-induced explication of further senses rely on a conception of ambiguity in which it is assumed that interpreters of ambiguous linguistic expressions are required to disambiguate the ambiguous linguistic expression to one of its meanings in order to grasp the meaning of the expression. It is this assumption which seems to me to fundamentally miss the mark in the analysis of Fodorian senses and ambiguous attitude reports in general. Instead, I would like to tentatively propose that Fodor’s puzzle requires a radical underspecification in that when (1) is considered on its own, i.e. without a discriminating context, it does not convey any specific logical form but rather a set of possible logical forms which all characterize a justified assertion of (1) and that any of these logical forms is equally well suited as the logical form which an interpreter of (1) constructs in response to (1).

In order to substantiate this conjecture, I want to take up an observation that I made in connection with the discussion of the status of the main DRS in the analyses that I proposed and relate it with Kaufmann’s insight that Fodor’s puzzle is ultimately to be explained in terms of the purpose of an attitude report. I explicitly refrained from committing to the main DRS in the analyses of Fodorian senses in this paper as constituting the DRS which an interpreter of (1) constructs in response to (1) for I did not want to commit to one of the DRSs proposed in this paper being the DRS that an interpreter constructs in response to (1). The reason for this is that to me, it seems as if Fodor’s puzzle suggests that it can not be part of the semantic analysis of (1) how an ambiguous attitude report such as (1) is true, i.e. which specific truth-conditions it expresses, but rather that an ambiguous attitude report such as (1) is true. If (1) has a meaning on its own that can be grasped by an interpreter, then this meaning of (1) should be accessible to the interpreter when interpreted without the provision of a discriminating context. For if the interpreter of (1) knows about the discriminating context of (1), (1) would be rather useless as a report of the situation depicted by the discriminating context. Because the logical form of (1) is determined by the discriminating context, the logical form of (1) can not convey information which is not conveyed also by its discriminating context. As a matter of fact, (1)
can not be used unambiguously used to describe how (1) is true of a situation and in particular not of which kind of situation it is true. But (1) can be used unambiguously to assert that (1) is true of a certain kind of situation. Hence, under the assumption that the reporter is justified to assert that (1) is true, it is enough for the interpreter of (1) to be able to reconstruct any of the logical forms of (1) that characterize its truth. That is, because all senses of (1) – including *de dicto* and *de re* – express the justified assertion of the reporter that Adrian wants to buy a jacket like Malte’s, and because this assertion is the only meaning of (1) that can be grasped by an interpreter without the provision of discriminating context, it doesn’t matter to the interpreter which sense of (1) she adopts as the intended meaning of (1). So there is no need to disambiguate (1) in order to grasp the meaning that (1) conveys.

But if the meaning of (1) to an interpreter is not characterized by the derivation of particular disambiguated truth-conditions, what is the purpose of an attitude report if not describing a particular kind of situation? Kaufmann’s approach implicitly touches upon the same point, when she develops her semantics based on purposes – “For the sake of reporting an attitude . . .” (Schwager 2009: 400) – and proposes that “we need a proper pragmatic theory to explain when and why speakers choose to rely on the replacement rule” (Schwager 2009: 411).

I suggest that approaching Fodor’s puzzle by focusing on the purpose of attitude reports points to the role that (1) plays in the assessment of Adrian’s attitude by the interpreter of (1). For example, the purpose of reporting that (1) is true without providing any specific information about how it is true may be that on the basis of the information provided, the interpreter should revise her own plans for buying a jacket like Malte’s if she wants to avoid buying a jacket like Adrian does. Or, if Adrian doesn’t want to buy a jacket like Malte’s, telling him that the kind of jacket he wants to buy actually is like Malte’s may allow him to revise his desire independent of the actual situation in which he finds himself. Or, Adrian’s behaviour can be explained to someone who wonders what he does in terms of *Adrian wants to buy a jacket like Malte’s*. For all these purposes of reporting Adrian’s attitude, it is irrelevant to the interpreter how the reporter justifies her assertion with specific truth-conditions but all that the interpreter needs to grasp is that Adrian wants to buy a jacket which is like Malte’s. In general, the purpose of attitude reports with respect to the assessment of attitudes and behaviour has been emphasized in the philosophy of action, where the meaning of attitude reports is e.g. defined in terms of their having an impact on future plans of the interpreter of an attitude report (Bratman (1987)) or in terms of their rationalizing action (Davidson (1963)). From this point of view, Fodor’s puzzle involves an intimate connection between attitudes and their reports which is certainly worth further exploration.

