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Comparatives, Indices, and Scope

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1 Russell's ambiguity

Our knowledge of the natural world leads us to judge a sentence like (1) to be a contradiction: nothing is greater along some dimension than it is.

(1) Smith's yacht is larger than it is.

As noted by Bertrand Russell (1905), however, when a sentence like (1) is embedded under an intensional predicate, the resulting sentence is ambiguous.

(2) Jones thinks Smith's yacht is larger than it is.

Russell observed that (2) can either be interpreted as a claim that Jones has a mistaken belief about the size of Smith's yacht, as in the paraphrase given in (3), or as a claim that Jones believes a contradiction, as in (4).

(3) The size that Jones thinks Smith's yacht is is greater than the size that it is.
(4) Jones thinks that the size of Smith's yacht is greater than the size of Smith's yacht.

As is evident from his paraphrases of the interpretations of (2), which I will refer to as the "sensible" or *wide scope* interpretation and the "contradictory" or *narrow scope* interpretation, respectively, Russell derived the ambiguity from the principles of his theory of definite descriptions. Comparatives are a type of description, descriptions may take scope over intensional predicates, therefore (2) is ambiguous.

The majority of subsequent work on the syntax and semantics of comparative constructions retains the core of Russell's explanation (see von Stechow 1984 for a detailed discussion of various approaches to this ambiguity). In these accounts, the ambiguity of (2) and related sentences follows from the assumption that some component of the comparative construction may have wide or narrow scope with respect to an intensional predicate or operator. A common characteristic of these analyses is that they are *configurational*--the relative scope of the comparative operator and the intensional predicate is determined by the structural relationship which holds between these expressions in a logical form.

The goal of this paper is to develop an *indexical* account of Russell's ambiguity, in which the scope of a comparative is a function of its indexical value, where its index identifies (among other things) the world with respect to which its denotation is determined. Similar accounts have been discussed in von Stechow 1984, Hoeksema 1984, and Heim 1985, but never explicitly developed. I will adopt a semantics of comparatives based on that of Heim (1985), in which comparatives are analyzed as *degree descriptions*: restrictions on the possible values of the degree argument of a gradable predicate. Setting

my analysis in the framework of Farkas' (1993, 1994, 1995) indexical theory of the scope of indefinite NPs, I will argue that the scope of comparatives, like the scope of indefinites, is determined nonconfigurationally as a function of the indexical value of the degree description.

2 The configurational account

Von Stechow (1984) proposes that comparatives involve existential quantification over and addition of degrees.[1] A sentence like (5) has the interpretation paraphrased in (6).[2]

(5) Jones is taller than Smith is.
(6) There is a degree *d* such that the degree of Jones' height is *d* plus the (maximal) degree of Smith's height.

Assuming that comparative deletion is resolved through some kind of reconstruction (of the type proposed in e.g. Fiengo & May 1994), the Logical Form of (5) is (7), where the complement of the *than*-clause is taken to be an operator-variable construction (cf. Chomsky 1977). The LF (7) is mapped onto the logical representation shown in (8).

(7) Jones is taller than [Op_x Smith is e_x-tall]
(8) $\exists d\big[\mathit{tall}(d + \max(\lambda d_1.\mathit{tall}(d_1, \mathit{Smith})), \mathit{Jones})\big]$

In von Stechow's analysis, the *than*-clause denotes the maximal member of a set of degrees; in (8), the set of degrees to which Smith is tall. This constituent denotes the degree which, when added to the degree introduced by existential quantification, gives the degree of Jones' height.

Von Stechow argues that the *than*-clause is a type of nominal, and like other nominals, it may participate in configurational scope relations. Configurational scope relations are a function of the structural positions of constituents at Logical Form (LF), where LFs are derived from surface structures through an operation of Quantifier Raising (May 1977), which optionally adjoins a maximal projection to a dominating clausal node.

An account of Russell's ambiguity follows from these assumptions. The surface string in (2) is associated with two LFs: one in which the *than*-clause remains in situ, and one in which it is raised out of the embedded clause. In the former case, shown in (13), the *than*-clause remains within the scope of the intensional predicate *think*, deriving the contradictory reading shown in (14).

