A Truth-Conditional Account of Free-Choice Disjunction

Graeme Forbes

1. CONJUNCTIVE FORCE AND COMPARATIVE ADJECTIVES

In many languages, some uses of disjunction, often surprisingly, result in sentences that have a reading equivalent to that of certain conjunctions: these sentences have *conjunctive force*. In such a case, the word for 'or' is sometimes said to express 'free choice' disjunction (this traces to the examples involving permission with respect to which the phenomenon was first studied; von Wright 1968, Kamp 1979). I say only that conjunctive force is 'often' surprising because in a few cases there is no surprise; these are cases where the equivalence to a conjunction is guaranteed by the semantics of (or classical inference rules for) disjunction, material implication and negation, as for instance in:

(1) a. $(P \vee Q) \rightarrow R \dashv\vDash (P \rightarrow R) \wedge (Q \rightarrow R)$

b. $\neg(P \vee Q) \dashv\vDash \neg P \wedge \neg Q$

where in (1a), '→' may be either material or (variably) strict implication.

As a consequence of the equivalences in (1), English sentences taken to have forms that are essentially the left-hand-side formulae in (1) should have conjunctive force, for example,

(2) a. If Mary got a D or an F she will be dropped from the course

b. Mary didn't get a D or an F.

The prediction of conjunctive force is correct, since the preferred reading of (2a) is equivalent to 'if Mary got a D she'll be dropped, and also if she got an F', while for (2b) it is 'Mary didn't get a D and didn't get an F'. Given the equivalences in (1), there is no real mystery here.

The cases of conjunctive force that are more mysterious are those in which it is not at all evident why the force is with them. Comparative adjectives are a well-known example: (3a) below, barring cues to the contrary, means (3b), not (3c); this requires explanation; and there is little agreement on what it should be.

(3) a. A is taller than B or C

b. A is taller than B and A is taller than C

c. A is taller than B or A is taller than C.

In fact, it would be best to say that (3a) is ambiguous between a reading equivalent to (3b) and a reading and equivalent to (3c) (the ambiguity is also present in parallel examples with 'less tall than' and 'as tall as', and can be brought out by partitive paraphrases: 'A is taller than either of B or C' versus 'A is taller than at least one of B or C'). The default reading of (3a) is equivalent to (3b), but some examples are understood as equivalent to (3c): they get a 'pure disjunction' reading. But talk of ambiguity does not mean we endorse a *lexical* ambiguity hypothesis for 'or'.[1] Rather, we will develop a structural account of the free-choice/pure disjunctive distinction, within the framework of type-logical grammar (TLG). The main problem is to explain how (3a) acquires a meaning equivalent to that of (3b); however, we begin with a discussion of the (3c)-reading.

1. I haven't heard of any language in which there are distinct words for free-choice and pure disjunction.

2. PURE DISJUNCTION AND ELLIPSIS

The contexts in which (3a) means (3c) rather than the default (3b) are sometimes ones where some sort of 'epistemic distancing' rider is appended, as in

(4) A is taller than B or C, but it's hard to tell which.

One can get the same effect non-epistemically, say by continuing (3a) with 'whoever is younger'. It is the *wh*-word that forces the reading (3c), for the pragmatic reason that its use conveys something that assertion of (3b) conflicts with: it conveys that the speaker is not committing herself to A being taller than both B and C.

But this pragmatic explanation of why the reading (3c) is selected by *wh*-riders is only part of the story. If we are not explaining the difference between "or"'s that do and "or"'s that don't generate conjunctive force in terms of lexical ambiguity, then selection is not selection between alternative lexical entries for 'or'. So what exactly is the compositionally derived meaning for (3a) that *wh*-riders select? Plausibly, a reading that involves ellipsis is selected. That is, on the pure disjunctive reading, (3a) is taken to be the result of a process in which certain material common to the two disjuncts of a more verbose version is restored to the second disjunct for the purposes of interpretation, or, as in TLG, (3a) is interpreted *as if* such material is present. The examples in (5) indicate the range of options, and for none of these examples is an interpretation with conjunctive force available:

(5) a. A is taller than B or [taller than] C

b. A is taller than B or [is taller than] C

c. A is taller than B or [A is taller than] C.

All three of these have the same semantics, namely

(6) **(or(taller(b)(a)))(taller(c)(a))**

and we can arrive at this in a TLG-derivation (see (7) below) that in effect treats (3a) as synonymous with (5c). So the whole story about how (3a) gets a pure disjunctive reading combines semantics and pragmatics: the derivation of the semantics in (6) for (3a) shows that a pure-disjunctive reading is possible, and the imperative to avoid interpreting the speaker to be expressing a proposition that conflicts with what a *wh*-rider conveys, creates the obligation to process (3a) in the way the derivation in (7) below displays.

In this derivation, we resolve the problem of the apparently non-Boolean coordination ⌜NP or NP⌝ by lifting the type of NP, normally *individual* (*i* for short), to that of a quantifier, ($i \mapsto$ *boolean*) $\mapsto$ *boolean*, or (*ib*)*b* for short, since we can explain disjunction of quantifiers ultimately in terms of sentential disjunction. This is not the only option; we could, for instance, treat 'B or C' as the boolean co-ordination 'B [is] or C [is]', but since it makes no difference to the ultimate theory, we will avoid positing more elided linguistic material than necessary. Also in (7), I follow (Morrill 1995) in assigning quantifiers the syntactic category (s↑np)↓s, which is the category of an expression which inserts into an s that has a gap for an np, i.e., s↑np, and produces an s (I suppress the complexities of Morrill's wrapping rules). I switch from prefix to infix **or** as convenient (**p or q** is officially **(or(q))(p)**); occasionally abbreviate (*ib*)*b* as *q*, (s↑np)↓s as q, np\s as vp, vp/np as r; and write $\mathbf{or}_\tau$ for the disjunction coordinator for type τ – so $\mathbf{or}_q$ (i.e., $\mathbf{or}_{(ib)b}$) is the disjunction coordinator for quantifiers, as in 'some man or every woman'. $\mathbf{or}_q$ is defined in terms of $\mathbf{or}_b$ in (8) below.

