Appositive Projection and Its Exceptions

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Abstract
This paper has two major goals. The first is to offer a comprehensive account of the projection properties of appositive constructions. Appositives posit a challenge to traditional assumptions about form and meaning because they are interpreted in situ with respect to order-dependent phenomena like discourse anaphora but nevertheless escape the scope of entailment-canceling operators like negation or modals. Accounting for this pattern requires an innovative way of looking at propositional operators and how they interact with appositives. The second goal of the paper is to address various claimed exceptions to the otherwise robust projectivity of appositives. I argue that in some cases the construction under consideration is most likely not an appositive at all. In other cases, the observed non-speaker-oriented readings can be derived by pragmatic reasoning or are due to a perspective shift. Although genuine instances of semantically embedded appositives do seem to exist, I point out that such data have a limited empirical scope. I conclude that appositive projection is a pervasive phenomenon and is part and parcel of the semantics of appositives.

1 Introduction

Appositive constructions are non-selected constituents that are set off from the rest of the sentence by intonation breaks. They are typically felt to contribute supplemental information and are interpreted non-restrictively, i.e. as disjoint from the rest of the sentence. In this paper, I focus on NOMINAL APPOSITIVES, as in (1a), and APPOSITIVE RELATIVE CLAUSES, as in (1b).

(1) a. Jon Stewart, my favorite comedian, appeared on Larry King Live.
   b. Lance, who cheated his way to the top, admitted to doping.

Appositives exhibit a range of properties that challenge standard assumptions about linguistic form and meaning. The first major goal of this paper is to account for the fact that appositives escape the scope of entailment-canceling operators like negation or modals yet they appear to be interpreted in situ with respect to order-dependent phenomena like discourse anaphora. The general consensus in the semantics literature is that appositives cannot be interpreted in the scope of operators (see e.g. Böer & Lycan, 1976; Chierchia & McConnell-Ginet, 2000; Dever, 2001; Potts, 2005; Smith & Hall, to appear). For example, (2a) does not have a reading under which the appositive content is negated, and the appositive in (2b) cannot be interpreted in the scope of the modal. Both sentences imply the unaltered appositive content.
(2)  a. It's not true that Jon Stewart, my favorite comedian, appeared on Larry King Live.
    b. Lance, who cheated his way to the top, might have admitted to doping.

Examples like these demonstrate a fairly robust empirical generalization and have motivated the view that appositives project or do not scopally interact with external operators. At the same time, it is also known that appositives participate in order-dependent phenomena such as discourse anaphora (see Potts, 2005; Arnold, 2007; Nouwen, 2007; AnderBois et al., 2015). In the sentence below, the appositive needs to be interpreted in situ in order not to destroy the anaphoric links between the appositive and the rest of the sentence.1

(3) Johni, who nearly killed a womanj with hisi car, visited herj in the hospital.
    (AnderBois et al., 2013: 102)

It is then unclear why appositives are exempted from the scope of propositional operators but otherwise interact with neighboring discourse in the usual way. To solve this puzzle, I will assume that operators and lexical predicates are endowed with propositional variables (see Stone, 1997; 1999; Stone & Hardt, 1999). As a consequence, operators can bind into their complements but appositives cannot be so bound because their semantic content is directly tied to a component of the utterance context. This allows us to interpret appositives in surface position, thus explaining their interaction with anaphoric phenomena, while at the same time excluding them from the semantic scope of higher operators.

The second major goal of the paper is to try to reconcile the otherwise robust projectivity of appositives with the various claimed exceptions to it (see Wang et al., 2006; Amaral et al., 2007; Harris & Potts, 2009; Schlenker, 2009a; 2009b; ms; Sæbø, 2011; Nouwen, to appear). For example, the appositive in the second sentence below would most naturally be interpreted not from the speakers point of view but rather will be attributed to Joan.

(4) Poor Joan seems to have grown crazier than ever. She now claims that her apartment was bugged by the Feds, [who are listening to her every word]Joan. 
    (Harris & Potts, 2009: 548)

I will argue that in some of the alleged exceptions to appositive projection the construction under consideration might not be an appositive at all. In other cases, the observed non-speaker-oriented readings can be derived by pragmatic reasoning or are due to a perspective shift. Although genuine instances of semantically embedded appositives do seem to exist, I will point out that such cases have a limited empirical scope. I will conclude that appositive projection is a pervasive phenomenon and is part and parcel of the semantics of appositives.

The paper is structured as follows. In Section 2, I examine the projection behavior of appositives and their participation in anaphoric phenomena. In Section 3, I review previous approaches to appositive projection. In Section 4, I present the formal proposal that explains why appositives project even when they appear in the syntactic scope of propositional operators. In Section 5, I address various claimed exceptions to appositive projection. I conclude the paper in Section 6.

1I put superscripts on antecedents and subscripts on anaphors. The idea of marking anaphoric dependencies in this way goes back to Barwise (1987).
2 Appositive projection: The basic pattern

Appositives are well-known to project, i.e. escape the syntactic scope of operators placed elsewhere in the sentence. Their projection behavior is easily demonstrated when sentences with appositives are subjected to the so-called “projection family test” (see e.g. Chierchia & McConnell-Ginet, 2000). This test states that an implication associated with a given sentence projects if that implication does not vanish when the sentence is negated, modalized, hypothetically assumed, embedded under an attitude verb, etc. According to this diagnostic, implications triggered by appositives project. To illustrate, consider the sentence in (5), which implies that Edward is from Minnesota. This implication is not canceled in (6), despite the presence of various entailment-canceling operators elsewhere in the sentence.

(5) Edward, who is from Minnesota, enjoys cold winters.

(6) a. It’s not true that Edward, who is from Minnesota, enjoys cold winters.
   b. It’s possible that Edward, who is from Minnesota, enjoys cold winters.
   c. If Edward, who is from Minnesota, enjoys cold winters, then he’ll like it around here.
   d. Crystal believes Edward, who is from Minnesota, enjoys cold winters.

These data might lead one to conclude that appositives are somehow interpreted outside the syntactic scope of higher operators. This idea quickly proves problematic, though. It has been noticed that appositives are interpreted in surface position with respect to various anaphoric phenomena (see Potts, 2005; Arnold, 2007; Nouwen, 2007; AnderBois et al., 2015). For example, discourse anaphora can easily cross from the main clause into the appositive and vice versa. This is demonstrated in (7), where the antecedent and the anaphoric pronoun occur in different parts of the sentence yet there is no problem for the anaphoric dependency to be established.

(7) a. Jeremy helped Sarah, who thanked him. (MC ∈ APP)
   b. Sarah, who got help from Jeremy, thanked him. (APP ∈ MC)

What is important in such data is that the antecedent precedes its dependent. When this restriction is not met, the discourse anaphoric links are destroyed and the intended interpretations become difficult or impossible. Indeed, the interpretations in (7) become harder or unavailable if the pronoun linearly precedes the antecedent, as shown in (8).

(8) a. #He helped Sarah, who thanked Jeremy.
   b. ? Sarah, who got help from him, thanked Jeremy.

The paradigm in (7)-(8) instantiates a wider pattern, one which involves a broader class of anaphoric phenomena, such as presupposition and VP ellipsis. The examples in (9)-(10) are acceptable because the antecedent (a clause or a VP) precedes its dependent (the presupposition trigger too or a VP gap). The fact that the anaphoric dependency crosses the main clause/appositive boundary has no role to play. However, when the dependent comes before the antecedent, the sentences become incomprehensible. This is shown in (11a) for (9a) and in (11b) for (10a).
(9) a. [John saw Mary], who saw him too. (MC \(\rightarrow\) APP)  
b. John, [who saw Mary], saw Susan too. (APP \(\rightarrow\) MC)  
(AnderBois et al., 2015: 97)

(10) a. Someone that [supports the war] insulted Kim, who doesn’t \(\Delta\). (MC \(\rightarrow\) APP)  
b. Sandy, who [supports the war], insulted someone that doesn’t \(\Delta\). (APP \(\rightarrow\) MC)  
(Arnold, 2007: 290)

(11) a. # John saw Mary too, [who saw him].  
b. # Someone that \(\Delta\) insulted Kim, who doesn’t [support the war].

To see the two seemingly contradictory properties of appositives at a glance, consider (12). In this sentence the anaphoric dependences observe linear order (the anaphors follow their antecedents) and the result is a coherent piece of discourse. Since there is an anaphoric dependency from the main sentence into the appositive (that between John and his) and an anaphoric dependency from the appositive back into the main sentence (that between a woman and her), the appositive cannot be interpreted as entirely preceding or entirely following the rest of the sentence. At the same time, the appositive escapes the syntactic scope of the modal operator possible, as the implication that John nearly killed a woman with his car is not canceled.

(12) It’s possible that John, who nearly killed a woman with his car, visited her in the hospital.

The fact that appositives participate in order-dependent phenomena in the usual way suggests that they are interpreted in surface position. The task then is to devise a semantic mechanism that can explain why appositive content projects past propositional operators without escaping their syntactic scope. I first review previous accounts of appositive projection (see Section 3) and then propose one such mechanism (see Section 4).

3 Previous work on appositive projection

One simple solution to the projection problem for appositives is to claim that they escape the scope of operators because, at the relevant level of representation, they are or can be attached to a high syntactic node. This syntactic node could be the root node of the sentence or a text node, which would allow us to interpret appositives either as conjoined with the entire sentence or as independent clauses, respectively. I will call this the SCOPAL APPROACH to appositive projection (see Demirdache, 1991; Del Gobbo, 2003; Kubota & Uegaki, 2009; Schlenker, 2009a; ms; Nouwen, to appear; see also Venhuizen et al., 2014; Martin, ms). According to Schlenker (2009a; ms), for example, appositive relative clauses can be attached to any node of propositional type that dominates their anchor. However, there is a preference for high syntactic attachment, which explains their typical lack of scopal interaction. Low syntactic attachment is dispreferred but possible: it is needed to
account for cases in which appositive relative clauses appear to take scope under an operator.2

The scopal approach to appositive projection is very appealing because of its simplicity. There are some challenges, though. First, it seems that this approach predicts more flexibility than we actually need. In particular, it is not clear why high syntactic attachment is preferred and where the restrictions on low attachment come from. If low attachment is in principle allowed, then the fairly robust projection behavior of appositives starts to look like a mystery.

Perhaps more importantly, it is not obvious how the scopal approach would derive the sensitivity of appositives to order-dependent phenomena. Recall from Section 2 that appositives are interpreted in surface position with respect to anaphoric phenomena. This means that the interpretation procedure should be made sensitive to the linear order between the appositive and the remaining part of the sentence. But this requirement seems to go against the assumption of this approach that appositives are removed from the syntactic scope of higher operators.

Another approach to appositive projection is the TWO-DIMENSIONAL APPROACH (see Dever, 2001; Potts, 2005; see also Karttunen & Peters, 1979; Berckmans, 1994; Bach, 1999). According to this approach, appositives are attached to their anchors but the compositional semantics shunts their content into a secondary meaning dimension. The logical and compositional independence of appositive content explains why external operators have no effect on the way appositives are interpreted. To illustrate, the two-dimensional approach would interpret the sentence in (13a) roughly as in (13b), where the negation operator only takes scope over the main clause. This correctly predicts that the appositive content projects.

(13) a. Lance, who is a cyclist, didn’t win.
    b. ⟨¬(Lance won), Lance is a cyclist ⟩

The two-dimensional approach improves over the scopal approach because it does not rely on specific syntactic assumptions in order to explain appositive projection. But it inherits the main problem of scopal accounts, i.e. it does not make room for the fact that appositives are interpreted as integrated into the sentence with respect to order-dependent phenomena (see again Section 2). This approach neatly separates the appositive content from the content expressed by the main sentence, thus excluding unwarranted scopal interaction. But in doing so it also ignores the linear order between the appositive and the rest of the sentence. This leaves little hope of explaining the anaphoric interaction of appositives with surrounding discourse.

In addition, two-dimensional semantic architectures are well-known to inherit the “binding problem” of Karttunen & Peters (1979). The binding problem arises when a single indefinite element in the syntax appears twice in the meaning representation because it needs to bind into both meaning dimensions. The binding problem is particularly critical here because it leads to problems when the appositive anchor is an indefinite. Under the two-dimensional approach, the sentence in (14) would be represented as in (14a). But this last meaning is clearly too weak. It is compatible with a situation in which a friend

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2Apparent cases of semantically embedded appositive relative clauses are discussed in Section 5.4 below.
of mine wins the New York marathon and another friend of mine is a banker while the original sentence excludes such a situation. What we really want is a single existential quantifier that binds into both dimensions, as in (14b). But this would bring us back to having a single meaning dimension and thus goes against the most central assumption of the two-dimensional approach.

