Specific, Yet Opaque

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Abstract. In her dissertation, Janet Fodor has argued that the quantificational force and the intensional status of certain quantifier phrases can be evaluated independently. The proposal was only halfway accepted: the existence of non-specific transparent readings is well-established today, but specific opaque readings are deemed illusory. I argue that they are real and outline a semantic framework that can generate them. The idea is to permit two types of quantifier raising: one that carries the restrictor of the determiner along and another that does not. When the second is applied, the restrictor can be stranded within the scope of an intensional operator as the quantificational determiner itself takes wider scope.

1 Fodor's Readings

Assume Alex, Bart, and Chloe are three distinct people and consider the following inference:

(1) Ralph thinks Alex is an American spy
Ralph thinks Bart is an American spy
Ralph thinks Chloe is an American spy
———————————————
Ralph thinks at least three spies are American

This looks valid but under standard assumptions it can't be. The conclusion, under its *de re* reading, entails the existence of spies. But the premises don't: they are compatible with Ralph having false beliefs about Alex, Bart, or Chloe. Under the *de dicto* reading, the conclusion entails that Ralph has a general belief about the number of American spies. But the premises don't: they are compatible with him thinking nothing more than that Alex is an American spy, and Bart is, and Chloe is. It is certainly likely that if Ralph has these three specific beliefs he will also come to have the general one. But logic alone cant force him to live up to his commitments.

It would not be fair to dismiss this problem by pointing out that if propositions are taken to be sets of possible worlds then the inference is valid on the *de dicto* construal. True enough, if in all of Ralph's belief worlds Alex, Bart, and Chloe are American spies then all those worlds contain at least three spies. But we should not forget that given the high-flying idealization of a Hintikka-style semantics for attitude verbs, (2) is also supposed to be a valid inference:

(2) Ralph thinks Alex is an American spy
Ralph thinks Bart is an American spy
Ralph thinks Chloe is an American spy
―――――――――――――――――
Ralph thinks arithmetic is incomplete

Semanticists tend concede that (2) is not valid. Attitude verbs are hyper-intensional but for many purposes they can be treated as if they were merely intensional. Fair enough, we all like to keep things simple when we can. But if we don't want to take the blame when the simplifying assumption of logical omniscience leads to unacceptable predictions we should not take credit when it accidentally delivers the right result – as it happens in (1).

The real reason (1) is valid has nothing to do with logical omniscience. It is rather that the conclusion can be read in a way that differs from both the usual *de re* and *de dicto* interpretations. The relevant reading can be paraphrased as (3):

(3) There are at least three people Ralph thinks are American spies.

That intensional constructions may give rise to such readings has been conjectured before. Fodor [4] argued that the quantificational force and the intensional status of certain quantified phrases can be evaluated independently. Thus, she claimed that a sentence like (4) has four distinct readings:

(4) Mary wants to buy an inexpensive coat.

a. *Non-specific, opaque* (*de dicto*): Mary wants this: that she buys an inexpensive coat.
b. *Specific, transparent* (*de re*): There is an inexpensive coat which Mary wants to buy.
c. *Non-specific, transparent*: There are inexpensive coats of which Mary wants to buy one.
d. *Specific, opaque*: There is a thing which Mary wants to buy as an inexpensive coat.

It is easy to imagine conditions under which the non-specific transparent reading is true but the *de re* and *de dicto* readings are false. Mary could have a certain type of coat in mind and have the desire to purchase an instance of that type, while being completely unaware of the fact that such coats are inexpensive. That (4-c) is a genuine reading of (4) has been generally recognized by semanticists; many have taken it as evidence that the scope theory of intensionality is either completely mistaken or in need of a thoroughgoing revision.[1] But the reading that corresponds to (4) is (4-d) – it is specific (in the sense that it makes a claim about a particular object) yet opaque (in the sense that it characterizes this object not as it is but as it is thought to be).