Summing up, I propose that in the light of the discussion in this paper, the meaning of (1) to an interpreter out of the blue is that the interpreter of (1) is provided with
the information that (1) (in terms of having any of the logical forms that characterize the truth of (1) assigned to (1)) and, based on general principles of communication, that the reporter commits to having a justification for how (1) is true (in terms of having specific truth-conditions assigned to (1)). Obviously, Fodor’s puzzle points to methodological shortcomings in the analysis of ambiguous attitude reports. If the identification of distinct truth-conditions is not central to the meaning of an ambiguous attitude report, it may be that identifying the meaning of sentences with its disambiguated truth-conditions is in general a successful strategy for the analysis of descriptions of situations but that it can not be straightforwardly transferred to the ascription of attitudes. From this point of view, Fodor’s puzzle raises the question for what justifies the assumption that the meaning of attitude reports consists in their denoting distinct truth-conditions. Of course, this question only makes sense when considered together with the conception of ambiguity and disambiguation that underlies the approaches to Fodor’s puzzle discussed in this paper and formal approaches to natural language meaning in general, in which disambiguation of ambiguous natural language expressions is a necessary condition to the interpretation of ambiguous expressions, a conception which Fodor’s puzzle shows to be not applicable in general.

The apparent methodological shortcomings of current approaches to attitudinal semantics – the extension of DRT employed in this paper included – that are identified by Fodor’s puzzle are the reason why I refrained from postulating or even approaching a uniform analysis of Fodor’s puzzle in terms of a purpose-based semantic theory of attitude reports and it is the same shortcomings that have to be overcome in order to identify and put together the pieces of Fodor’s puzzle. The main shortcoming that this paper pointed out is that when advancing attitudinal semantics beyond the cases of structural ambiguity and single attitudinal modes to a theory of the semantics of complex attitudes and their reports, the content and structure of attitudes and their ascriptions gains central importance in the semantics and structure of their reports. The remarks in this final section of the paper have actually carried us beyond the horizons of Fodor’s puzzle. In the light of what has been said, it seems doubtful to me whether talk about the phenomenon exemplified by Fodor’s puzzle, the de dicto or the de re interpretation of attitude reports is really all that helpful. The discussion suggests that it is not so much a distinct phenomenon, e.g. “the intensional indepedence of DPs” (Schwarz (2012)) that is involved in the examples that Fodor first brought up, but rather that these examples show that we need a different semantics for ambiguous attitude reports generally. This new semantics applies not only to the cases that Fodor recognized as problematic for the semantic methods and frameworks that were available at the time when she wrote – and that appears to be a situation that seems to have changed but little since that time – but also to
those cases that we knew, or thought we knew, what to do with then, including most saliently the classical *de re* cases such as that where Adrian has seen a particular jacket and decides that that is the jacket he wants to buy. Fodor’s puzzle still clearly depicts the methodological limitations of the current state of art in the analysis of attitudinal semantics and this holds for both direct interpretation approaches and representationalist theories like DRT. The development of a semantics of attitudes and their reports which is able to capture the pervasive ambiguity and the cognitive grounding of attitude reports is a methodological challenge which requires a perspective on formal semantics that takes into account that language is not a cognitively isolated phenomenon but stands in close relation to other modules of cognition such as sensing, representation and planning. This paper is no more than a first clumsy attempt to get a grip on the identification of some of the pieces of Fodor’s puzzle. For obvious reasons, I did not make any attempt at trying to put these pieces together, but if the thoughts developed in this paper are on the right track, then the implications of Fodor’s observations may in the end be even more dramatic than seems implied by recent treatments of the cases she has brought to our attention.

A Syntax and Semantics of the extended DRS language

In this appendix, I present a model-theoretic semantics for the language of DRSs with the *Att*-Predicate which is employed in this paper. Even if the presentation closely follows Kamp (2003) and Kamp et al. (2011) and is rather lengthy and technical, in order to make the paper self-contained I decided to include a full definition of the model-theoretic semantics. Also, the proposal for a dynamic semantics of intentional anchors that I make can only be made precise against the background of the semantics for attitude representations based on information states developed in the following. However, elaborations are restricted to a minimum and the reader interested in a detailed development of the semantics is referred to Kamp et al. (2011).

The model-theoretic semantics that Kamp (2003) and Kamp et al. (2011) offer for the extension of DRT with attitudes and anchors assigns intensions to the DRSs *K* that occur in the expressions filling the second argument slot of *Att*. But such an intensional semantics is not optimal, in that it does away with some of the potential of this approach towards the structure of mental states and the meaning of mental state descriptions in natural language to escape the problems of logical omniscience. Descriptions of attitudinal states that are not just formally different, but are also meant to be different in a cognitively relevant sense – an agent with an attitudinal state answering to the one description can be expected to reason and behave differently from an agent with a state answering to the other description – will collapse under this kind of ‘intensional’ interpretation because cognitively distinct
content representations $K_1$ and $K_2$ are intensionally equivalent and thus their semantic values coincide. Because of this an intensional model-theory for the $Att$-extension of DRT is a compromise: it captures some of the important inferential properties of complex attitudinal states, and therefore also of some aspects of the cognitive dynamics of such states, but at the same time the coarseness of its granularity conceals many of the finer points of such a dynamics. This pertains in particular to the modelling of referential dependency among attitudinal states of one or more agents. What I am going to present in section (A.3.7) is a first shot at the problem of reference sharing across agents in the hope that future research will come up with proposals that provide a general account of the dynamics involved in the evaluation of cross-agent referential dependencies.