(7)

$$\frac{\text{C} \Rightarrow \mathbf{c};\ \text{np}}{\text{C} \Rightarrow \mathbf{\lambda P.P(c)};\ \text{q}}\ \text{Lift} \qquad \frac{\text{B} \Rightarrow \mathbf{b};\ \text{np}}{\text{B} \Rightarrow \mathbf{\lambda Q.Q(b)};\ \text{q}}\ \text{Lift}$$

$$\frac{\text{or} \Rightarrow \mathbf{or}_q;\ (\text{q}\backslash\text{q})/\text{q} \qquad \text{C} \Rightarrow \mathbf{\lambda P.P(c)};\ \text{q}}{\text{or}^\frown\text{C} \Rightarrow \mathbf{or}_q\mathbf{(\lambda P.P(c))};\ (\text{q}\backslash\text{q})}\ /\text{E}$$

$$\frac{\text{B} \Rightarrow \mathbf{\lambda Q.Q(b)};\ \text{q} \qquad \text{or}^\frown\text{C} \Rightarrow \mathbf{or}_q\mathbf{(\lambda P.P(c))};\ (\text{q}\backslash\text{q})}{\text{B}^\frown\text{or}^\frown\text{C} \Rightarrow \mathbf{(or_{(ib)b}(\lambda P.P(c)))(\lambda Q.Q(b))};\ (\text{s}\uparrow\text{np})\downarrow\text{s}}\ \backslash\text{E}$$

$$\frac{\text{B}^\frown\text{or}^\frown\text{C} \Rightarrow \mathbf{(or_{(ib)b}(\lambda P.P(c)))(\lambda Q.Q(b))};\ (\text{s}\uparrow\text{np})\downarrow\text{s}}{\text{B}^\frown\text{or}^\frown\text{C} \Rightarrow \mathbf{\lambda R^{ib}.((\lambda Q.Q(b))(R)\ or_b\ (\lambda P.P(c))(R))};\ (\text{s}\uparrow\text{np})\downarrow\text{s}}\ \text{Df}$$

$$\frac{\text{B}^\frown\text{or}^\frown\text{C} \Rightarrow \mathbf{\lambda R^{ib}.((\lambda Q.Q(b))(R)\ or_b\ (\lambda P.P(c))(R))};\ (\text{s}\uparrow\text{np})\downarrow\text{s}}{\text{B}^\frown\text{or}^\frown\text{C} \Rightarrow \mathbf{\lambda R.(R(b)\ or_b\ R(c))};\ (\text{s}\uparrow\text{np})\downarrow\text{s}}\ \beta$$

$$\frac{\text{is taller than} \Rightarrow \mathbf{taller};\ \text{r} \qquad \text{it} \Rightarrow \mathbf{x};\ \text{np}}{\text{is taller than}^\frown\text{it} \Rightarrow \mathbf{taller(x)};\ \text{vp}}\ /\text{E}$$

$$\frac{\text{A} \Rightarrow \mathbf{a};\ \text{np} \qquad \text{is taller than}^\frown\text{it} \Rightarrow \mathbf{taller(x)};\ \text{vp}}{\text{A}^\frown\text{is taller than}^\frown\text{it} \Rightarrow \mathbf{taller(x)(a)};\ \text{s}}\ \backslash\text{E}$$

$$\frac{\text{A}^\frown\text{is taller than}^\frown\text{it} \Rightarrow \mathbf{taller(x)(a)};\ \text{s}}{\text{A}^\frown\text{is taller than} \Rightarrow \mathbf{\lambda x.taller(x)(a)};\ \text{s}\uparrow\text{np}}\ \uparrow\text{I}$$

$$\frac{\text{A}^\frown\text{is taller than} \Rightarrow \mathbf{\lambda x.taller(x)(a)};\ \text{s}\uparrow\text{np} \qquad \text{B}^\frown\text{or}^\frown\text{C} \Rightarrow \mathbf{\lambda R.(R(b)\ or_b\ R(c))};\ (\text{s}\uparrow\text{np})\downarrow\text{s}}{\text{A}^\frown\text{is taller than}^\frown\text{B}^\frown\text{or}^\frown\text{C} \Rightarrow \mathbf{\lambda R.(R(b)\ or_b\ R(c))(\lambda x.taller(x)(a))};\ \text{s}}\ \downarrow\text{E}$$

$$\frac{\text{A}^\frown\text{is taller than}^\frown\text{B}^\frown\text{or}^\frown\text{C} \Rightarrow \mathbf{\lambda R.(R(b)\ or_b\ R(c))(\lambda x.taller(x)(a))};\ \text{s}}{\text{A}^\frown\text{is taller than}^\frown\text{B}^\frown\text{or}^\frown\text{C} \Rightarrow \mathbf{(\lambda x.taller(x)(a))(b)\ or_b\ (\lambda x.taller(x)(a))(c)};\ \text{s}}\ \beta$$

$$\frac{\text{A}^\frown\text{is taller than}^\frown\text{B}^\frown\text{or}^\frown\text{C} \Rightarrow \mathbf{(\lambda x.taller(x)(a))(b)\ or_b\ (\lambda x.taller(x)(a))(c)};\ \text{s}}{\text{A}^\frown\text{is taller than}^\frown\text{B}^\frown\text{or}^\frown\text{C} \Rightarrow \mathbf{taller(b)(a)\ or_b\ taller(c)(a)};\ \text{s}}\ \beta$$

The most important step here is the one on the right labelled Df, where we employ the standard account of $\mathbf{or}_{(ib)b}$ in terms of $\mathbf{or}_b$,

(8) $\mathcal{Q}\ \mathbf{or}_{(ib)b}\ \mathcal{Q}' \overset{\text{def}}{=} \mathbf{\lambda R}^{ib}\mathbf{.(}\mathcal{Q}\mathbf{(R)\ or}_b\ \mathcal{Q}'\mathbf{(R))}$

since it is the application of the function on the right to the meaning of the s↑np 'A is taller than' that distributes this meaning across the two disjuncts. As a result, we arrive at the semantics in (6) with little difficulty. So we turn now to the derivation of conjunctive-force readings.

3. THE FREE-CHOICE OPERATOR

Comparing the pure-disjunctive versions of (3a) in (5) with (3a) itself, it is tempting to adopt a scope hypothesis about the source of conjunctive force: the conjunctive force reading arises when *no* ellipsis is involved in producing the narrowest possible scope for 'or'. But the simplest version of this idea will lead to positing a lexical ambiguity, since if 'or' expresses a boolean disjunction, there is no way to contain its scope. The ⌜NP or NP⌝ disjunction exhibited in (3a) would have to involve a different 'or' subject to new principles, analogous to non-boolean (non-distributive) 'and'.