(9) Jones thinks Smith's yacht is longer than [Op_x it is x-long]
(10) *Jones thinks* $\exists d\big[\mathit{long}(d + \max(\lambda d_1.\mathit{long}(d_1, \mathit{Smith}(\mathit{yacht}))), \mathit{Smith}(\mathit{yacht}))\big]$

In the latter case, the *than*-clause is interpreted externally to *think*, deriving the sensible interpretation in which Jones has a mistaken belief about the size of Smith's yacht:

(11) $[\mathrm{Op}_x$ it is x-long$]_i$ Jones thinks Smith's yacht is longer than e_i
(12) $\max(\lambda d_1.\mathit{long}(d_1, \mathit{Smith}(\mathit{yacht})))\ \lambda d_2\big[\mathit{Jones\ thinks}\ \exists d\big[\mathit{long}(d + d_2, \mathit{Smith}(\mathit{yacht}))\big]\big]$

3 The puzzle of unboundedness

A number of researchers have observed that Russell's ambiguity is not isolated to contexts in which an apparently contradictory comparative occurs in the clausal complement of an intensional verb (see e.g. Horn 1980, von Stechow 1984, and the references cited in these papers). On the contrary, this ambiguity is observed in a wide range of constructions which are similar only in that a contradictory comparative occurs within the domain of some intensional predicate or operator. The following examples illustrate contexts in which an apparently contradictory comparative has a sensible interpretation; that is, within the framework of a configurational account such as von Stechow's, contexts in which the than-clause may be interpreted externally to the intensional operator or predicate in whose domain it appears in the surface representation.

(13-14), in which the comparative is contained in the clausal complement of an intensional noun, allow both a sensible and a contradictory interpretation.[3]

(13) Max maintained the illusion that the job was less boring than it was.
(14) The widely-held belief that the Soviet Union was more powerful than it was dictated American foreign policy for years.

Similarly, (15-16), in which the comparative is contained in the sentential subject of an intensional verb, have both readings.

(15) That lead weighs more than it does was assumed by our class in order to simplify calculations.
(16) That Maria was older than she was was believed by all the bartenders.

Postal (1974), Williams (1976), and von Stechow (1985) discuss sentences such as (17-18), in which the comparative is part of the antecedent of a counterfactual conditional. If these allowed only the contradictory interpretation, then these sentences would be vacuously true. This is clearly not the case; each has an interpretation in which the *than*-clause denotes a degree in the world of discourse, rather than a degree in some similar alternative world.

(17) If Jones had smoked less than she did, she would be healthier than she is.
(18) Had relations been any more strained than they were, the two sides would never have resolved their differences.

Finally, it is important to note von Stechow's (1984) observation the possible interpretations of the *than*-clause are not limited to narrow scope (contradictory) and widest scope (sensible). It is also possible for the *than*-clause to take intermediate scope when it is in the domain of two (or more) intensional expressions, as in (19).

(19) Mona had a dream in which a novelist thought he was more clever than he was.

(19) has a contradictory reading (narrow scope), a reading in which the *than*-clause denotes the degree of the novelist's cleverness in the world in which the sentence is uttered (widest scope), and an interpretation in which the *than*-clause has wide scope with respect to *think* but narrow scope with respect to *dream* (intermediate scope), as paraphrased in (20).

(20) Mona had a dream in which the degree to which a novelist thought that he was clever was greater than the degree to which he was clever *in the world of Mona's dream*.

The importance of this reading is that it argues against an approach to comparative scope along the lines of Fodor & Sag's (1981) analysis of indefinites, which allows only a two way ambiguity between a narrow scope reading and a widest scope interpretation.[4]

What these facts indicate is that the scope of the *than*-clause is *unbounded*. In each of (13-19), as well as in Russell's original example (2), the widest scope reading of the contradictory comparative is derived in the configurational account by raising the constituent corresponding to the *than*-clause to a position in a higher clause. Moreover, in (13-19) this operation involves movement out of various syntactic islands: a complex NP in (13-14) and (19), a subject in (15-16), and the antecedent clause of a conditional in (17-18).