Alas, the consensus these days is that the existence of the specific opaque reading is an illusion. One reason for this is the difficulty of paraphrase. The

[1] The presence of the non-specific transparent readings is attested by other examples as well; cf. Bäuerle [2], Abusch [1], Percus [9].

reading is sometimes rendered as 'There is a thing which Mary wants to buy under the description *inexpensive coat*' but this is quite artificial. I used an *as*-phrase but that too is a rather obscure construction. Perhaps the best we can do is (5):

(5) There is a thing Mary wants to buy. She thinks it is an inexpensive coat.

Can (4) have a reading like (5)? Here is a widely-accepted argument that it cannot.[2] (4) and (5) do not permit the same continuations; while (5+) is coherent (4+) is not:

(4+) Mary wants to buy an inexpensive coat. # But it is actually quite expensive.

(5+) There is a coat Mary wants to buy. She thinks it is inexpensive. But it is actually quite expensive.

But then (4) and (5) cannot be synonyms, and thus, (4) lacks a specific opaque reading. I think the argument is too quick. The presence of the anaphoric pronoun forces a specific reading on the preceding sentences in both (4+) and (5+). In (5+) the anaphoric pronoun can pick out the coat Mary wants to buy and thinks is inexpensive. In (4+) the the anaphoric pronoun must pick out the inexpensive coat Mary wants to buy, which leads to inconsistency. But this contrast could be explained by the fact that the word *thinks* is present in (5) but missing from (4). Thus, we should not jump to the conclusion that (4) and (5) cannot have the same truth-conditions.[3] Consider (6):

(6) Mary thinks she bought an inexpensive coat. It is actually quite expensive.

I think this sequence is perfectly consistent; it is certainly much better than (4+). If there is no such thing as a specific opaque reading, the contrast is a bit of a mystery.

The intuitive validity of (1) and the intuitive coherence of (6) suggest that the dismissal of Fodor's specific opaque reading is a mistake. But generating such a reading within the standard quantificational framework using QR is far from trivial. To get a non-specific transparent reading we need to find a way

[2] This argument goes back to Ioup [6]. My presentation follows Keshet [7].

[3] Compare this suggestion with what we would say in the case of Partee's marble example. The reason (i) *I lost ten marbles and found all but one* can but (ii) *I lost ten marbles and found nine* cannot be felicitously continued with (iii) *It must be under the sofa* has to do with the fact that (i) does and (ii) does not contain the word *one*. One might conclude from this example (as proponents of dynamic approaches have) that (i) and (ii) are not synonyms. But one would certainly not want to say that (i) and (ii) differ in their truth-conditions. Similarly, I am inclined to accept that (4) and (5) cannot mean the same while I reject the suggestion that they cannot have the same truth-conditions.

to evaluate the restrictive predicate of a quantificational DP "higher up" while interpreting the quantificational force of the DP "downstairs". There are various mechanisms that can do this – we can, for example, use overt world-variables.[4] Then the simplified logical forms of the two non-specific readings of (4) would differ only in the choice of the world variable associated with the DP:

(4) a′. λw Mary wants [$\lambda w'$ to buy [an inexpensive coat in w']]
c′. λw Mary wants [$\lambda w'$ to buy [an inexpensive coat in w]]

To get the corresponding specific readings we would need to raise the DP, which results in the following logical forms:

(4) b′. λw [an inexpensive coat in $w]_i$ Mary wants [$\lambda w'$ to buy i])
d′. λw [an inexpensive coat in $w']_i$ Mary wants [$\lambda w'$ to buy i])

(4b′) is a perfectly adequate way to capture the specific transparent (*de re*) reading, but (4d′) says nothing like (4d). It would if the world-variable within the raised DP could be bound "from below" – but that is not how variable binding works.

To bypass this problem, we need to change the standard framework more radically. Before proposing such a change in section 4, I will try to provide more robust evidence that the specific opaque readings are real.