(14)  
a. A friend of mine, who is a banker, won the New York marathon.  
b. \( \langle \) a friend of mine won the New York marathon, a friend of mine is a banker \( \rangle \)  
c. \( \exists x [ x \text{ is a friend of mine } \langle x \text{ won the New York marathon, } x \text{ is a banker } \rangle ] \)  

Yet a third approach to appositive projection is the **PRESUPPOSITIONAL APPROACH**. It views appositives as presuppositional elements, which then expectedly project past higher operators. Although this approach is underrepresented in the field, an account of appositive projection along those lines is given in Sæbø (2011) (see also Schlenker, 2009a; 2009b; ms). Unlike scopal or two-dimensional accounts according to which appositives scope out of higher operators and project in the strong sense, the presuppositional approach makes a different and more specific prediction. It predicts that appositive projection matches the distinct and well-studied pattern of presuppositions (see Karttunen, 1973; 1974; Heim, 1983; 1992; Beaver, 2001; a.o.). In particular, if inferences triggered by appositives are presupposed, they are expected to be cancelable in certain environments, similarly to presupposition cancelation. The mechanism that explains presupposition projection should then also explain appositive projection.

This prediction does not seem to be borne out, though, as it appears that appositive inferences project in a stronger sense than presupposed content. Presuppositions can be canceled in linguistic environments in which appositive inferences cannot. To illustrate, the embedding predicate *regret* presupposes the content of its complement in simple sentences, as seen in (15), which implies that Obama kissed Hillary. However, this presupposition is blocked if it is entailed by a previous conjunct, as in (16a), or a conditional antecedent, as in (16b). In each of those sentences the presupposition projects only to the preceding clause. Since the initial clauses are in the scope of a modal operator (a possibility modal in (16a), an *if*-operator in (16b)), their entailments are blocked and thus the sentences as a whole do not presuppose that Obama kissed Hillary.

(15)  
Obama regrets that he kissed Hillary.

(16)  
a. It’s possible that Obama kissed Hillary and that he regrets that he kissed her.  
b. If Obama kissed Hillary, then he regrets that he kissed her.

Structurally similar sentences with appositives furnish different results. While (17), a counterpart of (15), does imply that Obama is a socialist, (18a)-(18b), the counterparts of (16a)-(16b), are odd. The reason for the oddness is that the appositive implication that Obama is a socialist is not canceled. Given that this proposition is also hypothetically assumed in a previous part of each sentence, the speaker is conversationally implicating that she is both certain and not certain that Obama is a socialist, which results in infelicity. There is no such problem in (16), where the presupposition triggered by *regret* is filtered out, so the speaker implicates only uncertainty towards the proposition that Obama kissed Hillary and the sentences are felicitous.
Obama, who is a socialist, will raise taxes on the rich.

We see that appositive content projects stronger than classical presuppositions: implications triggered by appositives are harder to cancel than presupposed content. This finding casts serious doubts on the claim that the scopal inertness of appositives is best explained in terms of presupposition projection.

The final approach that I discuss is the DISCOURSE TOPIC APPROACH (see Amaral et al., 2007; Roberts et al., 2009; Simons et al., 2010; see also Tonhauser et al., 2013 and AnderBois et al., 2015). This approach seeks to derive the projectivity of appositives from their “not-at-issue” discourse status, i.e. from the fact that appositives typically do not address the discourse topic or the “question under discussion.” The discourse topic approach is actually not limited to appositive constructions; its far-reaching goal is to explain in a unified way all sorts of projective meanings, including appositive implications and presuppositions. To this end, its proponents hypothesize that there is a perfect overlap between projective meanings and not-at-issue meanings, as seen from the following statements:

“Projective meaning just is not-at-issue meaning.” (Roberts et al., 2009: 6)
“All and only the not-at-issue content of a constituent projects, given an appropriate context of utterance.” (Roberts et al., 2009: 7)
“Meanings project IFF they are not at-issue [...].” (Simons et al., 2010: 309).

It is clear that the discourse topic approach does not regard projective content as rooted in grammar but rather as arising from discourse. For appositives, this means that their discourse status (at issue vs. not at issue) could be used as a predictor for their projection behavior. In most cases, this idea seems to make good predictions, as appositives typically contribute secondary or not-at-issue implications (see Potts, 2005; Murray, 2010; 2014; AnderBois et al., 2015). It then correctly follows that appositives trigger projective inferences. But the projectivity of appositives appears to be less sensitive to their discourse status than predicted by this pragmatic approach. For example, Koev (2013), AnderBois et al. (2015), and Syrett & Koev (2015) argue that appositive relative clauses can be at issue when they occur at the end of the sentence. In (19), the appositive relative clause is a good target of the direct rejection That’s not true, which arguably diagnoses at-issue status (see e.g. Tonhauser, 2012). Even so, the appositive implication projects past the possibility

Schlenker (2009) provides examples from French which purport to show that appositive projection could mimic the pattern of presupposition projection. While evaluating claims about appositives in other languages goes beyond the scope of this paper, I believe that some of his examples would be explained if appositives can, in certain limited cases, be interpreted as semantically embedded. That is, if appositives are semantically embedded, then the conditional inferences they trigger might be simple entailments, not presuppositions. (See also Section 5.4.)

modal *might*. This suggests that the projection properties of appositives are more a matter of grammar and less a matter of discourse status.

\[(19)\quad \text{A: Liz might be with her husband, who has prostate cancer.} \\
\text{B: That’s not true—he has lung cancer.}\]

Similar arguments can be made about other types of constructions, whose projection properties seem to be primarily determined by grammar rather than discourse. Complements clauses, especially those embedded under fiction verbs (like *dream, imagine, hallucinate*, etc.) provide an illustration. Imagine that we are developing a cure that is supposed to help people who never dream to start having dreams. In this context, the question under discussion in \((20)\) would more likely be about whether Jessica had a dream and less likely about the content of her dream. This means that the embedded clause in the answer below does not address the question under discussion, i.e. it is not at issue. This would lead us to expect that the embedded content that Jessica became Miss Universe should project. The fact that it does not could be attributed to the fact that embedded clauses under non-factive predicates simply do not project, no matter what their discourse status.

\[(20)\quad \text{A: What happened last night?} \\
\text{B: Jessica dreamed she became the next Miss Universe.}\]

Coming back to appositives, the discourse topic approach needs to address two important questions. First, it needs to explain why appositives are bound to project even though they can sometimes be at issue.\(^5\) Second, it should be based on a mechanism that makes explicit the link between discourse status and projective behavior. I believe that the account presented below brings us closer to providing an answer to both of these questions (see in particular the discussion in Section 4.3). I will offer a formal mechanism which ties appositive content directly to the utterance context and thus makes them escape the semantic scope of propositional operators. This mechanism forces appositives to project and could also explain the intuition that their projectivity is somehow rooted in discourse.

## 4 Explaining appositive projection

In Section 2 we saw that appositives project past propositional operators even though they are interpreted in surface position with respect to anaphoric phenomena. This section introduces a formal mechanism that captures those two seemingly contradictory properties. The proposal builds on Koev (2013) and AnderBois *et al.* (2015), both of which owe their main insight to the account of modal anaphora in Stone (1997; 1999) and Stone & Hardt (1999). I present a comprehensive account of appositive projection that generalizes to all sorts of propositional operators. I first sketch the basic idea and then flesh it out in formal

\(^5\)An anonymous reviewer wonders whether appositive content is at issue only if it does not project or whether appositive content can simultaneously project and be at issue. I believe that the former and weaker claim is uncontroversial (see again Koev, 2013; AnderBois *et al.*, 2015; Syrett & Koev, 2015). The example in (19) suggests that even the stronger claim – that an appositive can both project and be at issue in the same utterance – might be true. I do not want to commit to this latter claim without further research, though.
terms. I also discuss various wide-ranging implication of the proposal. The formal system introduced in this section is defined in full in the Appendix.

4.1 Informal characterization

I start off by discussing the syntactic position of appositives within the sentence. There are two major views on the attachment site of appositives in the literature. The older view is that appositives are generated outside the host clause – e.g. as conjoined with the sentence or as discontinuous constituents that enter the syntactic derivation at a later stage – but are linearized as adjacent to their anchors by some exceptional syntactic mechanism (see Ross, 1967; Emonds, 1979; McCawley, 1982; Safir, 1986; Fabb, 1990). This view is motivated by the relative independence of appositives from the rest of the sentence, including their lack of scopal interaction. Since I will propose a projection mechanism that does not rely on interpreting appositives outside the syntactic scope of operators, I will not pursue this approach. The more recent view is that appositives are syntactically integrated into the sentence and form a constituent with their anchor, e.g. are adjoined to it (see Jackendoff, 1977; Kayne, 1994; de Vries, 2006; Potts, 2005; Citko, 2008). This is the view that I will adopt. It comes at no theoretical cost since appositives are linearly adjacent to their anchors. It also explains the surface position anaphoric interaction of appositives, assuming that appositives are interpreted dynamically at the point of their occurrence in discourse.

In order to derive the projection behavior of appositives, I make two major assumptions. The first assumption is that appositives, just like independent sentences, are tied to a context, which is typically the utterance context (cf. Murray, 2010; 2014; Koev, 2013; AnderBois et al., 2015). This means that by uttering a sentence with an appositive the speaker publicly commits herself to both the main clause content and the appositive content.6 The second assumption I make is that lexical predicates are adorned with propositional variables and operators like negation or modals can bind such variables (see Stone, 1997; 1999; Stone & Hardt, 1999). This gives us a mechanism whereby operators bind into the semantic content of their complement(s). Importantly, appositive content cannot be so bound because it is directly linked to the utterance context (or, exceptionally, to a secondary context). It then follows that appositives project even when they are placed in the syntactic scope of a higher operator.

Here is an outline of how this is supposed to work. Imagine that the phrase Jack, who is a lawyer, is rich is in the syntactic scope of some propositional operator $O$. We know that this operator can only target the proposition that Jack is rich while the appositive content that Jack is a lawyer projects. Why this is so can be read off from (21a) below. $O$ introduces a propositional variable $q$, which binds into the main clause predicate rich and stores the content that Jack is rich. Let us call this content the scope proposition of this operator. $O$ itself is relativized to what may be called a reference proposition, represented below as $p$. Depending on what this operator stands for, it can state various relationships between the scope proposition and the reference proposition. For example, if $O$ is a negation op-

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6 Section 5.3 discusses the case of shifted appositives, which are anaphoric to a secondary context and entail commitments for the agent of that context. Nonetheless, shifted appositives project, i.e. they fall outside the semantic scope of propositional operators placed elsewhere in the sentence.
erator, it will require that the reference proposition be disjoint from the scope proposition (see the following section). If (21a) is further embedded, this reference proposition would be the scope proposition of the closest operator higher up in the structure, which is $P$ in (21b). If $P$ is the highest operator in the sentence, as in (21b), its reference proposition would express a commitment for the speaker, i.e. a commitment for the agent of the utterance context. Below, this proposition is represented as $\text{com}(\text{ag}(u))$, where $u$ stands for the utterance context. Crucially, the appositive content is not bound by $O$ because it is directly relativized to the speaker’s commitment worlds. Uttering an appositive thus amounts to uttering an independent sentence.

(21)  
\begin{align*}
\text{a. } & \ldots \ O^q_p \left[ \text{Jack} \left[ \text{who is a lawyer} \right] \text{com}(\text{ag}(u)) \right] \text{is rich}_q \ldots \\
\text{b. } & P^p_{\text{com}(\text{ag}(u))} \ldots \ O^q_p \left[ \text{Jack} \left[ \text{who is a lawyer} \right] \text{com}(\text{ag}(u)) \right] \text{is rich}_q 
\end{align*}

The overall effect of this scopal mechanism is that operators can target semantic content selectively. That is, among the various constituents that fall under the syntactic scope of an operator, only constituents that are bound by it are actually interpreted in its scope. The rest of the structure is interpreted as if it were outside the syntactic scope of the operator. This is the case for appositives, which are not bound by propositional operators and are attributed to the speaker.

As can be seen, the account crucially relies on a particular analysis of propositional operators, one according to which they bind modal variables. This idea is already implicit in Kripke’s seminal work on the semantics of modal logic (see Kripke, 1963) and has been widely adopted in the formal semantics literature (see Lewis, 1973; Montague, 1973; Kratzer, 1981; 1991; a.m.o.). Standardly, constituents in the syntactic scope of modal operators are interpreted with respect to the possible worlds which are accessible from the world of evaluation. However, this approach does not quite give us what is needed in order to derive the anaphoric and projection properties of appositives. First, this static approach does not capture the anaphoric data discussed in Section 2. In addition, while the standard approach treats modal operators as quantifiers over possible worlds, we need to state relationships between propositions, i.e. sets of worlds. Perhaps most importantly, the worlds which modal operators quantify over are located in the metalanguage rather than the interpreted language. This entails that modal operators have an effect on the way their entire syntactic scope is interpreted. There is no obvious way to exclude appositives from the semantic scope of modals.

There are several influential accounts of modal operators in a dynamic semantic setting (see e.g. Asher, 1986 and Kamp, 1990 on belief-operators, and Veltman, 1996 on English *might*). These dynamic accounts can easily capture the anaphoric dependences between appositives and the rest of the sentence. Yet these accounts entail that modal operators take scope in the traditional way, i.e. through syntactic configuration. For example, Asher (1986) and Kamp (1990) are primarily concerned with the problem of non-substitutivity of synonymous terms in belief contexts and propose that belief encodes a relation between an agent and a syntactic object, i.e. a discourse representation structure. Since appositives in the syntactic scope of attitude operators contribute to this structure, they will necessarily fall in the semantic scope of such operators and fail to project. As already mentioned, the current proposal is inspired by dynamic accounts which view negation and modal operators as binding propositional variables in their syntactic scope (see Stone, 1997; 1999;
Starting from this idea, it is but a small step to propose that appositives project because they are not bound by propositional operators placed elsewhere in the sentence.