A better proposal is to treat all cases of free-choice disjunction on the model of the examples in (1). Besides having the virtue of unifying the semantics of the various types of example discussed in this paper, such an approach avoids a *pragmatic* account of why (3a) means (3b) by default. Other things equal, it is unlikely that some cases of free-choice disjunction are explicable semantically – this can hardly be denied for 'or' in the antecedents of material and strict conditionals, as (1a) shows, and so leaves little else to say about (2a)[2] – while for others, even other types of conditional, a pragmatic account of conjunctive force is the best that is available.[3]

Specifically, following (Makinson 1984), let us take (1a) as the paradigm. We will therefore assimilate all other cases where the presence of conjunctive force is surprising to that of a conditional with a disjunctive antecedent.[4] (I will return later to justifying my preference for (1a) over (1b).) As far as assimilating comparatives to (1a) is concerned, the main observation is that (3a), repeated here as (9a), is synonymous in its free-choice sense with (9b):

(9) a. A is taller than B or C

b. A is taller than {each thing/anything} identical to B or identical to C.[5]

2. I am assuming that (2a) *is* a material or strict conditional (whose implicit □ may be restricted). Franke (2012:12) develops a pragmatic theory of conjunctive force in the context of a blanket rejection of the material analysis of 'if…then…', but my point here only requires that (2a) have *some* reading with conjunctive force which can be understood as material or (variably) strict.

3. See (Loewer 1976) for a (the first?) pragmatic account of conjunctive force, for counterfactuals with disjunctive antecedents. For more discussion of pragmatic approaches, see (Forbes 2014).

4. I first argued for this approach in an unpublished note written in 2000, unaware that I was simply rediscovering Makinson's idea. In the present paper, I go beyond Makinson by applying the proposal to a wider range of cases (Makinson considers mainly existential modals), and situating it within a compositional semantics.

5. With 'each' explicit, we would normally say 'A is taller than each of B or C', so in effect the free-choice reading of (9a) is being explained in terms of the covert presence of 'each of'.

In (9b) the choice between 'each' and 'any' is underdetermined, but 'any' itself has a free-choice sense, and it is better not to rely on that in explaining free-choice 'or'.[6]

(9b) embeds the structure of the left-hand-side of (1a). So one way of accounting for the behavior of 'or' is to explain how we can get from 'B or C' to the disjunctive quantifier in (9b). 'B' and 'C' individually lift to **λP.P(b)** and **λP.P(c)**, and they are coextensive with **(each(λx.x=b))** and **(each(λx.x=c))** respectively; we simply have two expressions for the characteristic function of the set of B's properties, and two for C's. But in (9b) we have an expression whose meaning is the quantifier **(each(λx.x=b or**$_b$ **x=c))**, the characteristic function of the intersection of the sets of properties of B and C. This means that free-choice disjunction can be realized truth-conditionally in interpreting the likes of (3a) by allowing the introduction of a *free-choice operator*, roughly 'each identical to…or…', that manifests itself in various types.

That a special operator is introduced is supported by the fact that free-choice 'or' is often indicated by special stress, which we write as 'OR' ('or' pronounced with what Jennings (1994: 128) calls a 'good intonational thump'), and that special stress is frequently associated with specific semantic effects *via* focus. For example, we can say 'everyone *doesn't* smoke' to express 'not everyone smokes', and can express 'everyone is unloved' with one intonational contour of 'no-one loves *everyone*'. Stress can also be used to focus the intended input to a function: contrast 'John only introduced *Sue* to Bill', for which we have, at least as a first approximation, **(only(sue))λx.intro(bill)(x)(john)**, with 'John only introduced Sue to *Bill*', for which we have, ditto, **(only(bill))λx.intro(x)(sue)(john)**.[7] Closer to home, if we begin with a disjunction that does not have conjunctive force, such as

(10) A taught B or C

6. Clearly, though, it would be good to have a theory that accounts for free-choice 'any' and free choice 'or' in the same way. See (Aloni 2007) for a theory which does this.

7. This style of example is due to Jackendoff (1972).

and negate it, the result is ambiguous between a de Morgan reading (cf. (2b)) and a disjunctive reading, an ambiguity which can be resolved with 'OR' one way and a *wh*-rider the other way:

(11) a. A didn't teach B OR C (= A taught neither)

b. A didn't teach B or C, whichever dropped out (= A didn't teach B or A didn't teach C).

So we might find in 'B OR C' an indication that **λx.x=b** $\mathbf{or}_b$ **x=c** is to be a constituent of the meaning and the input to **each** in the semantics of (9a).[8]

This resurrects a scope hypothesis about the free choice/pure disjunction contrast, for if we are associating **(each(λx.x=b** $\mathbf{or}_b$ **x=c))** with the free-choice reading of (3a), it is tempting to suppose that the pure disjunctive reading is to be associated with **(each(λx.x=b))** $\mathbf{or}_{(ib)b}$ **(each(λx.x=c))**, the characteristic function of the *union* of the properties of B and C. Then the contrasting readings have the semantics

(12) a. **(each(λx.x=b** $\mathbf{or}_b$ **x=c))(λy.a is taller than y)**

b. **((each(λx.x=b))** $\mathbf{or}_{(ib)b}$ **(each(λx.x=c)))(λy.a is taller than y).**

Since (12b) reduces to the semantics derived in (7), this is not really a different way of capturing the contrast between the two readings, but it's worth noting how difficult it is to compel an English sentence to have the semantics in (12b) directly. In particular, the obvious candidate,

(13) A is taller than each thing identical to B or each thing identical to C

8. Of course, intonational thumping cannot compel conjunctive force (see (10)) but it does appear to promote the conjunctive readng whenever it is available.

can easily be made to bear the interpretation (12a) by pronouncing 'or' as 'OR'. This will introduce a free-choice operator for quantifiers, represented on the current approach by the rather convoluted

(14) $$\mathbf{each}(\lambda \mathcal{Q}^{(ib)b}.\mathcal{Q} = (\mathbf{each}(\lambda x.x{=}b))\ \mathbf{or}_b\ \mathcal{Q} = (\mathbf{each}(\lambda x.x{=}c)))(\lambda \mathcal{Q}'.\mathcal{Q}'(\lambda y.\mathbf{taller}(y)(a)))$$

In view of this, it doesn't seem that a straightforward scope ambiguity in the English underlies the free-choice/pure disjunction distinction. Rather, conjunctive force is to be explained by the presence of a free-choice operator, frequently manifested by intonation, while pure disjunctive readings involve ellipsis and get their semantics as illustrated in (7).