2 Summative reports

Let's start with the core example. Alex is a somewhat paranoid – he thinks that his neighborhood is full of terrorists. He spends much of his time observing comings and goings, following people around, and making inquiries. One day he goes to the police. The police officer who interviews Alex hands him a pile of photographs of people who live in his neighborhood. When Alex looks at a photograph he is asked first whether the person is a terrorist and if he answers affirmatively he is then asked where the person lives. When he is done looking through the photographs he is asked whether there are terrorists in the neighborhood who are not on any of the photographs he has seen. He says that there are not. He is also asked whether he knows how many terrorists he has identified. He says that there were quite a few but he does not know precisely how many. Fortunately, the police officer took tally. It turns out that Alex has identified 17 photographs as showing terrorists, and of those 11 as showing ones that live in the apartment building across the street from him. When the police officer who conducted the interview later reports this to his superiors he says the following:

(7) Alex believes that eleven terrorists live across the street from him.

Assuming Alex was honest in expressing his beliefs this seems like a true report. It is neither a *de re* claim (Alex's accusations need not be true) nor a *de dicto* one

[4] See Percus [9], von Fintel and Heim [3], and Keshet [7].

(Alex did not count up his accusations). Rather, it is what I will call a *summative report*. Alex's answers express a number of *de re* beliefs regarding the people on the photographs and the police officer summarizes those beliefs in his report. The words 'terrorist' and 'lives across the street' show up in Alex's answers, so they are to be taken to reflect how Alex thinks of the people on the pictures. The police officer need not think that either of these predicates applies to any of those people. By contrast, the word 'eleven' is the police officer's contribution to the report. He is the one keeping tally. Alex need not have any belief about the number of people he takes to be terrorists across the street. The summative reading of (7) is what Fodor called specific opaque.

We could clearly replace 'eleven' in (7) with any other numerical determiner and preserve the summative reading. Other intersective determiners work as well. (8), for example, can be used to make a true report under the circumstances described above, even if Alex thinks that eleven terrorists across the street are but a pittance. (Perhaps he thinks most neighborhoods have a lot more terrorists than his own.)

(8) Alex believes that many terrorists live across the street from him.

When the report is summative 'many' is the police officers contribution, and the report is true because Alex in fact identified eleven people as terrorists living across the street from him and eleven terrorists across the street are in fact many.

Here is another example, this time using a non-intersective quantifier. Imagine that Bob, who lives in the same neighborhood, also comes to the police and claims that there are a number of terrorists living there. The police officer goes to his supervisor and they discuss the new development, comparing Bob's accusations with those made by Alex. The police officer observes that there is not much agreement between Alex and Bob about where the terrorists are concentrated in the neighborhood. He says:

(9) Alex believes that most terrorists live across the street from him.

Given that Alex has identified 17 people as terrorists and 11 of them as living across the street from him and that he also said that there are no terrorists in the neighborhood who are not on any of the photographs he has seen, this report seems true. The report quantifies restrictedly – the context makes clear that only people in Alex's neighborhood are at issue. With the obvious changes in the pattern of responses Alex gave, we can confirm the existence of summative readings involving other non-intersective quantifiers, such as 'every', 'two thirds of', or 'no'.

Given the character of summative reports one might expect that we can lump together not only *de re* beliefs of a single person, but also *de re* beliefs of multiple people. This expectation is borne out. Imagine that besides the 17 people Alex accuses of terrorism, Bob accuses another 9. The police officer could report the outcome of the two interviews as (10):

(10) Alex and Bob believe that twenty-six terrorists live in their neighborhood.

The summative reading of (10) is cumulative – it is like saying that Alex and Bob ate twenty-six cookies if they jointly devoured that much. The difference is that those twenty-six things Alex and Bob ate had to be really cookies while the twenty-six people they have beliefs about needn't be really terrorists.