4.2 Formal account

I now make explicit the scopal mechanism that derives appositive projection. What we need is a formal system (i) that has dynamic effects and can capture the anaphoric data discussed in Section 2, and (ii) that is fully compositional so that logical representations of sentences are derived in a systematic fashion. For ease of exposition, a frame the proposal in an update semantics, i.e. a dynamic semantics in which sentential terms express functions from information states to information states (see Heim, 1982; Veltman, 1996; Beaver, 2001; a.o.). I take the freedom of supplying dynamic terms with lambda operators, even though these are not part of the update semantics. Rather, I assume that lambda operators get their usual static meaning and view dynamic terms as abbreviations for type-logical expressions. The Appendix defines a mapping from dynamic terms into type-logical expressions, building on the method proposed in Muskens (1996) (see also Beaver, 2001 and Bittner, 2011). This means that the formal system is overall static; it emulates update semantics yet it enjoys full compositionaly. I couch the account in dynamic terms only for reasons of expository simplicity. As briefly illustrated in (24), the fully-fledged meanings are difficult to read and would make the presentation unnecessarily complex.

In update semantics, information states are often modeled as sets of assignment-world pairs, where the assignments record the anaphoric information and the worlds record the factual information. Since propositions (or sets of possible worlds) are explicitly represented in the in the logic, I will model information states simply as sets of assignment functions. The basic interpretation rules of the logic are given below.\footnote{Geurts (1999) lets modal operators relate “indexed” propositions, or sets of world-assignment pairs. From indexed propositions classical propositions, or sets of worlds, can easily be extracted.}

\begin{align}
(22) & \quad \text{a. } \sigma[[R_p(t_1, \ldots, t_n)]] = \{g \in \sigma \mid \text{for all } w \in [[p]]^g : \langle w, [[t_1]]^g, \ldots, [[t_n]]^g \rangle \in [[R]]^g\}
& \quad \text{b. } \sigma[[t_1 = t_2]] = \{g \in \sigma \mid [[t_1]]^g = [[t_2]]^g\}
& \quad \text{c. } \sigma[[\varphi \land \psi]] = \sigma[[\varphi]] [[\psi]]
& \quad \text{d. } \sigma[[\exists v]] = \{h \mid \text{for some } g \in \sigma : g[v|h]\}
\end{align}

The major innovation of the logic is that dynamic terms stating lexical relations are relativized to sets of worlds, thus recording the propositional information expressed. For example, given the rule in (22a), the dynamic term $\text{sloth}_p(x)$ will only keep those assignments $g$ in the input information state $\sigma$ which verify that $[[x]]^g$ is a sloth in all of the worlds in $[[p]]^g$. Relativizing semantic content to sets of worlds is crucial for the way propositional operators will be defined. The remaining interpretation rules are standard. Identity statements remove from the information state the assignments that do not verify them (22b).
Conjunction is order-sensitive and updates the information state first with the left conjunct and then with the right conjunct (22c). Finally, existential quantification is modeled as random value assignment to a variable (22d). Interpreting $\exists v$ amounts to adding to the information state any assignment $h$ that differs from some old assignment $g$ at most with respect to the value $h$ assigns to $v$. This last statement is abbreviated in (22d) as $g[v]h$.

Given this semantics, the simple sentence in (23) can be given the logical translation in (23b). According to it, an utterance of this sentence introduces a discourse referent $x$ that refers to Jack and commits the speaker to the proposition that Jack is rich. This is achieved by subscribing the lexical predicate $rich$ with $\text{com}(\text{ag}(u))$, the commitments of the agent of the utterance context.

(23) Jack is rich.
   a. $\text{DECL}_u \; [\text{Jack}^x \; \text{rich} ]$
   b. $\exists x \land x = jacks \land \text{rich}_{\text{com}(\text{ag}(u))}(x)$

In order to compositionally derive the representation in (23b), I assume that independent sentences host a declarative operator $\text{DECL}$ that is tied to the utterance context. Let us agree that (23a) is the parsed and fully specified structure of (23). If $\text{Jack}^x$ translates as $\lambda P. \exists x \land x = jacks \land P(x)(p)$ and $\text{rich}$ translates as $\lambda x. \text{rich}_p(x)$, these can be composed to $\lambda P. \exists x \land x = jacks \land \text{rich}_p(x)$, which can further be combined with $\text{DECL}_u \Rightarrow \lambda P. P(\text{com}(\text{ag}(u)))$ to produce (23b). We see that clauses in isolation express functions from sets of worlds to updates, e.g. $\text{Jack}^x \; \text{rich}$ is translated as $\lambda P. \exists x \land x = jacks \land \text{rich}_p(x)$. Such terms are incomplete and could be called SENTENCE RADICALS (see Stenius, 1967). In order to unfold their dynamic potential, sentence radicals need to be composed with operators, i.e. a higher propositional operator (such as negation or modals) or a declarative operator.

The representation in (23b) can be viewed as an abbreviation for the type-logical meaning in (24a), where the following metalanguage variables are used: $I$ for information states, $i, j$ for assignment functions, and $w$ for possible worlds; $\| \cdot \|$ is the usual static interpretation function. When supplied with an information state $\sigma$, as in (24b), this meaning is turned into a function from assignments $j$ to truth values. It will produce truth if and only if $j$ may only differ from some assignment $i$ in $I$ in that it interprets $x$ as Jack and Jack is rich in all worlds that make up the speaker’s commitment set. This meaning exactly describes the information state given in (25), which results from the interpretation rules in (22) if (23b) is uttered in the information state $\sigma$. The meaning in (24) then inherits the dynamic effects of the update semantics but can be compositionally derived in the usual way (see again footnote 9).

(24) a. $\lambda I. \lambda j. [\exists i(Ii \land i[x]j) \land \| x \|^2 = jacks \land \forall w \in \| \text{com}(\text{ag}(u)) \|^2 : \langle w, \| x \|^2 \rangle \in \text{rich} ]$
   b. $\lambda j. [\exists i(\sigma i \land i[x]j) \land \| x \|^2 = jacks \land \forall w \in \| \text{com}(\text{ag}(u)) \|^2 : \langle w, \| x \|^2 \rangle \in \text{rich} ]$

(25) $\{ h \mid \exists g \in \sigma : g[x]h \land \| x \|^h = \| jacks \|^h \land \forall w \in \| \text{com}(\text{ag}(u)) \|^h : \langle w, \| x \|^h \rangle \in \| \text{rich} \|^h \}$

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$^9$The meaning in (24a) can be compositionally derived from the following lexical meanings: $[\text{Jack}^x] = \lambda P. \lambda i. \lambda j. [P(x)(p)(\lambda j. [\exists i(Ii \land i[x]j) \land \| x \|^2 = jacks])(j)], [\text{rich}] = \lambda x. \lambda i. \lambda j. [Ii \land \forall w \in \| p \|^i : \langle w, \| x \|^i \rangle \in \text{rich}]$, and $\| \text{DECL}_u \| = \lambda P. P(\text{com}(\text{ag}(u)))$. 

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Needless to say, logical representations as in (23b) are much easier to read than meanings as in (24). This is why in the main body of the paper I will stick to the update semantics in (22) and defer its static reformulation to the Appendix.

I take it that appositives carry their own illocutionary force that is not dependent on the force of the main sentence. For example, the appositive who \( x \) is a lawyer gets translated as \( \text{lawyer}_{\text{com}(\text{ag}(u))}(x) \), where its descriptive content is attributed to the speaker. This translation can be derived by composing the lexical entry \( \text{lawyer} \leadsto \lambda x \lambda p. \text{lawyer}_p(x) \) with the anaphor \( \text{who} \leadsto \lambda P \lambda p. P(x)(p) \) to produce \( \lambda p. \text{lawyer}_p(x) \), and then by further composition with \( \text{lawyer}_{\text{com}(\text{ag}(u))}(x) \).\(^{10}\)

I believe the assumption that appositives host declarative operators is not a controversial one. It is evidenced by the fact that appositives admit speech act adverbials which otherwise only occur in main clauses. In addition, appositives can encode a speech act that is different from the one expressed by the main sentence. (26a) below contains a nominal appositive modified by the speech act adverbial \textit{hands down} and (26b) has an appositive relative clause that expresses a statement while the rest of the sentence is a question.

(26) a. We rented \textit{The Good, the Bad, and the Ugly}, hands down the best Clint Eastwood movie ever made.

b. Has Cameron, who was talking to Gloria a minute ago, gone home?

(Syrett & Koev, 2015: 567)

As we will see, it is the presence of declarative operators that links appositives directly to the utterance context and prevents them from being bound by higher operators.

I assume that appositives compose with their DP anchors via the following rule.

(27) \textit{DP-APP composition rule}
If \( \text{DP} \leadsto \alpha \) and \( \text{APP} \leadsto \beta \), then \( \text{DP} \text{ APP} \leadsto \lambda P \lambda p. (\lambda y \lambda q. \beta)(p) \land P(x)(p) \).

In essence, this rule lets the appositive fill the first argument slot of the DP anchor and creates a new argument slot. It imports the appositive contribution between the anchor and the remaining material, thus producing a more complex meaning of the same logical type, which is in line with the adjunct nature of appositive modifiers. For example, \( \text{Jack}^x \leadsto \lambda P \lambda p. \exists x \land x = \text{jack} \land P(x)(p) \) and \( \text{who}_x \) is a lawyer \( \leadsto \text{lawyer}_{\text{com}(\text{ag}(u))}(x) \) can compose to \( \lambda P \lambda p. \exists x \land x = \text{jack} \land \text{lawyer}_{\text{com}(\text{ag}(u))}(x) \land P(x)(p) \), which can enter into the remaining semantic composition in the usual way.\(^{11}\) If further composed first with \( \text{rich} \leadsto \lambda x \lambda p. \text{rich}_p(x) \) and then with \( \text{DECL}_u \leadsto \lambda P. P(\text{com}(\text{ag}(u))) \), the result is as in (28b).

(28) Jack, who is a lawyer, is rich.

a. \( \text{DECL}_u [ \text{Jack}^x [ \text{DECL}_u \text{ who}_x \text{ lawyer} ] \text{ rich} ] \)

b. \( \exists x \land x = \text{jack} \land \text{lawyer}_{\text{com}(\text{ag}(u))}(x) \land \text{rich}_{\text{com}(\text{ag}(u))}(x) \)

\(^{10}\)This is how appositive relative clauses are composed. I assume that nominal appositives contain a covert anaphoric element comparable to the \textit{wh}-pronoun in appositive relative clauses (see e.g. Heringa, 2011). The semantic composition of nominal appositives closely follows the one sketched above for appositive relative clauses.

\(^{11}\)The appositive contribution is underlined for better readability.
The sentence in (28) then commits its utterer to Jack being a lawyer and Jack being rich. These two commitments stem from two different sources, i.e. the two declarative operators in (28a). This might be less obvious for (28), since this sentence does not contain negation or modals. But it becomes clear as soon as we look at the way such sentences interact with propositional operators.

I now turn to the last important ingredient of the proposal: the semantics of operators. Traditionally, propositional operators are modeled as primitive symbols that affect the interpretation of the material in their syntactic scope. In update semantics, for example, negation is assumed to remove all assignments from the input information state that survive after the information state is updated with the non-negated sentence (cf. Heim, 1982; Veltman, 1996; Groenendijk et al., 1996).

\[(29) \quad \sigma[[\neg \varphi]] = \sigma - \sigma[[\varphi]]\]

The interpretation rule in (29) is hard to reconcile with our observation in Section 2 that certain parts of the non-negated sentence, i.e. the ones contributed by appositives, escape the semantic scope of negation. I thus propose a definition that effectively makes negation a binding operator that could fail to bind into parts of its syntactic scope. I assume that negation abbreviates the series of conjuncts as shown in (30a). The first conjunct introduces a proposition (represented as \(q\)) and its semantics was defined in (22d). The second conjunct is an abbreviation of any dynamic term that contains \(q\) as a free variable. The interpretation of the third conjunct is given in (30b) below.

\[(30)\begin{align*}
a & \quad \text{NOT}^\theta_p(\varphi_q) := \exists q \land \varphi_q \land \neg_p(q) \\
b & \quad \sigma[[\neg_p(q)]] = \{ g \in \sigma \mid [p]_\theta \cap [q]_\theta = \emptyset \}\end{align*}\]

Negation then has the following semantic effects: it introduces a propositional variable \(q\) which stores the content of \(\varphi_q\) and states that the reference proposition (represented as \(p\)) of the negated sentence is disjoint from the maximal value of \(q\).\(^{12}\) The maximal value of \(q\) in an information state \(\sigma\) is defined as \([q]_\sigma = \{ w \in [q]_\sigma \mid g \in \sigma \}\), i.e. it collects all the worlds assigned to \(q\) by assignments in \(\sigma\).