A.1 The DRS Language $\mathcal{L}_{Att}$

A.1.1 Vocabulary

Definition 1 The vocabulary for the DRS Language $\mathcal{L}_{Att}$

- Sorts of Discourse Referents: The set $\text{Ref}$ is the union of the following three mutually disjoint sets of discourse referents
  - $\text{Ind} = \{x_1, \ldots, x_n, \ldots\}$, a set of referents for individuals
  - $\text{Plu} = \{Q_1, \ldots, Q_n, \ldots\}$, a set of referents for sets of individuals
  - $\text{Prop} = \{X_1, \ldots, X_n, \ldots\}$, a set of referents for predicates
  - $\text{Event} = \{e_1, \ldots, e_n, \ldots\}$, a set of referents for events
  - $\text{State} = \{s_1, \ldots, s_n, \ldots\}$, a set of referents for states

- Relation Symbols: The set $\text{Rel}$ is the union of the following sets of relation symbols:
  - $\text{Pred}_1$: a set of $n$-place predicates of individuals
  - $\text{Event}$: a set of $(n+1)$-place predicates (with $n \geq 0$) where the first argument is of type event and the remaining arguments are of type individual
  - $\text{State}$: a set of $(n+1)$-place predicates (with $n \geq 0$) where the first argument is of type state and the remaining arguments are of type individual
  - $\text{TRel}$: a set of 2-place predicate symbols denoting temporal relations between events and states $\prec, \subseteq$
– Pred₂: a set of 1-place predicates of predicates

• The set of logical symbols Sym: \{=, \neg, \land, \Rightarrow\}
• The indexical discourse referents i and n
• The predicate Att
• A set Name: of 1-place relation constants

A.1.2 Syntax of DRSs and DRS conditions

Definition 2 Syntax of DRSs and DRS conditions of \( L_{\text{Att}} \)

• If \( U \subseteq \text{Ref} \) and Con a (possibly empty) set of conditions, then \( \langle U, \text{Con} \rangle \) is a DRS.
• If \( x_i, x_j \in \text{Ref} \) then \( x_i = x_j \) is a condition.
• If \( N \in \text{Name} \) and \( x \in \text{Ind} \) then \( N(x) \) is a condition.
• If \( P \) is a \( n \)-place predicate constant in \( \text{Pred}_1 \) and \( x_1, \ldots, x_n \in \text{Ind} \), then \( P(x_1, \ldots, x_n) \) is a condition.
• If \( P \) is a 1-place predicate constant in \( \text{Pred}_1 \) and \( Q \in \text{Plu} \), then \( P^*(X) \) is a condition.
• If \( X \in \text{Pred}_2 \) and \( Q \in \text{Prop} \), then \( X(Q) \) is a condition.
• If \( e \in \text{Event}, x_1, \ldots, x_n \in \text{Ind} \) and \( R \in \text{Pred}_1 \) an \((n+1)\)-place event predicate, then \( e : R(x_1, \ldots, x_n) \) is a condition.
• If \( s \in \text{State}, x_1, \ldots, x_n \in \text{Ind} \) and \( R \in \text{Pred}_1 \) an \((n+1)\)-place event predicate, then \( s : R(x_1, \ldots, x_n) \) is a condition.
• If \( \tau, \delta \in \text{Event} \cup \text{State} \cup \text{Time} \), R one of the predicates \( \subseteq, \prec \) then \( \tau R \delta \) is a condition.
• If \( K \) is a DRS then \( \neg K \) is a condition.
• If \( x_i \in \text{Ind} \) and \( X_j \in \text{Plu} \) then \( x_i \in X_j \) is a condition.
• If \( K_1 \) and \( K_2 \) are DRSs, then \( K_1 \lor K_2 \) is a condition.
• If \( K_1 \) and \( K_2 \) are DRSs, then \( K_1 \Rightarrow K_2 \) is a condition.

9 I do not elaborate on the semantic interpretation of i and n in the following, but refer the interested reader to Kamp et al. (2011).
• If \( x_i, x_j, z \in \text{Ref} \) then \( \langle x_i, x_j, z \rangle \) is an intentional anchor.

• An Attitude Description Set (ADS) of \( \mathcal{L}_{\text{Att}} \) is a set of pairs each of which has one of the following two forms:
  
  – \( \langle \text{MOD}, K \rangle \) where \( \text{MOD} \in \{\text{BEL}, \text{DES}, \text{INT}\} \) and \( K \) is a DRS of \( \mathcal{L}_{\text{Att}} \).
  
  – \( \langle [\text{ANCH}, \Upsilon] \rangle \) where \( \Upsilon \) is a discourse referent and \( K \) is a DRS of \( \mathcal{L}_{\text{Att}} \) such that \( \Upsilon \in U_K \).

• If \( K \) is an ADS, then \( \text{IA}(K) \) is the set of internal anchors of \( K \), i.e. those members of \( K \) whose first component is of the form \([\text{ANCH}, \Upsilon]\).

• If \( K \) is an ADS, then an external anchor for \( K \) is a function \( f \) sth. \( \text{Dom}(f) \subseteq \text{IA}(K) \), i.e.
  