The unboundedness of comparative scope is unusual because other expressions which arguably participate in configurational scope relations, such as proportional quantifiers (e.g. *most* N' and *every* N') cannot in general scope out of the contexts in (13-19). In fact, the restriction on quantifier scope is quite strong: in the unmarked case, a quantificational expression cannot have scope out of the clause in which it occurs: it is *clause bounded* (Farkas 1981). This is illustrated by (21-25), which do not permit interpretations in which the italicized quantified NPs in the embedded clauses have scope over the indefinites in the higher clause.[5]

(21) At least one professor believed that *every student* would respect him.
(22) Some college basketball player thinks he could play for *most teams*.
(23) At least one professor maintained the illusion that *every student* would respect him.
(24) That *most students* dropped out of school bothered at least one administrator.
(25) If Smith had coached *every contestant* an official would have been alerted.

The contrast between comparatives and quantifiers with respect to possible scopal interpretations is puzzling if the scopal interpretations of both types of expressions are determined in the same way, i.e. through configurational relations at LF. The basic assumption of a configurational theory of scope is stated in (26), and (27) expresses a well-established generalization about possible syntactic operations in natural language.

(26) *The LF Hypothesis*
Scope relations are represented as configurational relations at LF.
(27) *Ross' Lesson*
No syntactic operation is completely unbounded.

The fact that quantifier scope is clause bounded is not unexpected given (26) and some specific instantiation of (27).[6] What is puzzling in a configurational theory, if these principles are accepted, is the unboundedness of comparative scope:

(28) *The puzzle of unboundedness*
Comparative scope is unbounded; quantifier scope is bounded.

The puzzle of unboundedness constitutes the principal argument against the configurational account of Russell's ambiguity. The null hypothesis in a configurational theory of scope is that all elements which participate in configurational scope relations should have the same scopal possibilities. Moreover, in a theory in which scopal relations are syntactically represented at a level of Logical Form, possible scope assignments should be constrained by some implementation of (27). The comparative scope facts show that neither of these claims holds of comparatives. The basic assumption underlying the analysis developed in this paper is that the different scopal behavior of comparatives and quantifiers should follow from differences in the principles which govern their respective interpretations.

4 The free variable problem

A different sort of problem for the configurational account comes from examples like (29), discussed by Hoeksema 1984 and Heim 1985. (29) has a reading which corresponds roughly to (30), where the universally quantified NP *every teenage boy* is within the scope of the intensional predicate *think*.

(29) Sue thinks that every teenage boy believes he is more suave than he is.
(30) The degree to which Sue thinks every teenage boy believes he is suave is greater than the degree to which he actually is suave.

In order to derive this reading, the comparative must have matrix scope. If this is the case, however, the logical form corresponding to this interpretation should be ill-formed because it would contain an unbound variable in the constituent corresponding to the *than*-clause, namely the variable corresponding to the pronoun *he*, as illustrated by (31-32).

(31) [the degree to which **he**$_j$ is suave]$_i$ Sue thinks that **every teenage boy**$_j$ believes he suave to a degree greater than e$_i$

(32) $\max(\lambda d_1.\mathit{suave}(d_1,\boldsymbol{x}))\lambda d_2$[*Sue thinks that every*$_x$*:teenage-boy(x)* [*x believes that* $\exists d\left[\mathit{suave}(d+d_2,x)\right]$]]

5 An indexical theory of scope

The comparative scope facts discussed in section 3 are similar to facts discussed by Farkas (1993, 1994, 1995) in recent work on the scope of indefinite NPs. Indefinites have precisely the same interpretive possibilities as the comparatives in the contexts listed above, as illustrated by the following set of examples. In each example, the italicized indefinite NP may be interpreted with widest scope (i.e., *de re*), regardless of its depth of embedding.

Arguments of intensional verbs and nouns
(33) Everyone thinks that Smith bought *an Australian yacht*.
(34) Most Americans want to meet *a tall Norwegian*.
(35) Max maintained the illusion that he would get *a job in the front office*.
(36) The belief that *an Eastern European country* threatened the American Way of Life was held for years.

Sentential subjects of intensional predicates

(37) That *a suspect* would arrive at 9 was assumed by the detectives planning the raid.

Counterfactual conditionals

(38) If Jones had met *a man from Brazil*, she would have moved to Rio.

(39) Had Smith learned *a foreign language*, he would have had more success.

Intermediate scope

(40) Mort had a dream in which he thought *an insurance salesman* threatened his life.