Consider now the negated sentence in (31a). Its logical representation in (31b) can be derived by composing \(\text{Jack}^x \text{rich} \sim \lambda p. \exists x \land x = \text{jack} \land \text{rich}_p(x)\) first with the negation \(\text{not}^q \sim \lambda P \lambda p. \text{NOT}^\theta_P(P(q))\) and then with the declarative operator \(\text{DECL}_u \sim \lambda P. P(\text{com}(\text{ag}(u)))\). The formula in (31b) states that the speaker’s commitment set of worlds is disjoint from the worlds in which Jack is rich. That is, the speaker is only committed to worlds in which Jack is not rich, as desired.

\[(31)\begin{align*}
a & \quad \text{Jack isn’t rich.} \\
b & \quad \text{NOT}^\theta_{\text{com}(\text{ag}(u))}(\exists x \land x = \text{jack} \land \text{rich}_q(x))\end{align*}\]

This treatment is general enough and allows for stacking of negation operators. The sentence in (32a) contains two negations and its logical representation in (32b) follows\(^{12}\)

\(^{12}\)The way the semantic composition works ensures that \(q\) in \(\varphi_q\) is bound by the negation operator (see below).
from the lexical translations already given. In (32b), the variable \(r\) represents the proposition that Jack is rich, and the variable \(q\) represents the proposition that Jack is not rich. The external negation operator requires that the speaker is committed to worlds that lay outside that last proposition, i.e. to worlds in which Jack is rich.

(32) a. Jack is not not rich.
   b. \(\text{NOT}^q_{\text{com}(\text{ag}(u))}(\text{NOT}^r_{\text{q}}(\exists x \land x = \text{jack} \land \text{rich}_r(x)))\)

With that much machinery in place, we can now see why appositives escape the scope of negation operators. Consider the example in (33a), which is represented as in (33b).

(33) a. Jack, who is a lawyer, isn’t rich.
   b. \(\text{NOT}^q_{\text{com}(\text{ag}(u))}(\exists x \land x = \text{jack} \land \text{lawyer}_{\text{com}(\text{ag}(u))}(x) \land \text{rich}_q(x))\)

The negation operator requires that the speaker is committed to worlds that are disjoint from the (maximal value of the) scope proposition, represented as \(q\). Since the negation operator only binds the non-appositive part of its scope, the scope proposition is that Jack is rich. The appositive portion of the scope commits the speaker to the proposition that Jack is a lawyer. As a whole, the sentence entails that Jack is a lawyer and that Jack is not rich. This means that the appositive projects past the negation operator, in spite of the fact that it is interpreted in its syntactic scope.

I now offer definitions for modal operators which follow the same basic idea: operators bind into their syntactic scope and state a relation between scope propositions and reference propositions. The definitions given correctly predict that appositives project past modals. The explanation mechanism is the same as the one already described for negation.

I first discuss modal auxiliaries. The auxiliaries \(\text{might}^q\) and \(\text{must}^q\) are given the logical translations of \(\lambda P\lambda q.\text{MIGHT}^q_{P}(P(q))\) and \(\lambda P\lambda q.\text{MUST}^q_{P}(P(q))\), respectively. These translations make use of the abbreviations in (34), whose last conjuncts are interpreted as in (35).

(34) a. \(\text{MIGHT}^q_{P}(\varphi_q) := \exists q \land \varphi_q \land \diamond_P(q)\)
   b. \(\text{MUST}^q_{P}(\varphi_q) := \exists q \land \varphi_q \land \Box_P(q)\)

(35) a. \(\sigma[[\diamond_P(q)]] = \{g \in \sigma \mid \text{for all } w \in [[P]]^g : MB(w) \cap [[q]]^g \neq \emptyset\}\)
   b. \(\sigma[[\Box_P(q)]] = \{g \in \sigma \mid \text{for all } w \in [[P]]^g : MB(w) \subseteq [[q]]^g\}\)

In essence, possibility modals require that there is a non-empty overlap between the modal bases generated by the worlds in the reference proposition and the scope proposition. Necessity modals require that such modal bases are included in the scope proposition.\(^\text{13}\)

These definitions produce the right interaction between modals and negation. The dual equivalences \(\text{not}(\text{might}(\varphi)) \equiv \text{must}(\text{not}(\varphi))\) and \(\text{not}(\text{must}(\varphi)) \equiv \text{might}(\text{not}(\varphi))\) are upheld. For example, (36a) and (36b) below have equivalent meanings. This is as predicted by their logical representations in (37a) and (37b), respectively. (37a) commits the speaker

\(^\text{13}\)Modal bases could be further restricted to conversational agents and structured by ordering sources (see Lewis, 1981; Kratzer, 1981; 1991; Yalcin, 2007). In order to keep the formulas simple, I disregard such complications.
to the complement of the proposition that only generates modal bases in which rain is possible. In turn, (37b) commits the speaker to the proposition which only generates modal bases in which rain is not possible. Clearly then, these two formulas encode equivalent semantic content.

(36) a. It is not true that it might be raining.
   b. It must not be raining.

(37) a. NOTq\text{\text{com}(ag(u))}(\text{MIGHT}_q^r(\text{rain}_r))
   b. MUSTq\text{\text{com}(ag(u))}(\text{NOT}_q^r(\text{rain}_r))

The second dual equivalence, i.e. that between not(must(\varphi)) and might(not(\varphi)), can be demonstrated to hold in a similar fashion.

Next, I discuss conditional operators. Conditional sentences require that the proposition expressed by the antecedent is included in the proposition expressed by the consequent. This is roughly the strict analysis of conditionals (cf. Stalnaker, 1968; Lewis, 1973). This analysis can be captured by assuming that if-operators express functions from two sentence radical meanings to a more complex sentence radical meaning which links the antecedent proposition and the consequent proposition in the right way. I thus assign to if-operators the translation $\text{IF}_q^r(x,\varphi,\psi) := \exists q \land \varphi \land \exists r \land \psi \land \rightarrow_p (q, r)$.

(38) a. $\text{IF}_q^r(x,\varphi,\psi) := \exists q \land \varphi \land \exists r \land \psi \land \rightarrow_p (q, r)$
   b. $\sigma[\rightarrow_p (q, r)] = \{ g \in \sigma \mid \text{for all } w \in [p]^g : \text{if } w \in [q]^g \text{ then } w \in [r]^g \}$

The interpretation rule in (38b) follows the strict analysis of conditionals. However, it is relativized to the worlds in the reference proposition. It says that if we restrict our attention to the worlds in the reference proposition (represented as $p$), the content of the antecedent (represented as $q$) is included in the content of the consequent (represented as $r$).

Finally, for attitude verbs like believe, I propose the translation $\lambda P \lambda x \lambda p. \text{BEL}_q^p(x, P(q))$, which first composes with the complement of believe and then with its subject. The abbreviation found in this translation states that the attitude holder’s doxastic alternatives are included in the scope proposition in all the worlds of the reference proposition, as witness (39). This definition follows the standard Hintikkan semantics for propositional attitudes (see Hintikka, 1969).

(39) a. $\text{BEL}_q^p(x, \varphi) := \exists q \land \varphi \land \text{bel}_p(x, q)$
   b. $\sigma[\text{bel}_p(x, q)] = \{ g \in \sigma \mid \text{for all } w \in [p]^g : \text{DOX}([x]^g, w) \subseteq [q]^g \}$

I have demonstrated that the idea of treating operators as describing relations between propositions generalizes to a wide range of operators. We now have a theoretical explanation for why appositives escape the semantic scope of negation, modal auxiliaries, conditional operators, and attitude verbs. In each of those cases, the appositive is linked to the speaker’s commitments and thus is not bound by the higher operator. At the same time,
appositives are interpreted in surface position, i.e. their scopal inertness is not accounted for at the cost of destroying the anaphoric links between the appositive and the surrounding parts of the sentence. This means that appositives project in spite of the fact that they are interpreted in situ, just as required.

4.3 Broader implications: scope and at-issueness

There are various mechanisms of scope-taking that have been explored in the literature (see Ruys & Winter, 2010; Szabolcsi, 2010; Barker, 2015 for recent overviews). What the current proposal adds to this debate is the idea that the traditional notion of “semantic scope” needs to be modified. We would like to say that propositional operators do not necessarily target their entire syntactic scope but rather only those parts of it that they bind into. The new notion of semantic scope is defined below.

(40) Semantic scope
A phrase $\alpha$ is in the semantic scope of a propositional operator $O$ if and only if
i. $\alpha$ is in the syntactic scope of $O$, and
ii. $\alpha$ is marked by a propositional variable that is bound by $O$.

This definition effectively equates semantic scope and operator binding. The novelty then is that propositional operators can be regarded as a particular kind of binding operators.

Several of the scopal mechanisms explored in the literature converge with the current proposal on the idea that semantic scope is restricted yet not fully determined by syntactic configuration. Below, I briefly compare my proposal to a few related scope-taking mechanisms and emphasize the similarities and differences. I also discuss the suitability of these mechanisms to derive appositive projection.

A number of approaches try to explain the peculiar scopal properties of indefinites. Unlike regular quantifiers, whose scope is restricted to their host clause, indefinites can take arbitrarily wide scope (see Fodor & Sag, 1982 and much subsequent literature). This has urged researchers to explore less standard scopal mechanisms. One such approach is based on “choice functions,” i.e. functions that select an arbitrary member of a given set. More precisely, $f$ is a choice function, written as $CH(f)$, if and only if $f(S) \in S$, for any non-empty set $S$. The basic idea behind this approach is that indefinites are interpreted in situ by choice functions, which are existentially closed arbitrarily far away (see Reinhart, 1997; Winter, 1997; a.o.).

To illustrate, the narrow scope reading of the indefinite in (41) is derived if the choice function variable is existentially bound below the universal quantifier while the wide scope reading comes about if the choice function variable is existentially bound from above the universal quantifier. Intuitively, (41a) says that for every semanticist there is a way of choosing a paper which she read, and (41b) says that there is a way of choosing a paper which every semanticist read.

(41) Every semanticist read a paper.
   a. $\forall x(\text{semanticist}(x) \rightarrow \exists f(CH(f) \land \text{read}(x, f(\text{paper})))))$ (narrow scope reading)
   b. $\exists f(CH(f) \land \forall x(\text{semanticist}(x) \rightarrow \text{read}(x, f(\text{paper}))))$ (wide scope reading)

See also Kratzer (1998), who assumes that choice functions are contextually supplied.
Another approach to the scope of indefinites is based on (in)dependence-friendly logic (see Hintikka & Sandu, 1989; 1997; Hodges, 1997; Väänänen, 2007; Brasoveanu & Farkas, 2011). (In)dependence-friendly logic is an extension of first-order logic that was developed in order to deal with cases in which an existential quantifier $\exists x$ is in the syntactic scope of a universal quantifier $\forall y$ but choosing a witness for $x$ does not depend on $y$. Here I focus on the format presented in Brasoveanu & Farkas (2011), where existential quantifiers are indexed with the set of variables on which their interpretation depends. Under Brasoveanu & Farkas’ approach, the ambiguous sentence in (41) can be represented as in (42). In (42a), the choice of witness for $y$ depends on $x$, so the existential quantifier takes narrow scope. In (42b), the choice of witness for $y$ depends on nothing, effectively giving the existential quantifier a wide scope.

(42) Every semanticist read a paper.
   a. $\forall x (\text{semanticist}(x) \rightarrow \exists \{x\} y (\text{paper}(y) \land \text{read}(x,y)))$ (narrow scope reading)
   b. $\forall x (\text{semanticist}(x) \rightarrow \exists \{\} y (\text{paper}(y) \land \text{read}(x,y)))$ (wide scope reading)

Despite the superficial similarities, these in-situ approaches are clearly different from the approach to appositive projection developed in this paper. The main difference is that these approaches involve scopal interaction between quantifiers with different forces while the approach I propose does not. All the propositional operators (modals, negation, declarative operators) defined in Section 4.2 are essentially existential quantifiers over propositions. Although there could be binding dependencies between some of those operators, they do not scopally interact. This is reflected in the fact that appositive projection does not depend on the syntactic position of the appositive within the sentence. This suggests that these approaches are not well-suited for explaining appositive projection.

An approach that comes closer to the current account yet involves different data is developed in Percus (2000), Keshet (2010), and Schwarz (2012), a.o. These authors try to explain the distinction between transparent (or de re) vs. opaque (or de dicto) interpretations of DPs in the syntactic scope of intensional operators. The mechanism they propose does not rely on syntactic movement (such as Quantifier Raising; see May, 1977; Heim & Kratzer, 1998) but instead leaves constituents in situ and relativizes their interpretation to situation/world variables which are locally or distantly bound by lambda operators sitting on top of each clause. For example, my brother in (43) can refer to my actual brother (the transparent reading) or the person that Mary thinks is my brother (the opaque reading). Percus (2000) notices that the transparent reading follows if the world variable on my brother is bound by a lambda operator sitting on top of the structure while the transparent reading is obtained if the world variable on my brother is bound by the local lambda operator placed inside the embedded clause.

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16 A major empirical motivation for developing such logical systems are examples like Some book by every author is referred to in some essay by every critic (Hintikka 1973: 345). Here the choice of books depends on authors only and the choice of essays depends on critics only, so the four quantifiers cannot be linearly ordered.