  – \( \{ x : \text{for some DRS } K, \langle [\text{ANCH}, x], K \rangle \in K \} \) or
  
  – \( \{ X : \text{for some DRS } K, \langle [\text{ANCH}, X], K \rangle \in K \} \) res.

• If \( s \) is a state discourse referent, \( x \) a discourse referent for individuals, \( K \) an ADS and \( \text{EA} \) a set of external anchors for \( K \), then \( s : \text{Att}(x, K, \text{EA}) \) is a DRS condition.

A.1.3 Free discourse referents and properness

Next, we define the set of free discourse referents of a DRS \( K \), \( FV(K) \) and properness of a DRS.

Definition 3 \( FV(K) \), the set of free discourse referents of \( K \) is defined by:

• \( FV(\langle U_K, \text{Con}_K \rangle) := \bigcup_{\gamma \in \text{Con}_K} FV(\gamma) - U_K \)

• \( FV(x_i = x_j) := [x_i, x_j] \)

• \( FV(P(x_1, \ldots, x_n)) := [x_1, \ldots, x_n] \)

• \( FV(P(X)) := [X] \)

• \( FV(\neg K) := FV(K) \)

• \( FV((K_1 \lor K_2)) := FV(K_1) \cup FV(K_2) \)

• \( FV(K_1 \Rightarrow K_2) := FV(K_1) \cup (FV(K_2) - U_{K_1}) \)

A DRS \( K \) is proper iff \( FV(K) = \emptyset \).
A.1.4 Accessibility

**Definition 4** $K_1$ is an immediate sub-DRS of $K$, $K_1 < K$, if any of the following conditions holds:

- $\neg K_1 \in \text{Con}_K$
- There is a DRS $K_2$ sth. $K_1 \Rightarrow K_2 \in \text{Con}_K$ or $K_2 \Rightarrow K_1 \in \text{Con}_K$
- There is a DRS $K_2$ sth. $K_1 \lor K_2 \in \text{Con}_K$ or $K_2 \lor K_1 \in \text{Con}_K$

**Definition 5** Given DRSs $K$ and $K_1$, $K$ is accessible from $K_1$, in symbols $K \text{ acc } K_1$, iff

- $K_1 \leq K$; or
- there exist DRSs $K_2$ and $K_3$ sth. $K_2 \Rightarrow K_2 \text{ acc } K_2$ and $K_3 \text{ acc } K_1$.

Given DRSs $K, K_1$ and discourse referents $x$ and $y$, $x$ is accessible from $y$, in symbols $x \text{ acc } y$ iff $x \in U_K, y \in U_{K_1}$ and $K_3 \text{ acc } K_1$.

A.2 Semantics for DRSs

The semantic scaffolding for the interpretation of $\mathcal{L}_{\text{Att}}$ is an intensional model theory. The central definition of this section is that of a context change potential $\text{CCP}$ of a DRS $K$ relative to a model $\mathcal{M}$. This section discusses only the standard part of DRT’s model theoretic semantics, the evaluation of ADSs is considered in the next section.

A.2.1 Intensional Models

**Definition 6** An intensional model $\mathcal{M}$ for the DRS language specified in definition 2 is a tuple $\langle W, U, \mathcal{I}, \text{EV}, P \rangle$, where

- $W$ is a set of possible worlds
- $U$ is a non-empty set of individuals
  - for names, $\mathcal{I}_\mathcal{M}: \text{Name} \mapsto \{ \{d\} \mid d \in U_{\mathcal{M}} \}$
  - for n-ary relations, $\mathcal{I}_\mathcal{M}: \text{Rel}^n \rightarrow (W_{\mathcal{M}} \mapsto \mathcal{P}(U^n))$
- $P_{\mathcal{M}}$ is a non-empty set of properties, $\mathcal{I}_\mathcal{M}: \text{Pred} \mapsto \{ \{p\} \mid p \in P_{\mathcal{M}} \}$
- $\mathcal{I}: \text{Name} \mapsto \{ \{u\} \mid u \in U \}$
• $\mathcal{I} : \text{Pred}_1^n \mapsto \mathcal{P}(U^n)$
• $\mathcal{I} : \text{Pred}_2 \mapsto \mathcal{P}(P)$
• $\text{EV}$ is an eventuality structure (see Kamp & Reyle (1993: 667f.))

**Definition 7** An embedding $g : (\text{Ind} \cup \text{Plu} \cup \text{Pred}) \mapsto (U \cup \mathcal{P}(U) \cup \mathcal{P}(P))$ is defined as an overriding of $g$, $g \oplus g' \oplus g''$, that relates any element of the domain of $g''$ to its image under $g''$, any element of the domain of $g'$ to its image under $g'$ and any other element of the domain of $g$ to its image under $g$, where

- $g : \text{Ind} \mapsto U$
- $g' : \text{Plu} \mapsto \mathcal{P}(U)$\(^{10}\)
- $g'' : \text{Prop} \mapsto P$

**A.2.2 DRS verification**

The core of the dynamic notion of truth involved in the semantics of DRSs is that of a verifying embedding. The notation $g \subset_X h$, where $X$ is a (possibly empty) set of discourse referents, states that embedding $h$ extends $g$ to the discourse referents in $X$, i.e. $\text{Dom}(h) = \text{Dom}(g) \cup X$.