The effect of the OR in 'B OR C' is shown in the following derivation of a conjunctive-force semantics for (3a). In this derivation, subscript Δ means 'by steps from a previous example' or 'by obvious steps', and italics are used for unpronounced material:

(15)

it is identical to $\Rightarrow_\Delta$ $\lambda y.x = y$; $(s{\uparrow}np)$ B⌢OR⌢C $\Rightarrow_\Delta$ $\lambda R^{ib}.((\lambda P.P(b))(R)\ \mathbf{or}_b\ (\lambda Q.Q(c))(R))$; $(s{\uparrow}np){\downarrow}s$

— ↓E

it is identical to⌢B⌢OR⌢C $\Rightarrow$ $\lambda R^{ib}.((\lambda P.P(b))(R)\ \mathbf{or}_b\ (\lambda Q.Q(c))(R))(\lambda y.x = y)$; s

— β, β

it is identical to⌢B⌢OR⌢C $\Rightarrow_\Delta$ $x = b\ \mathbf{or}_b\ x = c$; s

— ↑I

each $\Rightarrow$ **each**; $q/(s{\uparrow}np)$ *identical to*⌢B⌢OR⌢C $\Rightarrow$ $\lambda x.x = b\ \mathbf{or}_b\ x = c$; $s{\uparrow}np$

— /E

A⌢is taller than $\Rightarrow_\Delta$ $\lambda y.\mathbf{taller}(y)(a)$; $s{\uparrow}np$ *each*⌢*identical to*⌢B⌢OR⌢C $\Rightarrow$ $\mathbf{each}(\lambda x.x = b\ \mathbf{or}_b\ x = c)$; $(s{\uparrow}np){\downarrow}s$

— ↓E

A⌢is taller than⌢*each*⌢*identical to*⌢B⌢OR⌢C $\Rightarrow$ $(\mathbf{each}(\lambda x.x = b\ \mathbf{or}_b\ x = c))\lambda y.\mathbf{taller}(y)(a)$; s

The meaning of 'B OR C' here is no different from that of 'B or C' in (7), so there is no lexical ambiguity in 'or'. The role of 'OR' (the role of intonational thumping) is to introduce the free-choice operator expressed by '*each identical to*' and provide it with its input. The derivation assigns a semantics to (3a) that by (1a) is equivalent to the semantics for (3b).

Our approach leads to correct meaning-attributions to examples of free-choice 'or' with negation:

(16) a. A isn't taller than B or C.

b. **(each(λx.x=b or$_b$ x=c))λy.not(taller(y)(a)).**

The existence of the free-choice operator we have postulated is confirmed by (16a), which may be understood purely disjunctively (see note 9), but also, certainly when 'or' is 'OR', with conjunctive force ('is taller than neither'). The conjunctive force reading, which has the semantics in (16b), is obtained as in (15), only with

A is not taller than ⇒ **λy.not(taller(y)(a))**; s↑np

derived on the left at the penultimate line.[9]

We can also easily accommodate conjunctive force in other positions, for instance

(17) a. A OR B is taller than C

b. **(each(λx.x=a or$_b$ x=b))λy.taller(c)(y)**

c. A OR B is taller than C OR D

d. **(each(λx.x=a or$_b$ x=b))λy.(each(λz.z=c or$_b$ z=d))λw.taller(w)(y).**

The derivation in (15) is easily adapted to provide (17a) with the semantics in (17b), and (17c) the semantics in (17d). These cases also provide a justification for preferring the pattern of the left-hand-side of (1a), $(P \vee Q) \rightarrow R$, to that of (1b), $\neg(P \vee Q)$, as the basis of a general explanation of conjunctive force, namely, that $\neg(P \vee Q)$ would require negation-insertion in

9. One argument for a pragmatic account of free-choice disjunction is that if conjunctive force is encoded in truth-conditions, we would expect negations like (16a) to have a rather weak meaning as default (see Fox 2007: 81–3 for discussion and references). In fact, a weak, i.e., pure disjunctive, reading for (16a), 'isn't taller than B or isn't taller than C', can be forced by a *wh*-rider (just as with (11b)), but if the positive form has the semantics **each identical to…is…**, it's hardly surprising that the normal negation (16a) is **each identical to…isn't…** (to my ear, English with an explicitly wide-scope negation, 'it is not that case that A is taller than B or C', does admit the weak reading, though it's not the default, perhaps because it's less informative). Note that the weak reading shouldn't be given the wide-scope negation of (12a) as its semantics, since if the pure disjunctive reading is *intended* there would be no reason for the free-choice operator to be present in the first place. Rather, the disjunctive reading is obtained as in (7), only with **λy.not(taller(y)(a))**.

both subject and object positions. Actually, some treatments of comparatives, such as that in (Carpenter 1997:263–81), provide a standing negative context for the object term, whether or not the term is disjunctive, but there seems to be no prospect of doing the same for the position of the subject term in the semantics of 'A is taller than B'.[10] Nor is it plausible that the intonational effect of 'OR' is to insert a negation, since (17c) would require a double insertion, and it's hard to see how (17c)'s positive content could then be captured without baroque complexity.

The free-choice operator analysis is also adequate for examples with quantified NP's in place of singular ones:

(18) {Someone/everyone} in the room is taller than B OR C.

In (18) there may be a scope-ambiguity, in one case superficially between 'someone in the room' and 'OR', more fundamentally between the quantifier and the free-choice operator. Then the two readings would be

(19) a. **(some(in(the room)))λx.(each(λy.y=b** $\mathbf{or}_b$ **y=c))λz.taller(z)(x)**

b. **(each(λy.y=b** $\mathbf{or}_b$ **y=c))λz.(some(in(the room)))λx.taller(z)(x)**

10. Carpenter's analysis is based on a primitive **height**, which assigns individuals a numerical height. The predicate **tall** is a relation between individuals and heights, meaning that *x* has a height of at least amount *m*. A bare comparative such as 'taller' is taken to be the existentially quantified case of '*n* units taller', and the analysis of 'A is taller than B' is that for some non-zero amount of height *m*, A is tall by an amount greater than *m* and B is not tall even by amount *m* (Carpenter 1997: 274–5). The second conjunct suggests an explanation of conjunctive force in 'A is taller than B or C' based on the de Morgan distribution in (1b), but examples like those in (17) would be left unaccounted for. The accounts in (Klein 1980, Larson 1988) also, so far as I can tell, have problems with the cases in (17). These cases are still problematic if we say that 'A is taller than B or C' means that A is tall to some degree greater than any to which B or C is tall, which doesn't generalize straightforwardly to (17a). Worse, although we can paraphrase the conjunctive reading of 'A is slightly taller than B OR C' as 'A is tall to some degree slightly greater than any to which B OR C is tall', using degrees to explain 'OR' seems to lead only to "A's height is slightly greater than the *maximum* of B's and C's", which allows A to be enormously taller than one of B or C, and is therefore incorrect. We can produce correct 'degree'-paraphrases in a piecemeal way, but it's not obvious how to get compositional assignment of truth-conditions that works across the language.

though (19a) is much preferred, to my ear.[11]

In view of the relationship between ∃ and ∨, one might expect to have both free choice and pure disjunctive readings for

(20) A is taller than someone in the room.