17 Notice that choice function approaches and (in)dependence-based approaches do not derive different readings from quantifiers with the same force. In particular, $\exists f (CH(f) \land \exists g (CH(g) \land \varphi(f(P), g(Q))))$ and $\exists g (CH(g) \land \exists f (CH(f) \land \varphi(f(P), g(Q))))$ are equivalent and so are $\exists x \exists \{x\} y \varphi(x, y)$ and $\exists x \exists \{\} y \varphi(x, y)$.

18 While Percus eventually frames his account in terms of situation variables, I illustrate with possible world variables since these make the comparison to the current proposal easier. Nothing substantial depends on
Mary thinks that my brother is Canadian. (Percus 2000: 196)

a. \[ \lambda w_0 \text{Mary thinks}_{w_0} [\lambda w_1 \text{[my brother}_w_0\text{]} \text{is Canadian}_w_1]\] (transparent reading)

b. \[ \lambda w_0 \text{Mary thinks}_{w_0} [\lambda w_1 \text{[my brother}_w_1\text{]} \text{is Canadian}_w_1]\] (opaque reading)

The notion of transparency proposed here is very similar to the notion of projection. In fact, a structure as in (44b) would derive the fact that in (44a) the appositive projects past the attitude verb, as its main predicate (the preposition *from*) is coindexed with the higher lambda operator.

(44) a. Mary thinks that Jeff, who is from Alaska, is Canadian.

b. \[ \lambda w_0 \text{Mary thinks}_{w_0} [\lambda w_1 \text{Jeff}_w_0 \text{[who is from}_w_0 \text{Alaska}_w_0\text{]} \text{is Canadian}_w_1]\]

This will not work in the general case, though. The reason is that this coindexation mechanism makes appositives illocutionary dependent on the force of the main clause. However, as we saw in (26b), appositives carry their own illocutionary force, a fact that gets obfuscated when the appositive and the main clause are both declarative, as in (44a). The *in-situ* mechanism that derives transparent vs. opaque readings of DPs is then similar but not equivalent to the mechanism behind appositive projection proposed in this paper.

In the remaining part of this section, I discuss dynamic semantic accounts of apposition, focusing on the account presented in AnderBois et al. (2015), which is most closely related to my own proposal. Although this account derives appositive projection, I argue that my proposal makes better predictions with respect to the shiftability and the discourse status of appositives.

There are various dynamic semantic accounts of apposition that manage to keep appositive content and main clause content separate (see Nouwen, 2007; Murray, 2010; 2014; Koev, 2012). While these accounts can easily capture the discourse anaphoric facts presented in Section 2, they either do not offer interpretation rules for propositional operators or else only account for simple negated clauses without appositives. In contrast, AnderBois et al. (2015) derive the projectivity of appositives from their discourse status. The main goal of AnderBois et al. is to capture the fact that appositives are usually not at issue, i.e. they typically do not carry the main point of the utterance (see Chierchia & McConnell-Ginet, 2000; Potts, 2005; Simons et al., 2010; Tonhauser, 2012; a.o.). The authors model this fact by assuming that appositive content is directly imposed on the context set while main clause content is put on the conversation table and is up for negotiation. For example, the sentence in (45a) would be translated as in (45b) (assuming the current formalism and interpreting \( \subseteq \) as the subset relation and \( cs(u) \) as the context set). The major difference to my own analysis of the same sentence in (28) is that in (45) the appositive content is directly added to the context set while the main clause proposition (represented as \( p \)) is merely introduced. Despite this difference, since the appositive content is kept separate from the main proposition, the account predicts that appositives project, just like my own proposal does.

(45) a. Jack, who is a lawyer, is rich.
b. \( \exists p \land p \subseteq cs(u) \land \exists x \land x = \text{jack} \land \text{lawyer}_{cs(u)}(x) \land \text{rich}_p(x) \)

However, the two accounts make different predictions in at least two respects. First, it is not clear whether AnderBois et al.’s account is compatible with the fact that appositives can undergo perspective shift and be attributed not to the speaker but rather to another agent (recall (4) above). Notice, for example, that it would be no good to say that in such cases the appositive is interpreted with respect to a context set \( cs(c) \), where \( c \) is some reported speech context, e.g. the context introduced by a verb of saying. The reason is that shifted appositives give no information as to whether the appositive content was accepted in the original speech context. Section 5.3 below demonstrates that the phenomenon of shifted appositives naturally fits into the current proposal.

Second, AnderBois et al.’s account predicts that appositive content is invariably not at issue. In contrast, the current proposal only requires that appositives entail commitments for some agent (i.e. the speaker or, in the case of shifted appositives, an attitude holder). This leaves open the possibility that in the right discourse conditions appositives can be at issue. Indeed, as discussed in Koev (2012; 2013), AnderBois et al. (2015), and Syrett & Koev (2015), when appositive relative clauses appear sentence-finally they can be at issue. In particular, Syrett & Koev (2015) provide robust experimental evidence that final appositive relative clauses are often good targets of direct rejections. Syrett & Koev (2015: 541) found that when given a choice, as in (46)-(47), participants display an overall preference for “No” responses targeting the main clause over “No” responses targeting the appositive. However, “No” responses targeting a final appositive relative clause, as in (47), were chosen 35.5% of the time (as compared to choosing responses targeting a medial appositive relative clause, as in (46), 21.1% of the time). Syrett & Koev conclude that these percentages, especially those for final appositive relative clauses, are higher than what one might have expected if appositives could never be at issue.

(46) A: My friend Sophie, who performed a piece by Mozart, is a classical violinist.
   B₁: No, she’s not. (target: main clause)
   B₂: No, she didn’t. (target: appositive)

(47) A: The symphony hired my friend Sophie, who performed a piece by Mozart.
   B₁: No, she didn’t. (target: appositive)
   B₂: No, they didn’t. (target: main clause)

These findings go against AnderBois et al.’s assumption that appositives are invariably not at issue. To handle such data, the authors stipulate that final appositive relative clauses can optionally introduce propositions that are at issue and can be negotiated by standard conversational means. In contrast, the current proposal of projection does not predetermine the discourse status of appositives and needs no such stipulation. But then, why are appositives less likely to be at issue? And why is the discourse status of appositive relative clauses sensitive to linear position? While a detailed account of the at-issue status of

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19 The solution seems to lack any explanatory power. An anonymous reviewer asks how central AnderBois et al.’s assumption that appositive content is invariably not at issue is for their analysis. As far as I can tell, it is their most central assumption and it cannot be abandoned without a new proposal that explains the information status of appositives.
appositives goes beyond the scope of this paper, one can make the following suggestions. Regarding the first question, I suggest that there are additional, pragmatic restrictions on main clauses, which explains why such clauses are the usual carrier of the main point of the utterance. It is possible that main clauses are required to address the question under discussion while appositives may but need not do so (cf. the discourse topic approach to projection, discussed in Section 3). For the current proposal, this would imply that appositives and main clauses are headed by two similar but distinct declarative operators: the former entails commitments for the speaker while the latter also requires relevance to the question under discussion. As for the second question, I follow Koev (2013) and Syrett & Koev (2015) in assuming that at-issue status is at least partially determined by discourse recency. If appositive relative clauses can in principle be at issue, then it is more likely that they in fact are at issue when introduced last in discourse. We see that when coupled with a few discourse restrictions, the proposed projection mechanism is compatible with the somewhat flexible at-issue status of appositives.

5 Claimed exceptions to appositive projection

Thus far we have focused on the finding that appositives robustly project out of the syntactic scope of propositional operators. This fact was argued to follow from a formal mechanism whereby operators bind into their syntactic scope but disregard appositives because the latter are linked to a component of the utterance context (or, perhaps, a salient secondary context). There are, however, various apparent exceptions to appositive projection that have been discussed in the literature (see Wang et al., 2006; Amaral et al., 2007; Harris & Potts, 2009; Schlenker, ms; Sæbø, 2011; Nouwen, to appear). This section strives to understand the extent to which such cases present a challenge to the current proposal. I discuss four claimed exceptions to appositive projection and argue that these cases involve a possibly non-appositive construction, can be explained by some independent, typically pragmatic mechanism, or are real but have a limited empirical scope. I conclude that appositive projection is a fairly robust phenomenon and that the apparent counterexamples to it do not justify abandoning the proposal presented in Section 4.

5.1 One-modifiers

The first alleged case of non-projecting appositives that I discuss involves a particular type of nominal construction that contains one-anaphors as its head noun. Wang et al. (2006) and Nouwen (to appear) notice that the one-modifiers in (48) can be interpreted in the scope of various modal operators: an if-operator in (48a), a doxastic verb in (48b), a desiderative verb in (48c). This, however, is not possible for the appositive relative clauses in the minimally different sentences in (49). These authors conclude that nominal appositives can occasionally be semantically embedded and thus project in a weaker sense than do appositive relative clauses.

(48) a. If a professor, a famous one (that is), publishes a book, he will make a lot of money.
b. John believes that a professor, who is quite famous, published a new book.
c. Mary wants to marry an Italian, who is rich.

(Wang et al., 2006: 420)

(49) a. If a professor, who is famous, publishes a book, he will make a lot of money.
   (Nouwen, to appear: 1)
b. John believes that a professor, who is quite famous, published a new book.
   (Wang et al., 2006: 422)
c. Mary wants to marry an Italian, who is rich.

I will dispute the claim that one-modifiers are instances of appositive constructions. While it is true that such modifiers are marked by comma intonation, as Potts (2005: 92) remarks such prosodic prominence does not necessarily imply supplemental status. Nouwen (to appear) calls semantically embedded readings of one-modifiers “restrictive,” thus alluding to the distinction between restrictive and nonrestrictive/appositive relative clauses, and both AnderBois et al. (2015) and Nouwen (to appear) consider the possibility that such modifiers function as corrections.\(^{20}\) I agree with these assessments and will argue that the scopal and discourse properties of one-modifiers would follow if we assume that they are restrictive modifiers.

One-modifiers indeed behave like other restrictive modifiers in various respects. First, notice that the sentences in (50), where the information of the one-modifier is transformed into a restrictive adjective, are equivalent in meaning to the sentences in (48). More specifically, the italicized indefinites in (50) can receive de re or de dicto readings, just like their counterparts with one-modifiers in (48). This suggests that the interpretation of one-modifiers already follows from the scopal properties of their indefinite anchors. That is, if one-modifiers are interpreted restrictively, we expect them to have the scopal properties that they actually have.

(50) a. If a famous professor publishes a book, he will make a lot of money.
b. John believes that a quite famous professor published a new book.
c. Mary wants to marry a rich Italian.

In addition, one-modifiers project just as high as their anchor. In each of the sentences in (48), the one-modifier and its anchor are interpreted either both de re or both de dicto. Mixed readings in which the anchor is interpreted de re and the modifier is interpreted de dicto, or vice versa, are not available. This again is expected if such modifiers can only receive restrictive interpretations.

Finally, one-modifiers differ from true appositives in their information status. Appositive constructions are typically not at issue and are usually not good targets of direct rejections like That’s not true, as illustrated in (51).\(^{21}\) This is not so for one-modifiers. Such modifiers

\(^{20}\)Nouwen credits this idea to Katja Jasinskaia. However, he argues against it.

\(^{21}\)One exception to this generalization are sentence-final appositive relative clauses, which have been argued to be able to take on at-issue status (see Koev, 2013; AnderBois et al., 2015; Syrett & Koev, 2015; and the discussion in Section 4.3). Syrett & Koev (2015) also found that sentence-final nominal appositives are good targets of direct rejections 25% of the time.
readily accept direct rejections, as in (52), and thus must be part of the at-issue content of the sentence. The at-issue status of one-modifiers would follow if they are interpreted intersectively with their anchor.

(51) A: John crashed his car, a red Ferrari.
    B: ? That’s not true. He crashed his Lamborghini.

(52) A: John bought a car, a red one.
    B: That’s not true. He bought a blue car.

If this analysis is on the right track, we can assume that one-modifiers are not appositives at all. Rather, they must be some sort of restrictive modifiers. If so, the fact that they are routinely interpreted in the scope of propositional operators does not posit a true challenge to the projection mechanism proposed for appositives.

5.2 Appositives and polarity

Another case of seemingly non-projecting appositives is presented in Sæbø (2011). Sæbø’s claim is that appositives projects only in certain types of environments while they can be semantically embedded in other types of environments. More specifically, he argues that speaker-oriented (or projective) readings of appositives are preferred in upward-entailing attitude contexts while non-speaker-oriented (or semantically embedded) readings of appositives are preferred in downward-entailing attitude contexts. The claimed contrast is illustrated in (53) below. The appositive in (53a) is syntactically embedded under believe, which creates an upward-entailing environment, and would typically be attributed to the speaker. The appositive in (53b), however, is placed in the downward-entailing environment created by surprise and could be attributed to Mary.  