**Definition 8** Verifying embeddings for DRSs and DRS conditions of $\mathcal{L}$:

- $\langle g, h \rangle \models_{w} \langle U, \text{Con} \rangle \text{ iff } g \subset U \text{ and for all } \gamma \in \text{Con} : h \models_{w} \gamma$
- $g \models_{w} x_i = x_j \text{ iff } g(x_i) = g(x_j)$
- $g \models_{w} N(x) \text{ iff } \mathcal{I}(N) = \{g(x)\}$
- $g \models_{w} P(x_1, \ldots, x_n) \text{ iff } \langle g(x_1), \ldots, g(x_n) \rangle \in \mathcal{I}(P)$
- $g \models_{w} X(Q) \text{ iff } g(Q) \in \mathcal{I}(X)$
- $g \models_{w} \neg K \text{ iff there does not exist an } h \text{ sth. } \langle g, h \rangle \models_{w} K$
- $g \models_{w} K_1 \lor K_2 \text{ iff there is some } h \text{ sth. } \langle g, h \rangle \models_{w} K_1 \text{ or there is some } h \text{ sth. } \langle g, h \rangle \models_{w} K_2$
- $g \models_{w} K_1 \Rightarrow K_2 \text{ iff for all } m \text{ such that } \langle g, m \rangle \models_{w} K_1 \text{ there exists } k \text{ sth. } \langle m, k \rangle \models_{w} K_2$
- $g \models_{w} e : R(x_1, \ldots, x_n) \text{ iff } \langle g(e), g(x_1), \ldots, g(x_n) \rangle \in \mathcal{J}(R)(w)$

\(^{10}\)For a more adequate treatment of the plural, see Kamp & Reyle (1993: chapter 4)
• \( g \models_{\mathcal{M}, w} s : R(x_1, \ldots, x_n) \) iff \( \langle g(s), g(x_1), \ldots, g(x_n) \rangle \in \mathcal{J}(R)(w) \)

• \( g \models_{\mathcal{M}, w} P \ast (X) \) iff for all \( u \in g(X) \), \( g[x/u] \models_{\mathcal{M}, w} P(x) \)

• \( g \models_{\mathcal{M}, w} x \in X \) iff \( g(x) \subseteq g(X) \)

Definition 9  Truth of a proper DRS \( K \)

• A proper DRS \( K \) is true in a model \( \mathcal{M} \) at world \( w \) \( (\models_{\mathcal{M}, w} K) \) iff there exists a verifying embedding \( h \) of \( U_K \) such that \( \langle \Delta, h \rangle \models_{\mathcal{M}, w} K \), where \( \Delta \) is the empty assignment.

A.2.3  Propositions and Information States

Definition 10  Given a proper DRS \( K \), the proposition \( \llbracket K \rrbracket_{\mathcal{M}}^P \) expressed by \( K \) relative to an intensional model \( \mathcal{M} \) is defined as:

\[
\llbracket K \rrbracket_{\mathcal{M}}^P := \{ w | \models_{\mathcal{M}, w} K \}
\]

Definition 11  Given a proper DRS \( K \), the information state \( \llbracket K \rrbracket_{\mathcal{M}}^S \) expressed by \( K \) relative to an intensional model \( \mathcal{M} \) is defined as:

\[
\llbracket K \rrbracket_{\mathcal{M}}^S := \{ \langle w, f \rangle | \langle \Lambda, f \rangle \models_{\mathcal{M}, w} K \}
\]

Definition 12  Given an intensional model \( \mathcal{M} \), a DRS \( K \) and set of discourse referents \( X \) we define

• \( \mathcal{I} \) is an information state relative to \( \mathcal{M} \) and \( X \) iff \( \mathcal{I} \subseteq \{ \langle w, f \rangle | \text{Dom}(f) = X \wedge \text{Ran}(f) \subseteq U_\mathcal{M} \wedge w \in W_\mathcal{M} \} \)

• \( \mathcal{I} \) is an information state relative to \( \mathcal{M} \) iff there is an \( X \) such that \( \mathcal{I} \) is an information state relative to \( \mathcal{M} \) and \( X \)

• when \( \mathcal{I} \) is an information state relative to \( \mathcal{M} \) and \( X \), \( X \) is called the base of \( \mathcal{I} \)

• the empty information state \( \Lambda_{\mathcal{I}} := \{ \langle w, \emptyset \rangle | w \in W_\mathcal{M} \} \)

• the proposition \( \text{Prop}(\mathcal{I}) \) determined by \( \mathcal{I} \) : \( \text{Prop}(\mathcal{I}) := \{ w | \exists f (w, f) \in \mathcal{I} \} \)
A.2.4 Context Change Potentials