Each of the sentences in (33-39) is ambiguous between a reading in which the italicized indefinite NP takes scope out of the intensional context in which it occurs, and one in which the indefinite has narrow scope. Furthermore, (40) shows that indefinites may have intermediate scope when in the domain of more than one intensional expression. This example is three-ways ambiguous, depending on whether the indefinite is interpreted with narrow, intermediate, or widest scope with respect to *dream* and *think*. The important point made by these examples is that in the wide scope readings, the indefinite must scope out of the clause in which it occurs; in (35-40), this involves scoping out of an island. Thus indefinites, like comparatives, give rise to the puzzle of unboundedness described in section 3.

To account for the difference in scope possibilities between indefinites and quantificational expressions, Farkas (1993, 1994, 1995) has developed an *indexical* theory of NP scope, which has its roots in Enç's (1986) work on the temporal interpretation of NPs and Kaplan's (1979) semantics of demonstratives. Following Kaplan (1979), an *index* is defined as a sequence of coordinates (*w,t,p,a,h*...) with respect to which the denotation of a meaningful expression is evaluated (where *w* is a world, *t* is a time, *p* is a three dimensional location, *a* is the agent of the sentence (the speaker), *h* is the addressee, etc.). The "in the scope of" relation is calculated not in terms of configurational relations between meaningful expressions, but rather in terms of *indexical dependencies*, as summarized in (41).[7]

(41) *Indexical scope principle*
An expression e_1 is in the scope of an expression e_2 iff the value of a coordinate of the index of e_1 is determined by e_2.

The particular coordinate that is relevant to the determination of the scope of an expression in an intensional context is the world coordinate, which I will refer to as the *w*-index. The *w*-index identifies the world with respect to which the denotation of an expression must be determined. The value of *w* may be set in two ways (cf. Farkas 1993, 1994).

It may be *bound*. A *w*-index is bound by virtue of the context in which it appears. For example, the semantics of the intensional predicate *believe* as stated in (42) ensures that the *w*-index of the propositional complement of *believe* is bound; I will assume that this means that the *w*-index of the main predication of φ is also bound (cf. Svenonius 1994).

(42) $\|believe(a,\varphi)\|^{M,g,w} = 1$ iff $\forall w_b(a) \in W$: $\|\varphi\|^{M,g,w_b(a)} = 1$, where $w_b(a)$ is a world compatible with the beliefs of *a*.

Alternatively, a *w*-index may be *free*, in which case its value may either be set by some other expression, or it may be selected from a contextually determined set W_c of possible worlds ($W_c \subseteq W$, the set of all possible worlds).[8] The membership of W_c is a function of the use of world-introducing expressions (intensional predicates, modal operators, etc.); crucially, because the world in which the discourse occurs (w_0) is always salient, w_0 (the world in which the discourse takes place) is always a member of W_c.

According to (41), then, an expression e_1 is in the scope of another expression e_2 either because the *w*-index of e_1 is bound by e_2 (e.g., by virtue of the fact that e_1 is an argument of e_2), or because the *w*-index of e_1 is free but receives its value from e_2.[9] Conversely, an expression e_1 has widest scope when its value is set to w_0.

For an illustration of this system, consider the interpretation of the indefinite NP *a tall Norwegian* in (43), which manifests the classical *de dicto/de re* ambiguity.

(43) Peter believes that Mort married a tall Norwegian.

On the indexical analysis, the two interpretations of (43) are a consequence of the two different possible indexical values of the indefinite description. On the *de dicto* reading, schematically represented in (44), the *w*-index of the indefinite inherits its value from *believe*, which introduces a set of worlds.[10] It follows that the value of the variable introduced by the indefinite must be in the set of individuals who are tall Norwegians in *Peter*'s belief worlds.

(44) Peter believes$_{\lambda w_b(p)}$ [that Mort married$_{w_b(p)}$ [a tall Norwegian]$_{w_b(p)}$]

Alternatively, the indefinite may be indexed to w_0, as in (45), In this case, the value of the variable introduced by the indefinite is constrained to belong to the set of individuals who meet the description in w_0. Given other constraints on the use of indefinites (cf. Heim 1982), this indexing derives the *de re* interpretation.