(53) a. upward-entailing context $\leadsto$ speaker-oriented appositive
    Sheila believes that Chuck, a psychopath, is fit to watch the kids.
    (Amaral et al., 2007: 710)

b. downward-entailing context $\leadsto$ non-speaker-oriented appositive
    Mary is surprised that John, an Amish, wears a necktie.
    (Sæbø, 2011: 83; slightly modified)

Sæbø offers the following pragmatic explanation for the contrast in (53). In upward-entailing contexts speaker-oriented readings of appositives are more frequent because they derive a weaker statement, thus giving the sentence a better chance to be true. In downward-entailing contexts the picture is reversed: here it is non-speaker-oriented readings of appositives that give rise to a weaker statement. Sæbø’s idea seems to be that, since $A$ believes that $p$ and $q$ asymmetrically entails $A$ believes that $q$ and $A$ doesn’t believe that $q$ asymmetrically entails $A$ doesn’t believe that $p$ and $q$ (where $p$ is the appositive content and $q$ is the embedded proposition), the generous hearer will have a bias towards the latter and weaker readings. There appears to be a potential problem with this argument, though. If in speaker-oriented readings the appositive is represented as a sentence-level conjunct, the comparisons should really be between $A$ believes that $p$ and $q$ vs. $p$ and $A$ believes that $q$ for the upward-entailing case, and between $A$ doesn’t believe that $p$ and $q$ vs. $p$ and $A$ doesn’t believe that $q$ for the downward-entailing case. Since there is no entailment relation between the sentences in each comparison, it is not clear to what extent Sæbø’s explanation is feasible.

22Sæbø offers the following pragmatic explanation for the contrast in (53). In upward-entailing contexts speaker-oriented readings of appositives are more frequent because they derive a weaker statement, thus giving the sentence a better chance to be true. In downward-entailing contexts the picture is reversed: here it is non-speaker-oriented readings of appositives that give rise to a weaker statement. Sæbø’s idea seems to be that, since $A$ believes that $p$ and $q$ asymmetrically entails $A$ believes that $q$ and $A$ doesn’t believe that $q$ asymmetrically entails $A$ doesn’t believe that $p$ and $q$ (where $p$ is the appositive content and $q$ is the embedded proposition), the generous hearer will have a bias towards the latter and weaker readings. There appears to be a potential problem with this argument, though. If in speaker-oriented readings the appositive is represented as a sentence-level conjunct, the comparisons should really be between $A$ believes that $p$ and $q$ vs. $p$ and $A$ believes that $q$ for the upward-entailing case, and between $A$ doesn’t believe that $p$ and $q$ vs. $p$ and $A$ doesn’t believe that $q$ for the downward-entailing case. Since there is no entailment relation between the sentences in each comparison, it is not clear to what extent Sæbø’s explanation is feasible.
Examples as in (53b) present a potential challenge to the projection mechanism developed in Section 4, which predicts that appositives cannot take scope under external operators.

Sæbø notices the following exception to the alleged non-speaker-orientation of appositives in downward-entailing modal contexts. In the sentence below, the appositive occurs in a downward-entailing context but it is nevertheless speaker-oriented.

(54) Mary is surprised that John, a notorious casanova, betrays her. (Sæbø, 2011: 84)

Examples as these already point at an alternative characterization of Sæbø’s data. In general, it is not reasonable to be surprised that a notorious casanova betrays his partners, so the appositive in (54) can only be attributed to the speaker. It is thus possible to reanalyze the unexpected non-speaker interpretations noted by Sæbø in terms of the coherence relation that holds between the appositive and the rest of the sentence. Notice that the appositive in (53b) provides an explanation for why the state described by the rest of the sentence holds. That is, the fact that John is an Amish explains why Mary is surprised that he wears a necktie, assuming that it is common knowledge that Amish people only wear plain clothes. Since the sentence describes a mental state, the hearer is forced to conclude that this mental state comes about because its attitude holder, i.e. Mary, believes the appositive proposition. This by itself does not exclude the possibility that the speaker is committed to the appositive content as well. In short, my suggestion is that appositives as in (53b) are speaker-oriented. The fact that their content is also attributed to the subject of the sentence is a pragmatic inference triggered by the discourse role of the appositive and the presence of a mental state predicate in the main clause.23

This reanalysis makes the prediction that when there is an Explanation relation between the appositive and the main clause, the appositive content can be attributed to the attitude holder regardless of the polarity of the embedding predicate. This prediction is borne out, as demonstrated in (55)-(56). In those examples, the appositive serves as an explanation for the rest of the sentence and is most naturally interpreted as (also) subject-oriented.

(55) \textit{upward-entailing context + Explanation} \rightarrow \textit{subject-oriented appositive}

a. Mary believes that Jack, who studied Chinese, can translate comrade Mao’s book for us.

b. Mary was not surprised that Bill, who is a Mormon, wears a sacred undergarment.

(56) \textit{downward-entailing context + Explanation} \rightarrow \textit{subject-oriented appositive}

a. Mary doubts that Jack, who never studied Chinese, can translate comrade Mao’s book for us.

b. Mary was surprised that Bill, who is a Mormon, doesn’t wear a sacred undergarment.

23Sæbø (2011: 88) considers this line of explanation but briefly discards it because, according to him, it would not predict the claimed orientation biases of appositives in intensional contexts depending on polarity. However, I believe that if taken seriously, this idea demonstrates that there are no such biases.
In contrast, when no Explanation relation is present, the subject-orientation of appositives should vanish. This prediction is also met, as seen in (57)-(58). Here the appositive cannot be read as an explanation for why the event described by the main clause happened and can only receive a speaker-oriented reading. This reading is independent of the polarity of the environment created by the attitude predicate in the matrix clause.

(57) **upward-entailing context, no Explanation ➝ speaker-oriented appositive**
   a. Mary believes that Jack, who just walked in, can translate comrade Mao’s book for us.
   b. Mary was not surprised that Bill, who had dropped his pants, wears a sacred undergarment.

(58) **downward-entailing context, no Explanation ➝ speaker-oriented appositive**
   a. Mary doesn’t believe that Jack, who just walked in, can translate comrade Mao’s book for us.
   b. Mary was surprised that Bill, who had dropped his pants, wears a sacred undergarment.

To sum up: Sæbø’s (2011) alleged examples of subject-oriented/semantically embedded appositives in downward-entailing intensional contexts can be attributed to a pragmatic inference based on the coherence relation that holds between the appositive and the rest of the sentence. Crucially, this inference is contingent upon the fact that the appositive content is also speaker-oriented, i.e. entailed by the entire sentence.

### 5.3 Shifted appositives

Yet another set of data that challenges appositive projection comes from Thompson (1971), Amaral *et al.* (2007), and Harris & Potts (2009). These authors notice that when appositives are in the syntactic scope of an attitude predicate they can undergo perspective shift and imply commitments not for the speaker but rather for the attitude holder. The following examples illustrate the phenomenon of shifted appositives. In each case, I indicate the perspective from which the appositive is evaluated by subscripts.

(59) The claims agent said that the paint job, [which should have been done long ago]_{claims.agent}, would cost $150, but he doesn’t know that now is when it should be done. (Thompson, 1971: 86)

(60) Joan is crazy. She’s hallucinating that some geniuses in Silicon Valley have invented a new brain chip that’s been installed in her left temporal lobe and permits her to speak any of a number of languages she’s never studied. Joan believes that her chip, [which she had installed last month]_{Joan}, has a twelve year guarantee. (Amaral *et al.*, 2007: 735–736; slightly shortened)

(61) Poor Joan seems to have grown crazier than ever. She now claims that her apartment was bugged by the Feds, [who are listening to her every word]_{Joan}. (Harris & Potts, 2009: 548)
In these examples, the appositive content is attributed to an attitude holder, i.e. the claims agent in (59) and Joan in (60)-(61). In fact, a speaker-oriented interpretation of these appositives seems unlikely in the contexts described.

To my knowledge, no theoretical analysis of such data exists. It has nevertheless been suggested in the literature that such readings do not arise through semantic embedding under an operator but are best explained as instances of indexicality (see Amaral et al., 2007; Harris & Potts, 2009). I agree with this assessment and will analyze shifted appositives as anaphoric to a context that is different from the utterance context, e.g. a secondary speech context. Such secondary contexts are canonically introduced by attitude predicates but their existence can also be inferred from the broader discourse. If so, shifted appositives are not semantically embedded and do not posit a real challenge to the mechanism of appositive projection proposed in this paper.

To convince ourselves that shifted appositives are not semantically embedded under a higher attitude operator, consider the short discourse in (62). This example crucially differs from (60) in that the appositive in the last sentence is in the syntactic scope of a negative attitude verb, i.e. *doubt*. While in cases with positive attitude verbs as in (60) one might get the impression that the appositive is semantically embedded (thus giving rise to the inference that Joan believes she had a chip installed last month), in (62) the two mechanisms of perspective shift and semantic embedding peel apart. If the shifted appositive in (62) was indeed interpreted in the scope of the attitude verb, the expected reading would be that Joan doubts that her (imaginary) chip was installed last month. Instead, the reading obtained is that Joan believes or said that her chip was installed last month (while she doubts that it will last for another year).

(62) Joan is crazy. She’s hallucinating that some geniuses in Silicon Valley have invented a new brain chip that’s been installed in her left temporal lobe and permits her to speak any of a number of languages she’s never studied. Joan is now worried about the battery life of her chip. She doubts that her chip, [which she had installed last month] Joan, will last for another year.

The content of shifted appositives is then attributed to the attitude holder independently of the semantics of the attitude predicate. This means that shifted appositives are not semantically embedded.

In addition, Harris & Potts (2009) provide experimental evidence that appositive shift can also occur in the absence of an attitude predicate, which too speaks against a scopal account of shifted appositives. The example in (63) is similar to the one in (61) above but lacks the embedding segment in the second sentence. Harris & Potts found that appositive shift in such cases is harder but still possible.

(63) Poor Joan seems to have grown crazier than ever. Her apartment was bugged by the Feds, [who are listening to her every word] Joan. (Harris & Potts, 2009: 548)

One might try to postulate some sort of a covert intensional operator, perhaps a covert *say*-operator, for shifted readings like these. However, this solution puts (63) too much in line with (61) and makes some wrong predictions. Notice, for example, that (61) can easily be followed up by an adversative clause like ...but I don’t believe her while (63) cannot.
If a covert operator for (63) was a viable option, then this contrast in the possibilities of disavowing Joan’s opinions would be unexpected. In addition, keeping (61) and (63) syntactically distinct is more likely to shed light on Harris & Potts’ finding that appositive shift in unembedded environments is more difficult.

It is clear that while shifted appositives require a modal perspective, they express commitments of its agent without becoming a part of that modal perspective. This explains why shifted readings are typically “parasitic” on attitude reports. Even though appositives are not interpreted in the scope of attitude operators, such operators create a favorable environment for appositive shift because they supply secondary contexts which are anchored to an agent. While I leave open the question of how such secondary contexts are inferred in the general case, it is clear that they can be explicitly introduced by attitude verbs. Let us then revise the analysis of propositional attitudes in (39) in such a way that attitude verbs introduce contexts. For verbs of saying, I assume the translation \( \text{say}^{c,q} \sim \lambda P \lambda x \lambda p. \text{SAY}^{c,q}(x, P(q)) \) and the abbreviation and interpretation rule in (64). Verbs of saying then introduce speech contexts, represented below as \( c \). Other attitude verbs will have a similar semantics but introduce different types of contexts: belief contexts, doubt contexts, etc.

(64) a. \( \text{SAY}^{c,q}(x, \varphi_q) := \exists c \wedge x = \text{ag}(c) \wedge \exists q \wedge \varphi_q \wedge \text{say}_p(c, x, q) \)
   b. \( \sigma[\text{say}_p(c, x, q)] = \{ g \in \sigma \mid \text{for all } w \in [p]^g : \text{SAY}([c]^g, [x]^g, w) \subseteq [q]^g \} \)

Once these definitions are incorporated into the logic, we can represent the non-shifted reading of (65) as in (65a) and its shifted reading as in (65b). The only difference between those two representations lies in context to which the appositive contribution is anchored. In (65a) it is anchored to the utterance context (represented as \( u \)) and entails commitments for the speaker whereas in (65b) it is anchored to the reported speech context (represented as \( c \)) and entails commitments for Joan.

(65) Joan says that her apartment was bugged by the Feds, who are listening to her every word.
   a. \( \exists x \wedge x = \text{joan} \wedge \text{SAY}^{c,q}_{\text{com}(\text{ag}(u))}(x, \exists y \wedge \text{apt.of}_{\text{ag}(u)}(y, x) \wedge \text{bug.by.feds}_{\text{ag}(u)}(y) \wedge \text{listen.to}_{\text{com}(\text{ag}(u))}(x)) \)
   b. \( \exists x \wedge x = \text{joan} \wedge \text{SAY}^{c,q}_{\text{com}(\text{ag}(u))}(x, \exists y \wedge \text{apt.of}_{\text{ag}(c)}(y, x) \wedge \text{bug.by.feds}_{\text{ag}(c)}(y) \wedge \text{listen.to}_{\text{com}(\text{ag}(c))}(x)) \)

Under this analysis, shifted appositives do not entail commitments for the speaker. Even so, shifted appositives project in the narrow or technical sense of the term since their content is not interpreted in the scope of an attitude operator. This is one place where projection and speaker-orientation part ways. The proposed analysis ensures that appositives project. Nonetheless, their perspective (speaker vs. non-speaker) will depend on the context to which their declarative operator is anchored.

The shifting mechanism just outlined can only apply to content that is not semantically embedded. This is because complement clauses are anchored to the agent of the intensional context as a matter of grammar. In contrast, main clauses can undergo perspective shift under similar conditions as those for appositives, as witness (66). This is as expected, as both appositives and main clauses are headed by declarative operators which are anchored to contexts.
Poor Joan seems to have grown crazier than ever. She now claims that her apartment was bugged by the Feds. [They are listening to her every word].