But only the disjunctive, 'at least one', reading is possible: given that B and C are exactly those in the room, (20) is equivalent to (3c) and has no reading equivalent to (3b). That is, there is no reading "for each x such that there is someone y in the room such that $x = y$, A is taller than x".

There are also combinations of quantifiers and negation to be considered. Negative quantifiers provide perhaps the most contentious case, for example,

(21) No-one in the room is taller than B or C.

One might expect the semantics of (21) to be just the external negation of (19a), assuming that **no…** is **not(some…)**. This produces a semantics that is apt for the explicitly wide-scope English 'it is not the case that…', with the resulting meaning that each person in the room fails to exceed the height of at least one of B and C. And I think this meaning can also be attached to (21). There also needs to be a semantics for the pure disjunctive reading obtained by a 'wh'-rider. If I can't remember *who* it is that no-one is taller than, I'm saying that no-one is taller than B or no-one is taller than C, which isn't logically equivalent to 'each person in the room fails to exceed the height of at least one of B and C'. But given the necessary linear ordering of heights, the two conditions are necessarily equivalent.

There is, in addition, a conjunctive force reading, 'no-one is taller than B and no-one is taller than C'. If this is obtained using a free-choice operator, **each** will have to have **no** with-

11. For the pure disjunctive readings of the two cases in (18), add a *wh*-rider and change 'OR' to 'or'.

in its scope – the other way round means that no-one in the room is taller than both, which is the external negation of (19a) again. This switching of the quantifier order of (19a) might be a worry, but it's independently unlikely that the free-choice operator is responsible for the conjunctive force in what's plausibly the most natural reading of (21). The conjunctive force is simply a de Morgan effect, in the same way as conjunctive force in (2b) is.[12]

Finally, I should empasize that all I have argued to this point is that all cases of comparative constructions where conjunctive force is present can be reduced to a single, well-understood, paradigm, that of a conditional with a disjunctive antecedent. *Why* exactly these cases manifest conjunctive force, while other somewhat similar sentences do not (see (10)), has not been explained, and I will not be attempting such an explanation here. The explanation might involve special semantic structure in comparatives, with, say, a *more than* operator which is in some way existential, thus linking up with the 'existential modals' to be discussed in §5. Alternatively, it may be that free-choice 'or' exists to avoid an ambiguity that use of 'and' would produce, between individual versus collective readings. There's no such ambiguity in the 'and'-variant of (10), but an example like 'A is heavier than B and C' could easily be taken to mean that A's weight exceeds the *combined* weights of B and C. A similar ambiguity is also present with existential modals.

4. Larson's Puzzle

Larson (1988:13) notes a puzzle about temporal comparatives such as the prepositions or subordinating conjunctions 'before' and 'after'. Comparing

12. Geurts (2005:398) reports an experiment by Johnson-Laird and Savary in which subjects were presented with a disjunction of conditionals of the form $(A \rightarrow B) \vee (\neg A \rightarrow B)$ and asked what follows if A is given. Almost all respondents replied that B follows, which Johnson-Laird and Savary regarded as a fallacy. Geurts suggests instead that the subjects might simply have been interpreting the disjunction as having conjunctive force, which is very plausible, especially given that the antecedents seem to be trying to cover all the options ('he's asleep in his office if he's on campus or asleep at home if he's not on campus'). The Makinson-style analysis of this case would be 'for each proposition *p* identical to A or identical to $\neg$A, if *p* then B'.

(22) a. A arrived before B or C

b. A arrived after B or C

an asymmetry emerges, according to Larson: there is a dominant free-choice reading of (22a), but none at all for (22b).[13] Why is there such a contrast involving expressions for converse relations on times or events ('before'/'after'), and why doesn't focusing 'or' in (22b) produce an 'arrived after both' reading? Since one might anticipate a parallel between 'before/after' and the comparative adjectives 'earlier/later', because the two pairs of expressions seem to pick out the same pair of converse relations, it's natural to ask if our account of conjunctive force with comparative adjectives helps us resolve the puzzle in (22).

One suggestion is that the existence of a conjunctive force reading of (22a) and the non-existence of one for (22b) is to be expected just on the basis of the lexical meanings of 'before' and 'after'. Treating them as sentential operators, the homophonic equivalences

(23) *S before/after S′* is true iff *S* is true before/after *S′* is true

look reasonable. But then (22a) requires that A arrived before the disjunction 'B arrives or C arrives' became true, which requires that A arrived before 'B arrives' became true, and A arrived before 'C arrives' became true. Thus (22a) says A's arrival preceded *both* B's and C's. However, (22b) says, in these terms, that A arrived after the disjunction 'B arrives or C arrives' became true. So A is only required to arrive after at least one disjunct becomes true, and hence could arrive after B but before C, or vice-versa. If this is right, (22a) is like (2a), in that (22a)'s conjunctive force is generated by the interaction of the lexical meaning of 'before' with inclusive disjunction, just as conjunctive force in (2a) is a product of the lexical meanings of the conditional and negation in combination with disjunction. There would

13. This is one of a number of judgements in this section that I checked with informants. This one was supported 9-0.

then be no reason to suppose that (22a) gets its conjunctive force from the covert presence of a free-choice operator, any more than such a supposition is required for sentences whose logical forms are the left formulae in (1). That the free-choice operator isn't in play with 'before' is borne out by the fact that there is no conjunctive force when 'or' is in the subject; for example, 'A or B arrived before C' contrasts with (17a).[14]

However, this idea, and the principle (23) it is based on, don't seem to be correct. If (23) is endorsed, it is hard to see how we could resist

(24) *S shortly before S′* is true iff *S* is true shortly before *S′* is true.

But this is incorrect, for if A arrived shortly before B OR C arrived, then A arrived shortly before each of them. But once the first of the two arrives, say B, the disjunction becomes true, so (24) would have it that it does not matter how much time elapses before C arrives; thus A may arrive *long* before C arrives, and it would still be that A arrived *shortly* before B OR C arrived.[15]

So conjunctive force in (22a) is instead a candidate for explanation in terms of permissible use of the free-choice operator: the reading 'for each of B or C, A arrived before that person' is allowed. But this makes the absence of conjunctive force in 'A OR B arrived before C' especially perplexing. (22b) raises further questions if no amount of intonational thumping can give it conjunctive force.[16] For then 'earlier'/'later' fails to pattern with 'before'/'after'. In particular, the examples in (25),

14. My informants agreed with this, 9-0.

15. See also the discussion of 'slightly taller than' in n. 10. I was helped to see this problem with (23) by a counterexample to an 'at the same time as' version of it due to Ivano Ciardelli (p.c.): 'A arrived at the same time as B or C' is true if B arrived before C and A arrived when C did. But by then, the disjunction may have been true for some time, so it's incorrect that *p at the same time as q* is true iff *p* is (becomes) true at the same time as *q* becomes true. Perhaps this only shows that 'A arrived at the same time as B or C' can be understood as 'A arrived at the same time as B or at the same time as C', but then where is the missing reading with narrow-scope 'or'?