(45) Peter believes$_{\lambda w_b(p)}$ [that Mort married$_{w_b(p)}$ [a tall Norwegian]$_{w_0}$]

This analysis carries over to contexts in which an indefinite NP occurs within a syntactic island, as in (35-40). The widest scope interpretation is derived when the indefinite is indexed to w_0, and the narrow or intermediate scope interpretations when the indefinite inherits its indexical value from some intensional expression. The crucial aspect of the indexical analysis is that the ambiguity of indefinites in intensional contexts is a function of the indexical value of the indefinite, not of transformations which alter configurational relations among constituents in a Logical Form. In the indexical account, no syntactic movement is involved, hence the puzzle of unboundedness does not arise.

6 An indexical account of Russell's ambiguity

Within the context of an indexical theory of scope, the observed parallels between the interpretations of indefinites and comparatives in intensional contexts--in particular, the puzzle of unboundedness--are straightforwardly explained if comparative constructions are analyzed as a type of complex *degree description*, as suggested originally in Heim 1985. The function of a degree description is to restrict the possible values of the variable

introduced by a Degree Phrase (cf. Bresnan 1973, Jackendoff 1977), which identifies the degree argument of a gradable predicate. In an indexical theory of scope, if comparatives are a type of description, then they should participate in the same types of indexical scope relations as other descriptions, e.g., indefinite NPs.

According to this line of thinking, (46) maps onto the logical expression in (47).[11]

(46) Jones is tall*er than Smith is*.

(47) $\left[tall\left(\left[er\ than\ \lambda y\left[tall(y, smith)\right]\right], jones\right)\right]$

Roughly, (47) is true in *w* iff there is a degree $d >_{tall} d'$ such that Jones is *d*-tall, where $>_{tall}$ is an ordering relation along a scale determined by *tall*, and *d'* is the (maximal) degree denoted by the *than*-clause (cf. Heim 1985, Cresswell 1976). The truth conditions of "more" comparatives are stated more formally in (48).

(48) $\left\|\left[P_\gamma\left(\left[er\ than\ \lambda y\left[\ldots\left[Q_\gamma(y,a)\right]\ldots\right]\right], b\right)\right]\right\|^{M,g,w} = 1$ iff:

$$\exists d\left[d >_\gamma \left\|\max\left(\lambda y\left[\ldots\left[Q_\gamma(y,a)\right]\ldots\right]\right)\right\|^{M,g,w'} \wedge \left\|P_\gamma(d,b)\right\|^{M,g,w} = 1\right]$$

The semantics of comparatives given in (48) states that the *w*-index associated with the degree description is independent of the *w*-index associated with the gradable predicate whose argument the degree description restricts. From this it follows that when a proposition involving a gradable predicate occurs as the argument of an intensional expression, the *w*-index of the gradable predicate is bound (by virtue of the context in which it appears; see the discussion of (42) above), but the *w*-index of the *than*-clause is free. Since the *w*-index of the *than*-clause is free, its value may be inherited from the worlds introduced by some other expression, or it may be set to w_0, the world of discourse.

Russell's ambiguity follows as a consequence of these two possibilities. (49-50) illustrate the two interpretations of Russell's original example (2), repeated below.

(2) Jones thinks Smith's yacht is larger than it is.

(49) *The sensible reading*

$$Jones\ thinks_{\lambda w_t(j)}\left[large_{w_t(j)}\left(\left[er\ than\ \lambda d\left[large_{w_0}(d, yacht)\right]\right], yacht\right)\right]$$

In (49), the degree description is indexed to w_0. Therefore, the value of the variable indicating the degree of *Smith's yacht*'s size in the worlds of *Jones'* thoughts is constrained to be greater than the degree of *Smith's yacht*'s size in w_0; i.e., *Jones* has a mistaken idea of the size of *Smith's yacht*. If, however, the degree description inherits its indexical value from the worlds introduced by *think*, as in (50), the value of the variable indicating the degree of *Smith's yacht*'s size in the worlds of *Jones'* thoughts must be greater than the degree of *Smith's yacht*'s size in the worlds of *Jones'* thoughts; i.e., *Jones* must entertain a contradictory belief.