I conclude that summative readings are available for quantified belief reports no matter what quantifier is used. This strenghtens the evidence for the existence of specific opaque readings provided by the inference under (1).

3 Modals, tense, and aspect

Similar readings arise with modals, tense, and aspect as well. They are relatively easy to find, once one knows where to look.

Imagine that Anna is taking a course and the term paper is due next Monday. She has three outlines and she is trying to decide which one to work on. She doesn't have time to write more than one paper before next Monday. Under these circumstances (11) seems true.

(11) Anna could write three papers. Now she has to decide which one to write.

Note that it is false that three papers are such that it is possible that Anna writes them and equally false that it is possible that Anna writes three papers. The true reading is summative: three things (i.e. the outlines) are such that each could be a paper written by Anna.

Ben is in the same class but his situation is different. He has been working steadily for a long time but he tends to be unhappy with what he writes. On Friday he finishes a paper and burns it, on Saturday he finishes another and burns that too, and on Sunday he finishes the third but that one doesn't make it to Monday either. Still, when Monday comes (12) seems true:

(12) Ben wrote three papers. Unfortunately, he burned them all.

On the *de re* construal, *three papers* would scope above the tense and thus there would have to be three papers in existence on Monday for the sentence to be true then. On the *de dicto* construal, *three papers* is interpreted within the scope of the past tense and thus there would have to be some time before Monday when three papers were in existence. But there never were three papers Ben wrote in existence. The true reading is again summative: three things (i.e. the past papers) are such that each was a paper written by Ben.[5]

[5] The puzzle of summative readings for tense was discovered a long time ago. Sextus Empiricus in *Against the Physicists* 2.98. attributes a puzzle to Diodoros Chronos. The puzzle concerns Helen of Troy was consecutively married to three different men – Menelaus, Paris, and Deïphobus. Thus, it seems like we can use *Helen had three*

What summative readings involving attitude verbs, modals and tense have in common is that they express the results of counting across certain boundaries. In (7), we count across Alex's *de re* beliefs: he believes of this guy that he is a terrorist and also that he lives across the street, and he believes the same of this other guy, . . ., and of this eleventh guy as well, *ergo* Alex believes eleven terrorists live across the street. In (11), we count across worlds: there is a possible world where Anna finishes this outline, a different possible world where she finishes this other one, and a third where she finishes this third one, *ergo* Anna could write three papers. In (12), we are summing up what is the case at different times: there is a time when Ben finished this paper, another when he finished this other one, and a third when he finished this third one, *ergo* Ben wrote three papers.[6]

In the cases hitherto considered, the specific opaque reading had to be teased out by constructing the appropriate contexts in which the sentence is plausibly used with that intended reading. But there are also cases where this reading is arguably the dominant one. Consider Chris who is in the same class as the other two. Chris is a show-off – he intends to hand in not one but three papers on Monday. On Saturday he is sitting at his computer working simultaneously on all three drafts. (13) describes the case correctly:

(13) Chris is writing three papers. All three are up on his screen.

There is a long-standing debate in the semantics literature about the status of things in progress. The establishment view is that a sentence like (13) does not entail the existence of any actual paper Chris is writing. This is the *de dicto* construal, where *three papers* is interpreted below the aspect. The anti-establishment view denies this and says that (13) entails that there are three papers such that Chris is writing them. This is the *de re* reading, where aspect takes narrow scope with regard to *three papers*.[7] The establishment has the upper hand – it seems clear that while Chris is working on the papers there are no papers yet. But the anti-establishment makes a good point too – it seems equally clear that there are three things that are the objects of Chris's writing. They are actual drafts stored on the computer, not mere possibilia. Thus, the normal reading of (13) is, I think, neither *de re* nor *de dicto*. Rather, it is specific opaque one: there are three things (i.e. the drafts) such that each is becoming a paper written by Chris.

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husbands to say something true. Since the husbands are no more, it is false that three husbands are such that each was at some time in the past Helen's. Since Helen is not guilty of trigamy it is false that at some time in the past Helen had three husbands.