Definition 13 The context change potential $[K]_M^d$ of a DRS $K$ relative to a model $M$ is defined as a partial function from information states to information states $sth.$:

- $[K]_M^d$ is defined for those information states $\mathcal{I}$ relative to $M$ $sth.$ $FV(K) \subseteq X_\mathcal{I}$
- if $\mathcal{I}_i \in \text{Dom}([K]_M^d)$, then $[K]_M^d(\mathcal{I}_i) = \{ \langle w, g \rangle \mid \exists f(\langle w, f \rangle) \in \mathcal{I}_i \land \langle f, g \rangle \models M, w K \}$

Definition 14 Let $M$ be an intensional model and $\mathcal{I}$ a set of information states relative to $M$ $sth.$ The consistent merge of the $\mathcal{I}_i \in \mathcal{I}$, denoted $\cup \mathcal{I}$ is the information state defined by:

- $\cup \mathcal{I} := \{ \langle w, h \rangle \mid$ there exists a function $F$ $sth.$ $\text{Dom}(F) = \mathcal{I}$, for all $\mathcal{I} \in \mathcal{I}$,
  $\langle w, F(\mathcal{I}) \rangle \in \mathcal{I}$ and $h = \cup \{ f(\mathcal{I} \mid \mathcal{I} \in \mathcal{I}) \}$ is a function. $\}$

A.3 Semantics of anchored attitude DRSs

We now turn to the main point of the semantics of $\mathcal{L}_{Att}$, the definition of a semantics for anchored attitude DRSs. The challenge of such a semantics is to assign ADSs the right type of intensional constructs which can be used for their evaluation. Those intensional constructs are what we call “Information-State-Based-Attitudinal-State-Descriptions” (ISBAS). They are designed to resolve the problem that not all DRSs which are part of an ADS are proper, but they may referentially depend on other DRSs which are part of the same ADS. ISBAS deal with this problem by defining information states for improper DRSs on the basis of a merge of the information states defined by the proper components of an ADS. Two assumptions are necessary as a basis, the well-foundedness of the recursion through referentially dependent DRSs and that the merge of DRSs of an ADS contains no free variables.

A.3.1 Well-foundedness of ADSs

A basic assumption that underlies the commerce with referential dependencies of some components of a mental state on others is that we deal only with ADSs which satisfy the following well-foundedness constraint.

Definition 15 Well-foundedness
The transitive closure of $\prec_K$ of the relation $\prec$ between the DRS components $K_1$ and $K_2$ of an DRS $K$ is well-founded: $K_1 \prec K_2$ iff there is a discourse referent $x$ which occurs free in $K_2$ and belongs to the universe of $K_1$
A.3.2 Proper-over-all ADSs

In addition, we restrict attention to ADSs $K_1$ which are 'proper over all' in that for each pair $\langle MOD, K_1 \rangle \in K_1$ the set of free discourse referent $FV$ of $K_1$ is included in the union of the universes of DRSs occurring in pairs $\langle MOD', K_2 \rangle \in K_1$ s.t. $K_2 \prec K_1$.

**Definition 16** $K_1$ is a 'proper over all' ADS iff

- $FV(K_1) \subseteq \bigcup(U_{K_2} | \exists MOD' \langle MOD', K_2 \rangle \in K_1 \land K_2 \prec K_1)$

A.3.3 Relating Attitudes and Information States

The definition of the intensional constructs for the evaluation of ADSs proceeds in two steps. First, we define the notion of a Potential Information State Based Attitudinal State Description (PISBAS) and then narrow this concept down to that of an ISBAS. ISBAS are those objects that we use for the definition of the semantics of ADSs.

**Definition 17** Let $M$ be a model and let $\mathcal{J}, \mathcal{J}_1, \mathcal{J}_2, \mathcal{J}'$ be CCPs:

- A Potential Information State Based Attitudinal State Description (PISBAS) relative to $M$ is any set of pairs $\langle MOD, J \rangle$ with $MOD$ a mode indicator and $J$ a regular CCP relative to $M$.
- Let $J$ be a PISBAS relative to $M$. Let $\prec_J$ be the transitive closure of the relation $\prec$ between the members of $J$. $\prec_J$ is defined as
  - $\mathcal{J}_1 \prec_J \mathcal{J}_2$ iff there is a discourse referent $x$ which belongs to $FV(\mathcal{J}_2)$ and to a base of $\mathcal{J}_1$.
- We say that a PISBAS relative to $M$ is an Information State Based Attitudinal State Description (ISBAS) relative to $M$ iff
  - $\prec_J$ is well-founded and
  - it is possible to assign, by induction along $\prec_J$, to each CCP $J$ occurring in $J$ an information state $I(J)$ as follows:
    - Suppose that $J$ has no predecessors according to $\prec_J$ Then $J$ is a total CCP and the associated information state $I(J)$ is defined as $J(\Lambda)$.
    - Suppose that for all $J'$ occurring in $J$ s.t. $J' \prec_J J$, $I(J')$ has been defined. Then $J$ is defined on $\bigcup \{I(J') | J' \prec_J J \}$ and $I(J) = J(\bigcup \{I(J') | J' \prec_J J \})$.  