(50) *The contradictory reading*

$$Jones\ thinks_{\lambda w_t(j)}\left[large_{w_t(j)}\left(\left[er\ than\ \lambda d\left[large_{w_t(j)}(d, yacht)\right]\right], yacht\right)\right]$$

Precisely the same analysis applies to sentences in which the contradictory comparative occurs in an embedded context, including contexts involving syntactic islands, as in (13-19). In these types of sentences, the contradictory reading arises when the *w*-index associated with the *than*-clause inherits its value from the intensional expression which binds the *w*-index of the gradable predicate whose argument the degree description restricts. The sensible reading, on the other hand, is derived when the value of the *w*-index associated with the *than*-clause is set to w_0. This option is always available because, as noted in section 5, w_0 is always salient in discourse, hence always included in W_C. The crucial characteristic of the indexical analysis of comparative scope, like the indexical analysis of NP scope, is that no syntactic movement is involved in deriving wide scope readings, so the puzzle of unboundedness does not arise.

The logical representations corresponding to the sensible and contradictory interpretations of (13) are given in (51-52), respectively;[12] (14-18) are treated analogously.

(13) Max maintained the illusion that the job was less boring than it was.

(51) *Max maintained the illusion* $_{\lambda w_i(m)}$ *that*

$$\left[\left[boring_{w_i(m)}\left(\left[er\ than\ \lambda y\left[boring_{w_0}(y,\ the\ job)\right]\right],\ the\ job\right)\right]\right]$$

(52) *Max maintained the illusion* $_{\lambda w_i(m)}$ *that*

$$\left[\left[boring_{w_i(m)}\left(\left[er\ than\ \lambda y\left[boring_{w_i(m)}(y,\ the\ job)\right]\right],\ the\ job\right)\right]\right]$$

The indexical analysis also provides a straightforward account of more complicated cases, such as (19).

(19) Mona had a dream in which a novelist thought he was more clever than he was.

As noted above, (19) permits an intermediate interpretation of the *than*-clause, a fact which von Stechow (1984) claimed argues against an indexical approach (cf. fn. 4). The important characteristic of (19) is that it contains two world-introducing expressions: *dream* and *think*. Because the *w*-index of the *than*-clause is free, it may inherit its value from either of these two expressions, or it may set its value to w_0, resulting in a three-way ambiguity.

If the *w*-index is inherits its value from the worlds introduced by *think*, the degree of *a novelist*'s cleverness in the worlds of his thoughts is constrained to be greater than the degree of his cleverness in the worlds of his thoughts, deriving the contradictory reading. If the *w*-index is set to the worlds introduced by *dream*, however, as in (53), then the degree of *a novelist*'s cleverness in the worlds of his thoughts is must be greater than his cleverness in the world of *Mona*'s dream, which accurately characterizes the intermediate reading.

(53) *Mona had a dream* $_{\lambda w_d(m)}$ *in which a novelist thought* $_{\lambda w_t(n)}$

$$\left[\ \left[clever_{w_t(n)}\left(\left[er\ than\ \lambda y\left[clever_{w_d(m)}(y,n)\right]\right],n\right)\right]\right]$$

The widest scope reading arises when the degree description is indexed to w_0, as in (54), in which case the degree of *a novelist*'s cleverness in the worlds of his thoughts must surpass his cleverness in the world of discourse.

(54) *Mona had a dream* $_{\lambda w_d(m)}$ *in which a novelist thought* $_{\lambda w_t(n)}$

$$\left[\ \left[clever_{w_t(n)}\left(\left[er\ than\ \lambda y\left[clever_{w_0}(y,n)\right]\right],n\right)\right]\right]$$

Finally, because scope is determined nonconfigurationally, the free variable problem discussed in section 4 does not arise. The wide scope reading of the comparative in an example like (29) does not involve movement of the *than*-clause out of the c-command domain of the universal quantifier, so the necessary configuration for binding of the variable corresponding to the pronoun *he* is maintained in the logical representation, as shown in (55).

(29) Sue thinks that every teenage boy$_z$ believes he$_z$ is more suave than he$_z$ is.

(55) *Sue thinks* $_{\lambda w_t(s)}$ *that every*$_z$*:teenage-boy(z)* [*z believes* $_{\lambda w_b(z)}$ *that*

$$\left[\ \left[suave_{w_b(z)}\left(\left[er\ than\ \lambda y\left[suave_{w_0}(y,z)\right]\right],z\right)\right]\right]\ ]$$

7 Extensions of the analysis

The indexical analysis of the scope of comparatives proposed here has several interesting consequences. First, it provides a straightforward account of sensible interpretations of contradictory comparatives in modal subordination contexts. Consider the discourse in (56), focusing on the italicized comparatives.