[6] I argue for the existence of such readings in Szabó [10].

[7] The most prominent defense of the anti-establishment view is Parsons [8]. Zucchi [12] is the standard critique of this aspect of Parsons's work. In Szabó [11] I argue for an account of the progressive that takes a middle course – it takes the sentence *Jack is building a house* to entail the existence of an actual object Jack is building without characterizing this object as a house.

4 Split quantifiers

How can specific opaque readings be generated? Within a QR-based approach to quantification, the task comes down to specifying a mechanism that splits quantificational determiners from their restrictors. Then the former can move above an intensional operator while the latter is evaluated "downstairs". I will present such a mechanism within the standard framework of Heim and Kratzer [5].

The idea is that raising of a quantified DP is more akin to copying: the syntactic structure remains in its original position while an identical one is attached above a higher S node. The quantificational determiner moves to the higher position leaving an ordinary trace below. For the restrictor there are two possibilities: it can move or it can stay. The unfilled restrictor position – whether it is the higher one or the lower one – is filled by a default predicate whose extension is D_e. Finally, we need a new rule that combines the trace with a predicate and delivers what I call a *restricted trace*. The semantic value of a restricted trace is undefined whenever the trace is assigned a value that in not within the extension of the restrictor.

Here is a small fragment of a language that allows split raising. It contains just one verb (*run*), two nouns (*dog, thing*), three quantificational determiners (*every, some, most*) and traces indexed by natural numbers (t_ι, where $\iota \in \omega$). The semantic types of lexical items are the usual: the nouns and the verb are of type $\langle e,t\rangle$, the quantificational determiners of type $\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle$, and the traces of type e. Semantic values of lexical items are standard (since only traces have assignment-dependent semantic values the superscript is suppressed elsewhere):

$$\llbracket t_\iota \rrbracket^a = a(\iota)$$
$$\llbracket \textit{runs} \rrbracket = \lambda x \in D_e\ x \textit{ runs}$$
$$\llbracket \textit{dog} \rrbracket = \lambda x \in D_e\ x \textit{ is a dog}$$
$$\llbracket \textit{thing} \rrbracket = \lambda x \in D_e\ x = x$$
$$\llbracket \textit{every} \rrbracket = \lambda f \in D_{\langle e,t\rangle}\ .\ \lambda g \in D_{\langle e,t\rangle}\ .\ \text{for all } x \in D_e \text{ if } f(x) = 1 \text{ then } g(x) \neq 0$$
$$\llbracket \textit{some} \rrbracket = \lambda f \in D_{\langle e,t\rangle}\ .\ \lambda g \in D_{\langle e,t\rangle}\ .\ \text{some } x \in D_e \text{ is such that } f(x) = 1 \text{ and } g(x) = 1$$
$$\llbracket \textit{most} \rrbracket = \lambda f \in D_{\langle e,t\rangle}\ .\ \lambda g \in D_{\langle e,t\rangle}\ .\ \text{more } x \in D_e \text{ are such that } f(x) = 1 \text{ and } g(x) = 1 \text{ than are such that } f(x) = 1 \text{ and } g(x) = 0$$

The only slightly unusual thing here is the interpretation of *every*; normally the clause ends with '$g(x) = 1$' rather than '$g(x) \neq 0$'. The semantics allows partial functions, so this will make a difference, which will be explained below.

Concatenation is interpreted as functional application except in the following two cases (the first is Heim & Kratzer's, the second is new).

(PA) If ι is an index and σ is a sentence then $[\iota\sigma]$ is a *predicate abstract* of type $\langle e,t\rangle$, and $\llbracket \iota\sigma \rrbracket^a = \lambda x \in D_e\ \llbracket \sigma \rrbracket^{a[x/\iota]}$

(RT) If t_ι is a trace and ν is a noun then $[t_\iota\nu]$ is a *restricted trace* of type e, and $\llbracket t_\iota\nu \rrbracket^a = a(\iota)$ if $\llbracket \nu \rrbracket(a(\iota)) = 1$; otherwise undefined.