16. My informants split 7-2 on this, one of the two finding a conjunctive reading to be available when 'either' is prefixed.

(25) a. A arrived after B OR C

b. A arrived later than B OR C

offer a contrast, for while (25b) certainly has a reading with conjunctive force, (25a) does not, it seems to me.[17] The original thought, that an account of conjunctive force with comparative constructions would straighforwardly extend to 'before/after', was evidently far too optimistic.[18]

5. ZIMMERMAN'S ANALYSIS OF MODALS

Conjunctive force is commonly found in disjunctions within the scope of existential modals, as the following examples show:

(26) a. Socrates could have been a lawyer OR a banker (metaphysical 'could')

b. If Socrates had been a lawyer OR a banker, he would have lived longer

c. Socrates might speak in Doric OR Ionic (epistemic 'might', it's unpredictable)[19]

d. Socrates may speak in Doric, Attic OR Ionic (the permitted conference dialects).[20]

17. Here I am in agreement with (Geis 1970). However, one of my informants reported that he got an 'after B and after C' reading for (25a) by inserting 'either'. Evidently, it would be unwise to let important parts of a theory depend on how these cases are settled.

18. Larson observes (*op. cit.*, 12–13) that complement position of 'before' is an environment that permits negative polarity items, while the complement position of 'after' is not (perhaps '*p* before *q*' means 'when *p* becomes true, *q* is not yet true', while '*p* after *q*' means 'when *p* becomes true, *q* has already been true'). The same could be said of comparatives ('A is taller than C will ever be'). However, it doesn't seem that every free-choice disjunction is an NPI, since this wouldn't account for the examples in (17), or those in (26) other than (26b) (although counterfactuals are not downward-entailing in the antecedent – consider any counterexample to antecedent-strengthening – they do allow such NPI's as 'ever' and existential 'any' in their antecedents). And it's rather unattractive to offer a completely non-uniform account of conjunctive force.

19. "It's unpredictable (which)" doesn't force a pure disjunction reading, despite having the appearance of a *wh*-rider. The 'which' refers to the languages or the activities, not the epistemic possibilities; see further (Zimmerman 2000:259). Contrast (26d) – if we append "it's still to be decided which" we mean it's still to be decided which is to be *allowed*.

20. These examples all have a single protagonist ('topic'), Socrates. But that isn't necessary: 'Socrates could have been a lawyer OR Plato a banker' also has conjunctive force.

All these examples are interpreted by default as having conjunctive force; for example, (26a) standardly means that he could have been a lawyer *and* could have been a banker, and (26d) that speaking in Doric is permitted, and speaking in Attic is permitted, and speaking in Ionic is permitted. The conjunctive force in (26b), that being a lawyer would have let him live longer *and* so would being a banker, is not expected in Lewis-Stalnaker semantics: (26b) may be true for the reason that some world where (i) the antecedent *d* is true because Socrates is a lawyer, and (ii) Socrates lives longer, is closer than any world where *d* is true and he doesn't live longer; but if we suppose that it would have been much easier for him to be a lawyer than a banker, and that the Athenians had no particular problem with lawyers but were even more hostile to bankers than to subversive philosophers, then it's false that if Socrates had been a banker he would have lived longer. Nevertheless, the intuition that there is conjunctive force in (26b) is as strong as for (2a).[21]

The conjunctive force of the examples in (26) is easily explained by the hypothesis that in their default interpretations, a free-choice operator is present. For instance, (26a) may be glossed as in (27):

(27) For each property P that is either the property of being a lawyer or the property of being a banker, $\Diamond P$(Socrates).

So our approach to free-choice disjunction applies just as straightforwardly to existential modals as to comparatives.

But there are many other accounts of the modal cases. Some are pragmatic, which I discuss in (Forbes 2014). Among the semantic theories rival to Makinson's are those of Barker

21. Counterfactuals could be argued to be a special case, their conjunctive force deriving directly from their semantics. This would be so if we give them a *cotenability* semantics (Goodman 1947): $p \mathrel{\Box\!\!\rightarrow} q$ is true iff q is a consequence of p together with those actual truths which are *cotenable* with p. In the case where p is a disjunction, this requires that q follow from *each* disjunct. For more recent work in this vein, see (Kratzer 1981; Kaufman 2013). One catch is that there are cases where there seems to be no conjunctive force: 'if I were to vote for the Democrat or the Republican, I'd vote for the Republican' (see McKay and van Inwagen 1977:354–5). But the corresponding indicative conditional is similar.

(2010), Fox (2007), Simons (2005), and Zimmerman (2000). The last will be my focus at this point. The core idea of Zimmerman's radical proposal is that natural language expressions such as 'or' that are commonly taken to express the logician's inclusive (or even exclusive) disjunction truth-function, in fact do no such thing. Rather, natural-language "disjunctions" have the semantic structure of a *conjunction of epistemic possibilities*. For example, 'Holmes is in London or (Holmes is in) Paris' has the semantics '⟐L ∧ ⟐P', where '⟐' expresses epistemic possibility. So there is no mystery about the source of conjunctive force: conjunction is actually in the semantics.

One concern I have about this is whether the introduction of epistemic possibility is appropriate for non-modal cases. In an example like (9a), 'A is taller than B or C', the conjuncts are not qualified by a weakening possibility operator, epistemic or otherwise. Zimmerman has various ways of collapsing iterated modalities to a single modality (284–6), but there does not seem to be any way of eliminating modalities entirely (the same difficulty arises for the development of Zimmerman's account in Geurts 2005).[22] There is also a question about the particular case of metaphysical possibility, as in (26a). The prefix '⟐◇' cannot be reduced to '◇', because it is epistemically possible that Goldbach's Conjecture is metaphysically possible *and* epistemically possible that it is metaphysically impossible (consider also any proposition of whose metaphysical impossibility we've only recently been persuaded). And even if we liberalize the modality which appears in the conjuncts *via* the semantics of 'or', as Geurts recommends (2005:391), and allow '◇' for (26a), we would still be faced with the conjunction '◇◇L ∧ ◇◇B'. To get to the desired '◇L ∧ ◇B' we need a transitivity principle for relative metaphysical possibility. But transitivity is precisely the structural constraint on relative metaphysical possibility that is most controversial, and it would be a drawback to Zimmerman's semantics if it had to take sides in this dispute.[23]

22. See note 10 against *sui generis* semantics for comparatives, which would make this objection irrelevant.

23. The *locus classicus* of the case against transitivity is (Salmon 1989). See also (Peacocke 1999:196).

A second difficulty concerns inferences which the proposal seems to misrepresent, or even fail to account for entirely. Consider

(28) If Holmes is in Berlin or Paris, Watson won't find him. (We have just discovered that) Holmes is in Paris. So Watson won't find him.