(56) Philip K. Dick's novel *Flow My Tears, the Policeman Said* describes a United States that is quite different from the one in which we live. In the novel, the country is in even worse shape than it (actually) is: *the government is more repressive than it is, the police have more power than they do,* and *people are in general more scared of the authorities than they are*. Overall, there are fewer civil liberties in the U.S. of the book than there are in the real world.

In isolation, the italicized comparatives have only contradictory interpretations. In the context of this description of the Philip K. Dick novel, however, they exhibit Russell's ambiguity. This is expected in the current analysis if we adopt Farkas' (1993) suggestion that in modal subordination contexts, the worlds introduced into W_C by some world-introducing expression remain salient (i.e., in W_C) throughout a discourse. The sensible readings of these sentences arise when the value of the *w*-indices associated with the main (gradable) predicates in each clause--which in these examples must be free--are set to the

world introduced by mention of the novel, while the *w*-indices associated with the degree descriptions are set to w_0. This is illustrated by (57), where the expression subscripted with w_{PKD} is interpreted with respect to the world of the novel.

(57) $\left[repressive_{w_{PKD}}\left(\left[er\ than\ \lambda y\left[repressive_{w_0}(y, government)\right]\right], government\right)\right]$

(57) is true just in case the degree of the government's repressiveness in the world of the novel exceeds the degree of the government's repressiveness in the world of discourse.

A second result of the indexical account is that it explains a case of monoguity first noticed by Postal (1974). There is a contrast between present and past tense Russell-sentences when the subject is first person: whereas (58) manifests the familiar ambiguity, (59) has only a contradictory interpretation.

(58) I thought Smith's yacht was larger than it was.
(59) #I think Smith's yacht is larger than it is.

In the analysis proposed here, this contrast follows from some basic assumptions about presupposition and speaker's intention. In general, speakers are taken to believe their assertions are true at the time of utterance (t_0). In the case of (59), this means that w_0 is presupposed to be included in the set of worlds introduced by *think*. Given a semantics of *think* as in (60), which involves universal quantification over possible worlds, indexing of the degree description to w_0 does not derive the sensible reading, as in the normal case.

(60) $\|think(a,\varphi)\|^{M,g,w} = 1$ iff $\forall w_t(a) \in W$: $\|\varphi\|^{M,g,w_t(a)} = 1$, where $w_t(a)$ is a world compatible with the thoughts of *a*.

Because w_0 is presupposed to be a world compatible with the thoughts of the speaker at t_0, it will never be the case that in *all* worlds compatible with the subject's thoughts, the complement of *think* in (59) is true, since the complement of think is not true in w_0 at t_0.

Although speakers are presupposed to believe the truth of their assertions at the time of utterance, they are not assumed to maintain a commitment to past beliefs described by their assertions. Therefore, w_0 is not included in the worlds introduced by *think* in (58), with the result that this sentence has a sensible interpretation (as well as a contradictory one).

Finally, the analysis proposed here supports Heim's (1985) contention that the interpretation of phrasal comparatives is distinct from the interpretation of clausal comparatives. As illustrated by (61), a contradictory phrasal comparative in an intensional context does not permit a sensible interpretation.

(61) #Smith thinks Jones$_i$ is taller than herself$_i$.

Heim argues that sentences containing phrasal comparatives involve comparison of individuals along a dimension determined by a gradable predicate. A phrasal comparative defines an ordering on individuals; it does not restrict the value of a variable. If a phrasal comparative is not a degree description, then we would not expect it to have an indexical value independent of the gradable predicate with which it is associated. More precisely, if a

phrasal comparative simply denotes an ordering relation, there is no reason to believe that it would have an indexical value at all. An implementation of Heim's semantics of phrasal comparatives (which is essentially Cresswell's (1976) analysis of comparatives in general) which captures this restriction is given in (62), and the analysis of (61) is given in (63-64).