The syntax has two rules of quantifier-raising: one that carries along the restrictor and another that does not. (Like indices, the noun *thing* is phonologically null.)

(QR$^{\uparrow}$) $[_{\mathrm{S}}\ \xi\ [_{\mathrm{DP}}[\delta][\nu]]\ \psi] \Rightarrow [_{\mathrm{S}}[_{\mathrm{DP}}[\delta][\nu]][[\iota][_{\mathrm{S}}\ \xi\ [[t_\iota][\mathit{thing}]]\ \psi]]]$

(QR$^{\downarrow}$) $[_{\mathrm{S}}\ \xi\ [_{\mathrm{DP}}[\delta][\nu]]\ \psi] \Rightarrow [_{\mathrm{S}}[_{\mathrm{DP}}[\delta][\mathit{thing}]][[\iota][_{\mathrm{S}}\ \xi\ [[t_\iota][\nu]]\ \psi]]]$

Let me illustrate how all this works on (14). The sentence could be obviously interpreted without quantifier raising and the results of applying (QR$^{\uparrow}$) or (QR$^{\downarrow}$) will not change the truth-conditions. What they do is allow some intensional operator (attitude verb, modality, tense, aspect, etc.) to intervene between the quantificational determiner and its trace. (To keep things simple, I did not include these in the fragment but they could be introduced without complications.) If the restrictor of the DP is upstairs we get a specific transparent reading; if it is left downstairs we obtain the specific opaque one.

(14) $[_{\mathrm{S}}[_{\mathrm{DP}}[_{\mathrm{D}}\mathit{every}][_{\mathrm{N}}\mathit{dog}]][_{\mathrm{VP}}\mathit{runs}]]$

(14$^{\uparrow}$) $[_{\mathrm{S}}[_{\mathrm{DP}}[_{\mathrm{D}}\mathit{every}][_{\mathrm{N}}\mathit{dog}]][\ 5[_{\mathrm{S}}[[t_5][_{\mathrm{N}}\mathit{thing}]][_{\mathrm{VP}}\mathit{runs}]]]]$

(14$^{\downarrow}$) $[_{\mathrm{S}}[_{\mathrm{DP}}[_{\mathrm{D}}\mathit{every}][_{\mathrm{N}}\mathit{thing}]][\ 8[_{\mathrm{S}}[[t_8][_{\mathrm{N}}\mathit{dog}]][_{\mathrm{VP}}\mathit{runs}]]]]$

Since $[\![\mathit{thing}]\!]$ is the total identity function on D_e, according to (RT) $[\![[t_5][_{\mathrm{N}}\mathit{thing}]]\!]^a = a(5)$, and according to (PA) $[\![[\ 5[_{\mathrm{S}}[[t_5][_{\mathrm{N}}\mathit{thing}]][_{\mathrm{VP}}\mathit{runs}]]]]\!] = [\![\mathit{runs}]\!]$. So, obviously, $[\![(14)]\!] = [\![(14^{\uparrow})]\!]$. By contrast, $[\![[t_8][_{\mathrm{N}}\mathit{dog}]]\!]^a$ is only defined for those values of the assignment function that are dogs in D_e. So, $[\![[\ 8[_{\mathrm{S}}[[t_8][_{\mathrm{N}}\mathit{dog}]][_{\mathrm{VP}}\mathit{runs}]]]]\!] = [\![\mathit{runs}]\!]$ only if $a(8)$ is a dog; otherwise it is undefined. Now it is clear why the interpretation of *every* had to be modified: had we used the standard one (14$^{\downarrow}$) would come out as false when there are no dogs in D_e. But with the modified rule we have $[\![(14)]\!] = [\![(14^{\downarrow})]\!]$, as desired.