In the remaining part of this section, I situate appositive shift in the broader context of other perspective-sensitive phenomena in language. I briefly compare appositive shift to phenomena like concealed quotation, free indirect discourse, modal subordination, and shifted indexical pronouns. I will conclude that appositive shift is most closely related to the phenomenon of shifted indexical pronouns.

Shifted appositives are sometimes felt by native speakers to express the opinion of some agent “as uttered.” They are often understood as an expression of the attitude holder’s public commitment.24 This comes close to saying that shifted appositives express some form of a direct discourse. Indeed, Sæbø (2011) proposes to analyze shifted appositive as cases of what he calls “concealed quotation,” i.e. partial quotation that is not overtly marked as such. On this view, (61) above could really be as in (67), where part of the appositive occurs between quotation marks. This analysis directly explains why the descriptive content of the appositive is evaluated from Joan’s point of view.

But notice that if this was the right analysis, we would expect pronouns inside shifted appositives to be interpreted from a non-speakers perspective. (61) already demonstrates that this is not so. Joan words, quoted in (67), could not have included her every word but would have rather included my every word, if she was indeed referring to her own words. It is then less clear how a quotation-based analysis could explain appositive shift without also shifting the pronouns inside the appositive.

Another option is that appositive shift is an instance of free indirect discourse. Free indirect discourse is a literary device for reporting an agent’s words or thoughts without the use of syntactic embedding or direct quotation (see Banfield, 1982; Doron, 1991; Schlenker, 2004; Sharvit, 2008; Maier, to appear). The second sentence in the discourse below illustrates the phenomenon. Its content expresses Ryan’s thoughts, not those of the narrator.

Ryan arrived at the hotel. Yes, (he thought,) it had been a long journey.

As was the case with concealed quotation, it appears that the perspective-taking properties of shifted appositives and free indirect discourse significantly differ. A first difference is that temporal and locative indexical adverbials in free indirect discourse are anchored to the agent whose words or thoughts have been reported, as seen from (69). In contrast, indexical adverbials in shifted appositives retain their speaker-orientation. This is demonstrated in (70).

(69) She loved it here today, said Martha. (here = Martha’s here, today = Martha’s today)

24Note that Harris & Potts (2009) only used stimuli (in the embedded condition) in which appositives are in the syntactic scope of verbs of saying.
Poor Martha seems to be losing it.  
a. Yesterday she called me and said she is on the moon meeting there with the aliens, who like it here a lot. \( \text{here} = \text{speaker's here} = \text{the planet Earth} \)  
b. Last week she said that the end of our civilization, which was tomorrow, had finally arrived. \( \text{tomorrow} = \text{speaker's tomorrow} \)

A second difference lies in the perspective of gender features on pronouns. Such features can acquire non-speaker oriented readings in free indirect discourse, as in (71), but not in shifted appositives, as (72) shows.

(71) John thinks Bill likes him and mistakenly believes Bill is a woman.  
She / #He liked him, he could tell(, thought John). \( \text{Sharvit, 2008: 370} \)

(72) Max is having mental issues. He often talks about the aliens and also mistakenly believes that his best friend Jessica is a man.  
Max is again talking weird stuff about Jessica\( ^x \). He says that the aliens, who want to hijack her\( _x / #\text{him}_x \), will soon move to another planet.

The contrast between (69) vs. (70) and between (71) vs. (72) would be unexpected if shifted appositives were instances of free indirect discourse. It seems that the two phenomena differ in their perspective-taking properties.

Appositive shift is also reminiscent of modal subordination. The term “modal subordination” describes cases in which a clause that is not in the syntactic scope of a modal operator is interpreted as if it were (see Karttunen, 1976; Roberts, 1989; Frank, 1997; Geurts, 1999; Stone, 1999; Asher & McCready, 2007; Brasoveanu, 2010). In the classical example in (73), the second sentence is marked by the subjunctive mood and is interpreted as part of the hypothetical scenario introduced by the modal auxiliary in the first sentence. This is the reason why the pronoun it in the second sentence can be anaphorically linked to the hypothetical wolf introduced in the first sentence.

(73) A wolf might walk in. It would eat you.

Shifted appositives could certainly be regarded as cases of modal subordination in the broad sense of the word. This is because shifted appositives too are evaluated from a previously introduced modal perspective. Yet the two phenomena seem to require slightly different licensing conditions. Modal subordination can occur in a wide range of modal environments, including environments created by possibility modals, as in (73). This is not true for shifted appositives. In (74), the presence of the same possibility modal as in (73) does not allow the appositive content to be attributed to Masa without further support from the discourse. According to the analysis of shifted appositives suggested above, this is because Masa is not related to the modal environment created by might in any obvious way, e.g. Masa is not its agent. To be sure, appositives can sometimes be modally subordinated. But this is only possible when they are marked with the right mood morphology, as demonstrated in (75).

(74) We might visit Masa, who is a famous sumo fighter.
If John bought a book, he would be home reading it. The book, which would be a murder mystery no doubt, would be very expensive. (based on Roberts, 1989)

It then appears that appositive shift and modal subordination are two closely related but different phenomena.

So far I have listed three phenomena that turned out to significantly differ from appositive shift: concealed quotation, free indirect discourse, and modal subordination. The closest empirical cousin of shifted appositives seems to be shifted indexical pronouns. In some languages, first and second person pronouns can shift their reference in the presence of an intensional predicate (see Rice, 1986; Speas, 1999; Schlenker, 2003; Anand, 2006; Sudo, 2012; a.o.). When shifting occurs, first person pronouns refer to the agent of the intensional context and second person pronouns refer to the speaker. Below are two examples from Kurmanji (Iranian). They demonstrate that first person pronouns found in an embedded clause can refer to either the speaker (76) or an attitude holder (77), depending on the context.

(76) You are not feeling well. Ehmet, who is a doctor, examines you and says:
   a. Ti i nexoş-i.
      you.NOM COP ill-2SG
      ‘You are ill.’
   Later, you meet Adan and say to her:
   b. Ehmet go ki ez e nexoş-im.
      Ehmet.ERG say.PART that I.NOM COP ill-1SG
      ‘Ehmet said that I (=the speaker) am ill.’

(77) Ehmet is visibly not feeling well and says to you:
   a. Ez e nexoş-im.
      I.NOM COP ill-1SG
      ‘I am ill.’
   Later, you meet Adan and say to her:
   b. Ehmet go ki ez e nexoş-im.
      Ehmet.ERG say.PART that I.NOM COP ill-1SG
      ‘Ehmet said that he (=Ehmet) is ill.’

Appositives and pronouns differ in that the former express propositional content while the latter refer to individuals. At the same time, both constructions appear to shift under similar conditions. For one, the canonical environment for perspective shift of both appositives and indexical pronouns is attitudinal contexts. In addition, both appositive shift and pronominal shift can be licensed by means that go beyond syntactic configuration. In some languages pronominal shift can only be licensed by verbs of saying (see Speas, 1999: ft.4; Schlenker, 2003: ft.39; Anand, 2006: ft.18). The potentially privileged role of verbs of saying in appositive shift is investigated in Koev (2013: ch.5).
(78), the appositive in the second sentence can be attributed to Harold even though the licensor for the shift (the verb of saying) is found in the first sentence. Something similar is possible in Kurmanji, as illustrated in (79). Here an indexical pronoun in the second sentence is shifted to a speech context introduced in a previous sentence.\(^{26}\)

(78) Harold told me a bunch of interesting things the other night. His new girlfriend, who is a little bit crazy, wants to go to Hanoi.  
(after Thompson, 1971)

I.ERG yesterday Ehmet with word did-PL I.NOM COP ill-1SG  
‘Yesterday I talked to Ehmet. He (=Ehmet) is ill.’

The semantics presented above is well-equipped to analyze pronominal shift. The non-shifted vs. shifted interpretations in (76b) and (77b) can be represented as in (80a) and (80b), respectively. The crucial difference between those two representations is that in (80a) the indexical pronoun refers to the agent of the utterance context, i.e. the speaker, whereas in (80b) it is anaphoric to the secondary speech context introduced by the matrix verb and refers to its agent, i.e. Ehmet.

\[
\begin{align*}
\text{(80a)} & \quad \exists x \land x = \text{ehmet} \land \text{SAY}_{\text{com}(\text{ag}(u))}(x, \text{rich}_{q}(\text{ag}(u))) & \text{(non-shifted reading)} \\
\text{(80b)} & \quad \exists x \land x = \text{ehmet} \land \text{SAY}_{\text{com}(\text{ag}(u))}(x, \text{rich}_{q}(\text{ag}(c))) & \text{(shifted reading)}
\end{align*}
\]

The semantics in principle allows for either shifted or non-shifted interpretations of indexical pronouns. Pragmatic context and language-specific restrictions on indexical pronouns will decide which option is made use of in each particular case. Overall, we see that shifted appositives in English and shifted indexical pronouns obey similar distributional restrictions. It is then likely that they belong to the same class of empirical phenomena and can receive a uniform analysis.

### 5.4 Semantically embedded appositives

Schlenker (2009a; 2009b; ms) presents several classes of examples which challenge the claim that appositives invariably project. Here I focus on what appears to be the clearest case: data in which an appositive is interpreted in the scope of an \textit{if}-operator in a conditional sentence.\(^{27}\) To illustrate, the appositive in (81a) is interpreted as part of the

\[\text{John decided yesterday that tomorrow he would tell his parents that he was in Vegas with Ann, who was about to become his wife.} \quad \text{(Schlenker, 2009: 4)}\]

\(^{26}\)It is typically assumed that pronominal shift is only licensed if the pronoun is in the syntactic scope of a monster operator (an attitude operator or a silent operator selected by it), which manipulates the context with respect to which its complement is evaluated. Data as in (79) suggest that this does not apply to all languages or all environments. Such cases are more naturally analyzed in terms of an anaphoric dependency between the shifted pronoun and the licensing verb.

\(^{27}\)Schlenker (2009, ms) also discusses cases of Past tenses in appositives which, arguably, are interpreted in the scope of a higher tense. He claims that in (i) the Past tense in the appositive is semantically vacuous due to the presence of a higher Past tense and that in (ii) the Past tense in the appositive receives a future-oriented interpretation because of the presence of a higher Future tense.

\[\text{(i) John decided yesterday that tomorrow he would tell his parents that he was in Vegas with Ann, who was about to become his wife.} \quad \text{(Schlenker, 2009: 4)}\]
conditional antecedent and the sentence is virtually synonymous with its conjunctive counterpart in (81b). It then appears that the appositive in (81a) receives a semantically embedded interpretation, contrary to what the projection mechanism laid out above predicts.

(81)  
a. If tomorrow I call the Chair, who in turn calls the Dean, then we will be in deep trouble.  
(Schlenker, ms: 7)
b. If tomorrow I call the Chair and he in turn calls the Dean, then we will be in deep trouble.

It might be tempting to assume that such embedded readings of appositives are cases of modal subordination. However, Schlenker carefully contrasts (81a) with the minimally different sentence in (82) in which the appositive is substituted by a clausal parenthetical. In this last example, it is impossible to interpret the parenthetical in the scope of the if-operator and the sentence is infelicitous. It would then be very hard to explain why modal subordination should be allowed in (81a) but disallowed in (82).

(82)  
*If tomorrow I call the Chair (he in turn calls the Dean) then we will be in deep trouble.  
(Schlenker, ms: 7)

I will accept Schlenker’s claim that examples as in (81a) are true cases of semantically embedded appositives. What I would like to point out, though, is that these data have a limited empirical scope. Such semantically embedded interpretations seem only possible if the appositive describes the same episode as the one described by the rest of the sentence. Perhaps the clearest example of that being the case is when the appositive becomes part of the temporal structure of the sentence. First, notice that appositives can participate in temporal progression (see Koev, 2013).

In (83), the appositive contributes an event that is chronologically ordered with respect to the remaining discourse, i.e. the hitting event occurs after the sticking-out-of-the-tongue event and before the leaving event.

(83)  
Nick stuck out his tongue at Emily, who hit him. She left in a huff.

Schlenker’s example in (81a) has a similar flavor, as the appositive describes a chronologically ordered event, if a hypothetical one: the calling of the Chair precedes the calling of the Dean, which in turn precedes the ensuing trouble. In contrast, the appositive in (84a) below projects because it does not contribute to the temporal structure of the sentence and it is hard to construe it as talking about the same situation. Notice also that nominal appositives do not receive episodic interpretations and thus cannot be semantically embedded in the same way appositive relative clauses can. This is why the nominal appositive in (84b) projects, just like the appositive relative clause in (84a).

(84)  
a. If tomorrow I call the Chair, who is good friends with the Dean, then we will be in deep trouble.
b. If I call Jane, an influential administrator from the Dean’s office, we will be in trouble.

The claim that the embeddability of appositive relative clauses depends on discourse factors finds further support from the distribution of negative polarity items. Notice that negative polarity items like anyone can occur in conditional antecedents, as in (85a), arguably because conditional antecedents create downward-entailing environments (see e.g. von Fintel, 1999). In (85b), the appositive contributes to the hypothetical episode introduced by the if-operator and it can host anyone. This is different from (85c), where the appositive is not part of the hypothetical episode and anyone is disallowed. We can capture this pattern by saying that an (unembedded) occurrence of a negative polarity item in appositives is allowed only if the appositive is interpreted in the scope of a downward-entailing operator.