It is hard to shake the impression that this inference is valid, and that the reasoning underlying this impression consists in an application of $\vee$I (perhaps after factive detachment) on the second premise to get the antecedent of the first, followed by $\rightarrow$E (*modus ponens*). But on Zimmerman's analysis, $\vee$I is irrelevant, since the conditional premise has the form '$(\Diamond_e B \wedge \Diamond_e P) \rightarrow \neg F$'.[24] And while the second premise, in its '$\Box_e P$' version, might be held to justify '$\Diamond_e P$', '$\Diamond_e B$' appears to be unobtainable (granted '$\Box_e$[no-one is in Paris and Berlin simultaneously]', '$\Box_e P$' leads instead to '$\neg\Diamond_e B$', so "Watson won't find him" can't be inferred). And we cannot get round this by appealing to (1a), since the epistemic conjunction variant of (1a) fails left-to-right.[25]

Nor is the problem restricted to negative contexts such as a conditional's antecedent, for an inference like "Holmes is in either Berlin or Paris; he can't be in Berlin; so he's in Paris" appears to be misrepresented in fundamentally the same way. 'Holmes is in either Berlin or

24. Zimmerman has his doubts about $\vee$I, citing 'if 2 is prime then 2 is odd or prime' as a classical validity that misrepresents the ordinary meaning of 'or' (2000:274, n.29). But while it's clear that an isolated use of $\vee$I that produces a conclusion weakened by disjoining an obviously false disjunct would produce considerable puzzlement in an audience, a use of $\vee$I embedded in a piece of reasoning where the point is apparent and the outcome is an extension of our knowledge (as in (28)), is perfectly acceptable.

25. In fact, Zimmerman offers a semantics for 'if…then…' on which the English 'if *p* then *r* and if *q* then *r*' entails 'if *p* or *q* then *r*', but not vice versa. His counterexample is: 'if Mr. X is in either Regents Park or Bloomsbury, we may as well give up' (275, (41)). The point is that if X might genuinely be in either place, the pursuers, with their limited manpower and time, have only a low chance of catching him (which doesn't mean that if X is in Regent's Park, they have only a low chance of catching him). The example is interesting, but I draw a different moral, which is that "either Regent's Park or Bloomsbury" functions here as a term for the mereological aggregate of the two, so we are saying, in effect, that (even) if X can be anywhere in *r*, it's likely he'll be found, but if X can be anywhere in $r \sqcup r'$ it's unlikely he'll be found. The particular semantics for 'if…then…' Zimmerman endorses to get his result also seems to me to be unattractive: it is that 'if *p* then *q*' is true iff *q* is true at every world where our actual knowledge expands to include *p* (*loc. cit.*). Consequently, 'if *p* then *q*' is true not merely if *p* is impossible, but if *p* is possible but can't be known, e.g., 'there are no sentient beings'.

Paris' is '$\diamondsuit$B ∧ $\diamondsuit$P', and "he can't be in Berlin" is '¬$\diamondsuit$B', so the premises are contradictory and entail anything. This is clearly the wrong verdict on a simple disjunctive syllogism, but it is not easily withdrawn. For example, if we say that the worlds taken to be epistemically possible in the first premise are not the same as those for the second premise, then the argument becomes some kind of fallacy of equivocation, which is implausible.

My conclusion, therefore, is that Zimmerman's semantics is *too* radical. Much of the logic of disjunction (the logic of '∨') fits our intuitions about natural-language reasoning very well, and to have to give it up just to accommodate conjunctive force is a high price to pay.

6. INTENSIONAL TRANSITIVES

Some transitive psychological verbs pattern with modals:

(29) a. Socrates will enjoy law OR finance

b. Socrates used to believe you OR me

c. Socrates prefers philosophy to law OR finance.

(29a), for example, means 'Socrates will enjoy law and he will enjoy finance'. The same conjunctive meaning seems to attach to 'Socrates will enjoy law OR he will enjoy finance'. On the other hand, if we widen the scope of 'OR' in (29c) to 'Socrates prefers philosophy to law OR he prefers it to finance', the result only has a pure disjunctive reading.

So the examples in (29), even the intensional transitive example (29c), do not raise any new issues. However, with other intensional transitives, specifically verbs of absence, there is a further complication. There is conjunctive force in all the following examples (Socrates looks out the window and sees the weather deteriorating):

(30) Socrates {wants/needs/is looking for} an umbrella or a raincoat

where the indefinites are understood in Quine's *notional* sense (1956:185). Note that none of 'Socrates {wants/needs/is looking for} an umbrella' implies its disjunctive counterpart in (30): some sort of conjunctive force is present in the latter. Yet there is no simple distribution that articulates it. For example, we are not saying that Socrates wants an umbrella *and* wants a raincoat: given an umbrella, a raincoat would probably be unnecessary, and vice-versa. Rather, the meaning is, very roughly, that getting an umbrella satisfies his desire, *and* getting a raincoat satisfies it.

But there are some twists. We require some sort of *sufficient* condition for desire-satisfaction to be involved, since a necessary condition by itself only captures what Zimmerman calls exhaustivity (Zimmerman 2000:261): these are all the ways for the desire to be satisfied. On the other hand, not just *any* umbrella, or *any* raincoat, will satisfy Socrates' desire: an umbrella that can't be opened, or a raincoat full of holes, would not do it. This shows that *counterfactual* sufficiency is not what is meant either, since the actual world may be such that, were he to get an umbrella, it would be one that couldn't be opened. What we appear to be saying in (30) is that *in certain circumstances*, getting an umbrella will bring about satisfaction of Socrates' desire, and getting a raincoat will do so too. We need modal operators restricted to worlds where either he doesn't get an umbrella or raincoat, or he gets a properly functioning one, and his desire is satisfied *as a result*. Similar truth-conditions apply to 'need' and 'seek'. With 'need', the formulation would be in terms of Socrates' needs and the gettings by which they are *met*, and with 'seek', in terms of his searches and the findings with which they *successfully culminate*.