The interpretations of *some* and *most* did not have to be adjusted. In order for the predicate abstract to yield a truth-value for some assignment, the assignment must map its index to a member of D_e that satisfies the restrictor below. This requirement becomes part of the truth-conditions. Thus, the lower reading of 'Some dog runs' (i.e. the one obtained via (QR$^{\downarrow}$)) is true iff there is some $x \in D_e$ such that $[\![\mathit{thing}]\!](x)$ and $[\![[\ 8[_{\mathrm{S}}[[t_8][_{\mathrm{N}}\mathit{dog}]][_{\mathrm{VP}}\mathit{runs}]]]]\!](x) = 1$, where the latter requirement boils down to $[\![\mathit{dog}]\!](x) = 1$ and $[\![\mathit{runs}]\!](x) = 1$. The lower reading of 'Most dogs run' is true just in case there are more x's $\in D_e$ such that $[\![\mathit{thing}]\!](x) = 1$ and $[\![[\ 8[_{\mathrm{S}}[[t_8][_{\mathrm{N}}\mathit{dog}]][_{\mathrm{VP}}\mathit{runs}]]]]\!](x) = 1$ than x's $\in D_e$ such that $[\![\mathit{thing}]\!](x) = 1$ and $[\![[\ 8[_{\mathrm{S}}[[t_8][_{\mathrm{N}}\mathit{dog}]][_{\mathrm{VP}}\mathit{runs}]]]]\!](x) = 0$. This is equivalent to the condition that there be more x's $\in D_e$ such that $[\![\mathit{dog}]\!](x) = 1$ and $[\![\mathit{runs}]\!](x) = 1$ than x's $\in D_e$ such that $[\![\mathit{dog}]\!](x) = 1$ and $[\![\mathit{runs}]\!](x) = 0$. All as it should be.

If there is an intensional operator that intervenes between a raised determiner and a stranded restrictor we can get a specific opaque reading. But in an extensional setting (QR$^{\uparrow}$) and (QR$^{\downarrow}$) are semantically indistinguishable. Here is a sketch of a proof.

Let σ be a sentence in an extensional language containing the restricted quantifier $\delta\varrho$ (where δ is the determiner and ϱ is the restrictor). Let's say that the output of ($QR^{\uparrow}$) applied to an occurrence of $\delta\varrho$ is $\sigma^{\uparrow}$ and that an application of ($QR^{\downarrow}$) yields $\sigma^{\downarrow}$; let the index of the resulting restricted trace in both cases be ι. I want to show that $[\![\sigma^{\uparrow}]\!] = [\![\sigma^{\downarrow}]\!]$. Suppose $\varepsilon^{\uparrow}$ is an arbitrary constituent of $\sigma^{\uparrow}$ and $\varepsilon^{\downarrow}$ the corresponding constituent of $\sigma^{\downarrow}$. (The two sentences have the same syntactic structure.) Call an assignment function that assigns a member of D_e to ι that satisfies ϱ *good*. I claim that if a is a good assignment then $[\![\varepsilon^{\uparrow}]\!]^a = [\![\varepsilon^{\downarrow}]\!]^a$. This is enough to prove what we want because (assuming δ satisfies conservativity and extension) assignments that aren't good make no difference when it comes to the truth-conditions of σ. That $[\![\varepsilon^{\uparrow}]\!]^a = [\![\varepsilon^{\downarrow}]\!]^a$ for all good assignments can be proved by induction. When ε is the restricted trace left behind as a result of raising $\delta\varrho$ this follows from (RT). When ε is a lexical constituent of σ that is not part of the restricted trace $\varepsilon^{\uparrow} = \varepsilon^{\downarrow}$. And the inductive steps involving functional application, predicate abstraction, and restricted trace formation (using a different index) are trivial. (It matters here that we don't have intensional operators in the language.)[8]

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