(85)  
\begin{enumerate}
  \item If he calls/knows anyone from the Dean’s office, then we’ll be off the hook.
  \item If I call the Chair, who calls anyone from the Dean’s office, then we’ll be off the hook.
  \item *If we call John, who knows anyone from the Dean’s office, then we’ll be off the hook.
\end{enumerate}

Schlenker’s examples do not easily fit the otherwise robust pattern of appositive projection. The important point, though, is that they have a limited empirical scope as there are pragmatic restrictions on such readings. A confounding factor for such embedded readings is the requirement that the appositive contributes content to the episode that is described by the rest of the sentence. I will not attempt to account for such embedded readings of appositives here. However, given the current proposal, it is likely that semantically embedded appositives lack a declarative operator. If so, the appositive who in turn calls the Dean in (81a) would be given the rough translation of \( \lambda p. call_p(x, \text{the.dean}) \) (where \( x \) is anaphoric to the Chair). This translation can be directly composed with the conditional antecedent clause tomorrow I call the Chair (perhaps by a predicate modification rule) and enter the semantic scope of the if-operator in the way described in Section 4. I leave the details on how exactly such appositives differ from regular appositives to further research.

6 Conclusion

This paper offered a comprehensive account of the projection properties of appositive constructions. In the first part, I argued that appositives carry their own illocutionary force and proposed a formal mechanism that derives their projection behavior from the way they interact with propositional operators. The mechanism interpreted appositives in situ and thus explained their surface-order participation in anaphoric processes without further stipulations. In the second part of the paper, I looked at several claimed exceptions to appositive projection. I argued that one-modifiers are likely not appositive constructions at all; when they serve as explanations, appositives can be attributed to attitude holders without losing their speaker-orientation; appositives can undergo perspective shift despite, or rather, because of their projective nature; appositive relative clauses can be semantically
embedded if they are construed as describing the same episode as the main sentence. Overall, I have tried to demonstrate that the various claimed exceptions to appositive projection are either compatible with their projection properties or otherwise have a limited empirical scope.

It is often the case in semantics and elsewhere that an empirical generalization that is explained by some elegant formal mechanism is challenged by various sorts of exceptions. The question then becomes how much weight one is willing to attribute to such exceptions. With appositive projection, the ultimate choice is between a more conservative theory which views the exceptions to projection as only apparent vs. a more liberal theory which regards the exceptions as the true pattern and seeks to explain the scopal inertness of appositives by independent factors. The worry with the first type of theory is that it is too restrictive and limits our choices when explaining the exceptions to projection. The worry with the second type of theory is that it opens the floodgates to scopal interactions that are not empirically attested. In this paper, I pursued the former line of research, as I believe that appositive projection is too robust a phenomenon to be left to external factors. Needless to say, though, other paths of exploration are also possible.

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Appendix: Compositional update semantics

Types  The set of basic types consists of $e$ (the type of individuals), $\omega$ (the type of possible worlds), $t$ (the type of truth values), $\kappa$ (the type of contexts), and $s$ (the type of assignment functions). Functional types are built from these in the usual way.

Variables  I use the following variable conventions: $x, y, \ldots$ are individual variables; $p, q, \ldots$ are propositional variables and $d$ stands for an individual term; $c, c', \ldots$ are context variables and $u$ stands for the utterance context; $\alpha$ is a variable or a constant of any type; $t_1, t_2, \ldots$ stand for terms of any type; $v$ stands for a variable of any type; $\varphi, \psi, \ldots$ abbreviate dynamic terms of any complexity (i.e., terms that express updates or functions from information states to information states).

Domains  Basic domains consist of objects of basic types. Domains for functional types $D_{\sigma \tau}$ (where $\sigma, \tau$ are any types) are sets of functions from $D_{\sigma}$ to $D_{\tau}$. The full domain is $D = \bigcup_{\tau} D_{\tau}$. 
Models  Models $M = \langle F_M, I_M \rangle$ consist of a frame $F_M$, a tuple of sets of basic objects, and the basic interpretation function $I_M$, which maps non-logical constants into $D$.

Information states  Information states $\sigma$ are sets of assignment functions, i.e., $\sigma \subseteq D_\sigma$. Since the utterance context is represented as the variable $u$ and will be mapped into different values by different assignment functions, I stipulate that $\sigma^a = \{ g \mid a = [\text{ag}(u)]^\sigma \}$, i.e. utterance contexts are anchored to a unique agent $a$ across the entire information state (cf. Kamp & Reyle, 1993: 248; Zeevat, 1999). I leave the anchoring to agents implicit in the interpretation rules below.

Interpretation rules and abbreviations

(i) Interpretation rules for primitive and functional terms

a. $[\alpha]^\sigma_M = \begin{cases} g(\alpha) & \text{if } \alpha \text{ is a variable} \\ I_M(\alpha) & \text{if } \alpha \text{ is a constant} \end{cases}$

b. $[p]^\sigma_M = \{ w \in [p]^\sigma_M \mid g \in \sigma \}$

c. $[\text{ag}(c)]^\sigma_M = \{ w \mid [c]^\sigma_M = \text{the agent of } [c]^\sigma_M \}$

d. $[\text{com}(d)]^\sigma_M = \{ w \mid [d]^\sigma_M \text{ is committed to } w \in [c]^\sigma_M \}$

(ii) Interpretation rules for dynamic terms

a. $\sigma[R_p(t_1, \ldots, t_n)]^\sigma_M = \{ g \in \sigma \mid \text{for all } w \in [p]^\sigma_M : \langle w, [t_1]^\sigma_M, \ldots, [t_n]^\sigma_M \rangle \in [R]^\sigma_M \}$

b. $\sigma[t_1 = t_2]^\sigma_M = \{ g \in \sigma \mid [t_1]^\sigma_M = [t_2]^\sigma_M \}$

c. $\sigma[\neg p(q)]^\sigma_M = \{ g \in \sigma \mid [p]^\sigma_M \cap [q]^\sigma_M = \emptyset \}$

d. $\sigma[\emptyset p(q)]^\sigma_M = \{ g \in \sigma \mid \text{for all } w \in [p]^\sigma_M : MB(w) \cap [q]^\sigma_M \neq \emptyset \}$

e. $\sigma[\emptyset p(q)]^\sigma_M = \{ g \in \sigma \mid \text{for all } w \in [p]^\sigma_M : MB(w) \subseteq [q]^\sigma_M \}$

f. $\sigma[\rightarrow p(q, r)]^\sigma_M = \{ g \in \sigma \mid \text{if } w \in [q]^\sigma_M \text{ then } w \in [r]^\sigma_M \}$

g. $\sigma[\text{say}_p(c, x, q)]^\sigma_M = \{ g \in \sigma \mid \text{for all } w \in [p]^\sigma_M : \text{SAY}(\{c\}^\sigma_M, [x]^\sigma_M, w) \subseteq [q]^\sigma_M \}$

h. $\sigma[\varphi \land \psi]^\sigma_M = \sigma[\varphi]^\sigma_M [\psi]^\sigma_M$

i. $\sigma[\exists v]^\sigma_M = \{ h \mid \text{for some } g \in \sigma : g[v]h \}$

(iii) Abbreviations for propositional operators

a. $\text{NOT}_p(\varphi_q) := [\exists q \land \varphi_q \land \neg p(q)]$

b. $\text{MIGHT}_p(\varphi_q) := [\exists q \land \varphi_q \land \Diamond p(q)]$

c. $\text{MUST}_p(\varphi_q) := [\exists q \land \varphi_q \land \Box p(q)]$

d. $\text{IF}_p(\varphi_q, \psi_r) := [\exists q \land \varphi_q \land \exists r \land \psi_r \land \rightarrow p(q, r)]$

e. $\text{SAY}_p(c, x, q) := [\exists c \land x = \text{ag}(c) \land \exists q \land \varphi_q \land \text{say}_p(c, x, q)]$

A fragment  I use $\pi$ as an abbreviation for the type of propositions $\omega t$ and $[]$ as an abbreviation for the type of updates $(st)t$. I write $[]$ around other types and follow the convention $[\sigma\tau] := [\sigma] [\tau]$ (see Muskens, 1996). For example, a function from individuals to a function from propositions to updates is of type $e\pi[\pi]$, which will be written as $[e\pi]$.
Compositionality

The translations in the fragment above include lambda terms but the
rules in (i)-(ii) do not interpret such terms. Interpretation rules for lambda terms are not
easy to define in a dynamic system because assignment functions then need to do double
duty: be part of the information state and be a parameter on the denotation brackets. One
way around this problem is to view the dynamic terms in the fragment as abbreviations
for static meanings (see Muskens, 1996; Beaver, 2001; Bittner, 2011). A mapping that
achieves that for the core cases is defined in (vi). (Notice that if DP

(iv) \[ DP-APP \text{ composition rule} \]

If \[ DP^x \rightsquigarrow \alpha[|x|] \] and \[ APP \rightsquigarrow \beta[|] \], then \[ DP^x \text{ APP} \rightsquigarrow \lambda P \alpha \lambda p (\lambda y \lambda q \beta) (p) \wedge P(x)(p)[|x|] \).

(v) \[ Function application \]

If \[ A \rightsquigarrow \alpha \sigma \] and \[ B \rightsquigarrow \beta \sigma \], then \[ AB \rightsquigarrow \alpha(\beta) \sigma \] or \[ BA \rightsquigarrow \alpha(\beta) \sigma \].

As an illustration, the meaning of the translation in (vii) can be compositionally derived from the static type-theoretic meanings given below.

(vii) \[ DECL_u \text{ someone}^x \text{ run} \rightsquigarrow \exists x \wedge run_{\text{com}(ag(u))}(x) \]

<table>
<thead>
<tr>
<th>Lexical item</th>
<th>Translation</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jack [x]</td>
<td>( \lambda P \lambda p. \exists x \wedge x = j a c k \wedge P(x)(p) )</td>
<td>([</td>
</tr>
<tr>
<td>he, who [x]</td>
<td>( \lambda P \lambda p. P(x)(p) )</td>
<td>([</td>
</tr>
<tr>
<td>a [x]</td>
<td>( \lambda P \lambda Q. \exists x \wedge P(x)(p) \wedge Q(x)(p) )</td>
<td>([</td>
</tr>
<tr>
<td>man</td>
<td>( \lambda x. \lambda p. \text{man}(x) )</td>
<td>([\pi])</td>
</tr>
<tr>
<td>like</td>
<td>( \lambda Q \lambda x. Q(\lambda y \lambda p. \text{like}(x, y)) )</td>
<td>([([</td>
</tr>
<tr>
<td>not [q]</td>
<td>( \lambda P \lambda p. \text{NOT}^q_p(P(q)) )</td>
<td>([</td>
</tr>
<tr>
<td>might [q]</td>
<td>( \lambda P \lambda p. \text{MIGHT}^q_p(P(q)) )</td>
<td>([</td>
</tr>
<tr>
<td>must [q]</td>
<td>( \lambda P \lambda p. \text{MUST}^q_p(P(q)) )</td>
<td>([</td>
</tr>
<tr>
<td>if [p] [r]</td>
<td>( \lambda P \lambda Q. \lambda p. \text{IF}^p_q(x, P(q)) )</td>
<td>([</td>
</tr>
<tr>
<td>PP [q] [c]</td>
<td>( \lambda P \lambda x. \lambda p. \text{PP}^{c,q}_p(x, P(q)) )</td>
<td>([</td>
</tr>
<tr>
<td>and</td>
<td>( \lambda P \lambda Q. \lambda p. Q(p) \wedge P(p) )</td>
<td>([</td>
</tr>
<tr>
<td>DECL [u]</td>
<td>( \lambda P. P(\text{com}(ag(u))) )</td>
<td>([</td>
</tr>
</tbody>
</table>

As a variable over information states; and \( \| \alpha \| \) is the usual static interpretation of \( \alpha \).
\[
\|\text{DECL}_u \text{ someone}_x \text{ run} \| = \lambda I_i.\exists j(I_j \& i[x]j) \& \forall w \in \|\text{com}(\text{ag}(u))\|^i : \langle w, [x]^i \rangle \in \text{run}
\]

If (vii) is uttered in an information \(\sigma\), we get (viii). This last meaning is the static counterpart to the dynamic interpretation we would have arrived at for the translation of (vii) by following the rules in (i)-(iii). The final line of this dynamic interpretation is given in (ix). Notice that (viii) and (ix) express equivalent meanings.

(viii) \quad \|\text{DECL}_u \text{ someone}_x \text{ run}\| (\sigma) = \lambda I_i.\exists j(\sigma j \& i[x]j) \& \forall w \in \|\text{com}(\text{ag}(u))\|^i : \langle w, [x]^i \rangle \in \text{run}

(ix) \quad \sigma\|\exists x \& \text{run}_{\text{com}(\text{ag}(u))}(x)\| = \{ g \mid \exists h \in \sigma : g[x]h \& \forall w \in \|\text{com}(\text{ag}(u))\|^g : \langle w, [x]^g \rangle \in \|\text{run}\|^g \}

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