That is much to extract from the words that occur in (30). However, event semantics provides a model of how the two levels of complexity can be related. Following (Parsons 1990) we can distinguish *atomic* semantic representations, a level at which a transitive verb is just a binary relation, and *subatomic* semantic representations, a level at which the verb is broken up into a conjunction of a state or event predicate and binary relations involving states or events. At the atomic level, the 'wants' version of (30) is just

(31) **wants(an umbrella or$_q$ a raincoat)(socrates)**

where **or**$_q$ is a generalized-quantifier co-ordinator. But at the subatomic level there is a postulate governing **wants** that ties it to a specific subatomic semantics:

(32) $\lambda\mathcal{Q}^{(ib)b}.\lambda x.\text{wants}(\mathcal{Q})(x) \stackrel{\text{def}}{=} \lambda\mathcal{Q}.\lambda x.\lambda e.\text{want}(e) \text{ and experiencer}(e)(x) \text{ and } \Box(\mathcal{Q}\lambda y.\text{gets}(y)(x) \rightarrow \text{consequently}(\text{satisfied}(e)))$

where the necessity is restricted to a class of worlds *C* determined by context, which in our example would be worlds where Socrates doesn't get broken umbrellas, torn raincoats, and so on.[26] The subatomic version of (31) is then:

(33) $\text{some}(\lambda e.\text{want}(e) \text{ and experiencer}(e)(\text{socrates}) \text{ and } \Box[(\text{each}(\lambda\mathcal{Q}.(\mathcal{Q} = \text{an}(\text{umbrella}) \text{ or } \mathcal{Q} = \text{a}(\text{raincoat})))) \lambda\mathcal{Q}'.\mathcal{Q}'(\lambda y.\text{gets}(y)(\text{socrates})) \rightarrow \text{consequently}(\text{satisfied}(e))].$

The outcome is that the conjunctive force is explained by the free-choice operator emerging in the meaning-postulate for 'want': a certain property instantiates *each* property of properties. Clearly, there is a great deal more to be said, but in this approach to (33) I believe we have the beginnings of an explanation of the difference between the examples in (29) and (30): all semantics is event semantics, but only verbs of absence have postulates analytically relating states to conditions of their dissolution and events to conditions of their ter-

26. I am relying on the 'consequently' to deal with certain problem cases. Suppose ϕ expresses some condition that holds in all worlds in *C*. Then without 'consequently', 'Socrates wants an umbrella' would entail 'Socrates wants an umbrella and ϕ to obtain'. But his actual desire wouldn't be satisfied *as a consequence* of getting an umbrella and the holding of ϕ, for only getting the umbrella would play the right sort of role in the process resulting in desire-satisfaction. This, combined with the restriction on $\Box$, is intended to avoid some of the difficulties about sufficient conditions I wrestled with not entirely successfully in (Forbes 2006:94–117).

mination.[27]

Department of Philosophy
University of Colorado, Boulder, CO, USA
graeme.forbes@colorado.edu

27. I thank Daniel Büring, Kit Fine, Michael Glanzberg, Magda Kaufman, Stefan Kaufman, Friederike Moltmann, Benjamin Spector and Ede Zimmerman for comments and discussion which helped improve this paper through various drafts. I have especially benefited from comments on the penultimate draft by Ivano Ciardelli, Jeroen Groenendijk and Floris Roelofsen.

BIBLIOGRAPHY

Aloni, Maria. 2007. Free Choice, Modals and Imperatives. *Natural Language Semantics* 15:65–94.

Barker, Chris. 2010. Free Choice Permission as Resource-Sensitive Reasoning. *Semantics and Pragmatics* 3:1–38.

Carpenter, Bob. 1997. *Type-Logical Semantics*. The MIT Press.

Forbes, Graeme. 2006. *Attitude Problems*. Oxford University Press.

Forbes, Graeme. 2014. The Detachability Problem for Gricean Accounts of Free-Choice 'or'. In preparation.

Fox, Danny. 2007. Free Choice and the Theory of Scalar Implicatures. In *Presupposition and Implicature in Compositional Semantics*, edited by U. Sauerland and P. Stateva. Palgrave Macmillan.

Franke, Michael. 2011. Quantity Implicatures, Exhaustive Interpretation, and Rational Conversation. *Semantics and Pragmatics* 4:1–82.

Geis, Michael. 1970. Time Prepositions as Underlying Verbs. In *Papers from the Sixth Regional Meeting: Chicago Linguistics Society*, edited by M. Campbell. University of Chicago.

Geurts, Bart. 2005. Entertaining Alternatives: Disjunctions as Modals. *Natural Language Semantics* 13:383–410.

Goodman, Nelson. 1947. The Problem of Counterfactual Conditionals. *The Journal of Philosophy* 44:113–128.

Jackendoff, Ray. 1972. *Semantic Interpretation in Generative Grammar*. The MIT Press.

Jennings, R. E. 1994. *The Genealogy of Disjunction*. Oxford University Press.

Kamp, Hans. 1979. Semantics versus Pragmatics. In *Formal Semantics and Pragmatics for Natural Language*, edited by F. Guenthner and S. Schmidt. D. Reidel.

Kaufman, Stefan. 2013. Causal Premise Semantics. *Cognitive Science* 37:1136–1170.

Klein, Ewan. 1980. A Semantics for Positive and Comparative Adjectives. *Linguistics and Philosophy* 4:1–45.

Kratzer, Angelika. 1981. Partition and Revision: The Semantics of Counterfactuals. *The Journal of Philosophical Logic* 10:201–216.

Larson, Richard. 1988. Scope and Comparatives. *Linguistics and Philosophy* 11:1–26.

Loewer, Barry. 1976. Counterfactuals with Disjunctive Antecedents. *The Journal of Philosophy* 73:531–537.

Makinson, David. 1984. Stenius' Approach to Disjunctive Permission. *Theoria* 50:138–147.

McKay, T. J., and Peter van Inwagen. 1977. Counterfactuals with Disjunctive Antecedents. *Philosophical Studies* 31:353–356.

Morrill, Glyn. 1995. Discontinuity in Categorial Grammar. *Linguistics and Philosophy* 18:175–219.

Parsons, Terence. 1990. *Events in the Semantics of English*. Cambridge, Mass.: The MIT Press.

Peacocke, Christopher. 1999. *Being Known*. Oxford: Oxford University Press.

Quine, W. V. 1956. Quantifiers and Propositional Attitudes. *The Philosophical Review* 53:177–187.

Salmon, Nathan. 1989. The Logic of What Might Have Been. *The Philosophical Review* 98:3–34.

Simons, Mandy. 2005. Dividing Things Up: The Semantics of 'Or' and the Modal/'Or' Interaction. *Natural Language Semantics* 13:271-316.

Wright, G. H. von. 1968. *An Essay in Deontic Logic and the General Theory of Action*. North Holland.

Zimmerman, Thomas Ede. 2000. Free Choice Disjunction and Epistemic Possibility. *Natural Language Semantics* 8:255–290.