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A.3.4 Models for ADSs

Definition 18 We extend the intensional model \( \mathcal{M} \) with

- A set of cognitive Agents \( CA_w \): the set of cognitive agents of \( \mathcal{M} \) in each possible world \( w \) of \( \mathcal{M} \)
- A function \( AS_{\mathcal{M}}(a, w, t) \) such that \( AS_{\mathcal{M}} \) assigns in each possible world \( w \) of \( \mathcal{M} \) to each member \( a \) of \( CA_w \) of the universe of the model at each moment of time \( t \) belonging to a certain interval or set of intervals an ISBAS which identifies \( a \)'s mental state at the time in question.

A.3.5 Truth of an ADS

The discourse referents of an ADS \( K \) need not be the same as those occurring in the bases of the CCPs of the ISBAS. So we rename\(^{11}\) the discourse referents occurring in the ADS under the additional constraint that the discourse referents occurring in ISBAS are entirely disjoint from those which belong to the language \( \mathcal{L}_{Att} \). \( r(K) \) is the DRS obtained by replacing each discourse referent \( x \) occurring in \( K \) throughout \( K \) by \( r(x) \).

Definition 19 Truth conditions for ADSs:

- \( f \models_{\mathcal{M}, w} s : Att(x, K) \) iff there exists
  - a renaming function \( r \) sth. \( \text{Dom}(r) \) consists of the discourse referents occurring in \( K \) and
  - a function \( H \) with \( \text{Dom}(H) = r(K) \) sth.
    \[ * H(\langle MOD, K \rangle) \text{ is of the form } \langle MOD, J \rangle \]
    \[ * \text{for all } t \in \text{dur}(f(s)) \text{ and each } \langle MOD, K \rangle \in r(K), H(\langle MOD, K \rangle) \text{ belongs to } AS_{\mathcal{M}}(f(x), w, t) \text{ and} \]
    \[ * \text{for each } \langle MOD, K \rangle \in r(K), \left[ [K] \right]_{r, w, t, K}^s \preceq I(J), \text{ where } I(J) \]
    \[ \text{is the information state determined within } AS_{\mathcal{M}}(f(x), w, t) \text{ by the CCP } J \text{ of } H(\langle MOD, K \rangle). \]

\(^{11}\) Suppose that \( r \) is a 1-1 map from the set of discourse referents occurring in an ADS \( K \) onto some other set of discourse referents. Then the alphabetic variant of \( K \) determined by \( r \) is the set of all pairs \( \langle MOD, r(K) \rangle \) such that \( \langle MOD, K \rangle \) belongs to \( K \) together with the pairs \( \langle [MOD, r(K)] \rangle \) such that \( \langle [ANCH, x] \rangle \) belongs to \( K \).
A.3.6 Truth of an anchored ADS

Two requirements should be captured by a semantics of ADSs that takes into account the role of external anchors. First, the verification condition for $s : \text{Att}(a,K,EA)$ should be undefined when $K$ contains discourse referents which are internally but not externally anchored. The idea which is adopted here is to remove all internal anchors of such discourse referents in $K$, via a reduction of $K$ with respect to $EA$.

**Definition 20 Reduction of $K$ with respect to $EA$, $\text{Red}(K,EA)$**

- $\text{Red}(K,EA) := K \setminus \{ ([\text{ANCH},x], K) | ([\text{ANCH},x], K) \in K \land \neg \exists x' \langle x,x' \rangle \in EA \}$

Second, a DRS $K$ in which an external anchor for $x$ (atomic, non-atomic or second-order) occurs should be considered to express a proposition that is singular with respect to the value $x'$ of the external anchor for $x$. This is achieved by evaluating the proposition expressed by $K$ with respect to embeddings $f \cup (EA \circ f)$, which has each of the externally anchored discourse referents $x$ in its domain and assigns to $x$ the value that $f$ assigns to $x'$.

**Definition 21 Truth conditions for anchored ADSs, wide content evaluation.**

- $f \models_{\mathcal{M},w,s} : \text{Att}(a,K,EA)$ iff
  - for all $t \in \text{dur}(f(s))$ there exists a function $H$ from $\text{Red}(K,EA)$ into $\text{AS}_{\mathcal{M}}(f(a),w,t)$ sth.
  - for each $\langle \text{MOD},K \rangle \in \text{Red}(K,EA)$, $[K]_{w,f \cup (EA \circ f),t}^{\mathcal{M}}$ sth.
  - where $I$ is the information state determined within $\text{AS}_{\mathcal{M}}(f(a),w,t)$ by the CCP $\mathcal{J}$ of $H(\langle \text{MOD},K \rangle)$

The truth conditions in definition 21 considered the wide content interpretation of an ADS. For the narrow content interpretation, i.e. that content of attitude which does not depend on the environment of the agent who entertains the attitude, we can ignore the external anchor set $EA$ and treat internally anchored discourse referents of $K$ existentially. That is, the idea which is adopted here is to replace each internal anchor $\langle [\text{ANCH},x], K \rangle$ in $K$ by $\langle [\text{BEL},K] \rangle$.