(62) $\left\|er\langle a,b\rangle\lambda x.\,\imath d.\,P_\gamma(d,x)\right\|^{M,g,w} = 1$ iff

$$\left\|\lambda x.\,\imath d.\,P_\gamma(d,x)(a)\right\|^{M,g,w} >_\gamma \left\|\lambda x.\,\imath d.\,P_\gamma(d,x)(b)\right\|^{M,g,w}$$

(63) $\textit{Smith thinks}_{\lambda w_t(s)}\left[er\langle \textit{Jones}, \textit{Jones}\rangle\lambda x.\,\imath d.\,\textit{tall}_{w_t(s)}(d,x)\right]$

(64) $\|(63)\|^{M,g,w} = 1$ iff $\forall w_t(s) \in W$:

$$\left\|\imath d.\,\textit{tall}(d,\textit{Jones})\right\|^{M,g,w_t(s)} >_{\textit{tall}} \left\|\imath d.\,\textit{tall}(d,\textit{Jones})\right\|^{M,g,w_t(s)}$$

According to (64), (63) is true just in case the degree of *Jones'* height in each world compatible with *Smith*'s thoughts is greater than the degree of *Jones'* height in each world compatible with *Smith*'s thoughts; i.e., just in case *Smith* has a contradictory thought.

8 Conclusion

The analysis proposed here builds on the basic observation that a description may identify different objects in different possible worlds (and also at different times, in different locations, etc.). If comparatives are degree descriptions, as I have suggested, then the ambiguities they exhibit in intensional contexts follow directly from the principles of the indexical theory of scope. Moreover, since no syntactic movement is involved in generating the various interpretations, the puzzle of unboundedness associated with the configurational approach does not arise. Ultimately, the analysis proposed here is an affirmation of Russell's original observation that comparatives are a type of description. The important difference in the current approach lies in how a description is interpreted: in the indexical analysis, the scope of a description is not determined by an operation which alters its position in a logical representation, but rather is a function of its indexical value.

Notes

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1. Roughly speaking, for any gradable predicate γ, a degree of γ-ness is an equivalence class of individuals under an ordering relation $>_\gamma$ associated with γ (Cresswell 1976).
2. For concreteness, I will focus on Stechow's (1984) configurational analysis of Russell's ambiguity, though the objections I will raise can be applied to any analysis in which the relative scope of two expressions is a function of the structural relation that holds between them.
3. Postal (1974) claims that sentences such as (17-20) do not have sensible readings. Native speaker judgments argue against this claim, however, as do Liddell (1975) and Horn (1980).
4. Cf. von Stechow's (1984) claim that this fact argues against a "double-indexing" account of comparative scope, in which the scope of the than-clause is set by a covert operator which requires that the denotation of its argument be determined with respect to the actual world of discourse.

5. I focus here on finite embedded clauses. It is well known that quantifiers may have scope out of nonfinite embedded clause in certain contexts.
6. Such a constraint would have the effect of constraining QR to adjoin a quantificational NP to the most immediately dominating IP. Why QR should be constrained in this way remains a mystery, given the standard assumption that QR is a type of A-bar movement; that it is so constrained, however, seems to be a fact.
7. This is not to say that configuration plays no role in determining possible scopal relations; rather, as observed by Farkas (1994), configuration underdetermines scope. Some type of configurational locality may be a necessary condition for an expression e_1 to be in the scope of an expression e_2 (i.e., for e_1 to be able to inherit an indexical value from e_2), but not a sufficient condition; Farkas 1994a suggests that command is the relation involved in licensing an indexical dependency (where α commands β iff the IP which most immediately dominates α also dominates β).
8. A similar analysis has been proposed by Enç (1986) for the temporal parameter, which determines the time at which the denotation of an expression must be determined.
9. I avoid here a discussion of the issue of accessibility: what conditions must obtain in order for the worlds introduced e_2 to be available as possible values for the *w*-index of e_1. As a working assumption, I will take the position that in order for the *w*-index of e_1 to inherit its value from the worlds introduced by e_2, the former must be contained in an argument of the latter, where "contained in" is reflexive (see Farkas 1993, 1994 for more detailed discussion of the issue of accessibility).
10. The lambda subscripts in these examples indicate that an expression introduces a set of worlds, and the subscript indices on other expressions indicate the world with respect to which the denotation of that expression is determined. This notation is used for convenience only; it has no theoretical status. As noted above (see the discussion of (42)), whether an index is bound or free is a function of the context in which it appears.
11. For simplicity, I avoid here the issue of how comparative deletion is resolved.
12. The semantics of "less" comparatives is identical to the semantics of "more" comparatives given in (48), with the exception of the ordering relation: $>_\gamma$ should be replaced with $<_\gamma$.

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