**Definition 22 Existentialization of internal anchors**

- $\text{NC}(K) = (K \setminus \{ ([\text{ANCH},x], K) | ([\text{ANCH},x], K) \in K \}) \cup \{ ([\text{BEL},K]) : \langle [\text{ANCH},x], K \rangle \in K \}$
Definition 23 Narrow content verification of an ADS

- The narrow content verification of an ADS $s : (\text{Att}(a, K))$ is the verification of the condition $s : (\text{Att}(a, NC(K)))$ according to definition 21.

A.3.7 Semantics of intentional anchors

The semantics for anchored DRSs does not take into account the interpretation of intentional anchors. The definitions in the preceding paragraphs considered only referential dependencies between DRSs which are part of the same ADS. In order to deal with intentional anchors, we define the evaluation of ADSs against the ISBASs assigned to the agent $x$ whose mental state is represented by an ADS $K_1$ for cases, where the interpretation of discourse referents in $K_1$ depends on the values that are assigned to discourse referents from an ADS $K_2$ of an agent $y$. The problem with which we are faced in capturing intuitions about dependencies between attitudes of different agents is obvious: the semantics which was defined for the mapping from ADSs to information states is not a dynamic one in that it does not consider the mapping from ADSs to information states to depend on ‘previous’ mappings from ADSs to information states. But the value of an intentional anchor occurring in an ADS $K_1$ of an agent $x$ should not be determined with respect to the function $\mathcal{I}_{\mathcal{M}, x, w, t}$ but with respect to the value that $\mathcal{I}_{\mathcal{M}, y, w, t}$ assigns to the ADS $K_2$ of agent $y$ in which the second argument of the intentional anchor occurs. That is, the objects which were singled out by Adrian’s desire as jackets he wants to buy should constitute the set of objects with respect to which conditions involving an intentionally anchored discourse referent in the reporter’s ADRS should be evaluated. But while the evaluation of ADSs takes into account the difference between agents in the function $\mathcal{I}_{\mathcal{M}, a, w, t}$, this difference is lost at the level of information states, which are defined only with respect to embeddings and possible worlds and not with respect to agents.

What I propose in the following is a simplified approach to the problem of cross-agent referential dependencies. For the evaluation of intentional anchors of the form $\langle x, y, z \rangle$ I assume that the dependency between attitudes manifests in two ways: first there is a temporal order. Before the reporter can say something about Adrian’s attitude, he needs to have a representation of Adrian’s attitude. This temporal dependency must be captured as a much stronger claim: the representation must also have an interpretation at the time that the attitude report as a whole is evaluated. That is, we need to decompose the interpretation of DRSs containing referentially dependent conditions of the form $s : Att(a, K)$ incrementally, according to the temporal order in which they stand. But because the definition of truth in DRT pertains to DRSs
and not to DRS conditions, we must bypass this limitation by assuming that there are stop points in the interpretation algorithm for DRSs and that conditions of the form \( s : \text{Att}(a, K) \) are such stop-points which enforce an embedding of the DRS in which they occur. Then, we store for each ADS \( K \) its verifying embeddings \( g \) together with the agent who is the first argument of the ADS \( K \). Given that we rename ADSs in order to assign them CCPs, we have to ensure that we are able to link intentional anchors to their values in the right manner. That is, we also have to store the translation function \( r_z \) associated with a certain ADS \( K_1 \) of which the first argument is \( z \). The proposition expressed by \( K \) should not be evaluated with respect to embeddings \( f \cup (EA \circ f) \) but with respect to the extension \( f \cup (EA \circ f) \cup (VA) \), where \( VA \) has each of the intentionally anchored discourse referents \( \langle x, y, z \rangle \in K \) in its domain and assigns to \( x \) the value that \( g_z \) assigned to \( r(y) \). Thus, \( VA \) is a function from intentionally anchored discourse referents \( \langle y, x, z \rangle \) to \( g_z(r(y)) \).

**Definition 24** Verification of an anchored ADSs with intentional anchors.

- \( f \models_{\#, w, s} \text{Att}(a, K, EA) \) iff
  - for all \( t \in \text{dur}(f(s)) \) there exists a function \( H \) from \( \text{Red}(K, EA) \) into \( AS_{\#, f(a), w, t} \) s.th.
  - for each \( \langle \text{MOD}, K \rangle \in \text{Red}(K, EA) \),
    \[ [K]^{s}_{\#, w, f \cup (EA \circ f) \cup VA, K \circ f} \]
  - where \( I(\mathcal{F}) \) is the information state determined within \( AS_{\#, f(a), w, t} \) by the CCP \( \mathcal{F} \) of \( H(\langle \text{MOD}, K \rangle) \)

**Definition 25** Narrow content verification of an anchored ADSs with intentional anchors.

- The narrow content verification of an ADS \( s : (\text{Att}(a, K) \) is the verification of the condition \( s : (\text{Att}(a, NC(K)) \) according to definition 24.

**References**


