Numeral *Any*: in Favor of Viability

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Preview

1. A contrast: *any* vs. ‘numeral *any*’ (Dayal, 2004, 2013)
2. Two analyses:
    - the Wide Scope Constraint Analysis (Chierchia, 2013)
    - the Viability Constraint Analysis (Dayal, 2013)
3. The behavior of collective predicates favours the VCA.

Any vs. ‘Numeral *Any*’

Any

(Dayal, 2004, 2013)

(1) *Bill read any book.

(2) Bill can read any book.

(3) *Bill must read any book.

Any vs. 'Numeral *Any*' (Dayal, 2004, 2013)

(1) *Bill read any book.

(2) Bill can read any book.

(3) *Bill must read any book.

(4) *Bill read any two books.

(5) Bill can read any two books.

(6) Bill must read any two books.

Any vs. 'Numeral *Any*'

(5) Bill can read any two books.

(6) Bill must read any two books.

- (5) conveys *universal permission* over groupings of two books.
- (6) also conveys universal permission over groupings of two books + *existential requirement*

Two Analyses

The Wide Scope Constraint (WSC) Analysis (Chierchia, 2013)

The Viability Constraint (VC) Analysis (Dayal, 2013)

Wide Scope Contraint Analysis

The Wide Scope Constraint (WSC) Analysis (Chierchia, 2013)

Any is an existential that introduces alternatives used by EXH.

(7) $[\![$ any book$_D$ λ_1 Bill read t$_1]\!]$= $R(a) \vee R(b)$

(scalar alternative) $\{R(a) \wedge R(b)\}$

(domain alternatives) $\{R(a), R(b)\}$

(pre-exhaustified domain alternatives) $\left\{ \begin{array}{c} R(a) \wedge \neg R(b), \\ R(b) \wedge \neg R(a) \end{array} \right\}$

The Wide Scope Constraint (WSC) Analysis

(Chierchia, 2013)

In episodic sentences, strengthening *any* yields a contradiction.

(8) $[\![\text{EXH any book}_D\ \lambda_1 \text{ Bill read } t_1]\!] =$

$$\underbrace{[R(a) \vee R(b)] \wedge [R(a) \leftrightarrow R(b)]}_{\exists\ +\ \text{domain implicature}} \wedge \underbrace{\neg[R(a) \wedge R(b)]}_{\text{Scalar component}} \Leftrightarrow \perp$$

(negated scalar alternative) $\neg[R(a) \wedge R(b)]$

(negated pre-exhaustified domain alternatives) $[R(a) \leftrightarrow R(b)]$

The Wide Scope Constraint (WSC) Analysis (Chierchia, 2013)

Any must scope over modals, also deriving a contradiction.

(9) $[\![\textsc{exh}\text{ any book}_D\ \lambda_1\ \text{can}_C\text{ Bill read t}_1]\!] =$
$[\Diamond_C R(a) \wedge \Diamond_C R(b)] \wedge \neg[\Diamond_C R(a) \wedge \Diamond_C R(b)] \Leftrightarrow \perp$

(10) $[\![\textsc{exh}\text{ any book}_D\ \lambda_1\ \text{must}_C\text{ Bill read t}_1]\!] =$
$[\Box_C R(a) \wedge \Box_C R(b)] \wedge \neg[\Box_C R(a) \wedge \Box_C R(b)] \Leftrightarrow \perp$

To avoid the contradiction, one of the conjuncts (i.e. the scalar component) is weakened by requiring its modal domain to be a subset of the original domain.

('The Modal Containment Constraint')

(11) $[\![\text{EXH any book}_D\ \lambda_1\ \text{can}_C\ \text{Bill read } t_1]\!] =$
$\underbrace{[\Diamond_C R(a) \wedge \Diamond_C R(b)]}_{\exists\ +\ \text{domain implicature}} \wedge \underbrace{\neg[\Diamond_{C' \subset C} R(a) \wedge \Diamond_{C' \subset C} R(b)]}_{\text{Scalar component}}$

w_1	$R(a) \wedge \neg R(b)$
w_2	$\neg R(a) \wedge R(b)$

The Wide Scope Constraint (WSC) Analysis (Chierchia, 2013)

Modal Containment does not prevent $\perp$ with $\Box$.

- The first conjunct below will contradict any possible weakening of the second conjunct.

(12) $[\![\text{EXH any book}_D\ \lambda_1\ \text{must}_C\ \text{Bill read } t_1]\!] =$
$[\Box_C R(a) \wedge \Box_C R(b)] \wedge \neg[\Box_{C' \subset C} R(a) \wedge \Box_{C' \subset C} R(b)] \Leftrightarrow \perp$

Numeral *any* also yields $\perp$ in episodic sentences and with $\Box$.

(13) $[\![$EXH any two books$_D$ λ_1 must$_C$ Bill read t_1 $]\!]$ =
$[\Box_C R(a \oplus b) \wedge \Box_C R(b \oplus c) \wedge \Box_C R(a \oplus c)] \wedge \neg\Box_C R(a \oplus b \oplus c)$

(14) $[\Box_C R(a \oplus b) \wedge \Box_C R(b \oplus c)] \Rightarrow \Box_C R(a \oplus b \oplus c)$

The Wide Scope Constraint (WSC) Analysis (Chierchia, 2013)

- Chierchia introduces a constraint called the Scale Economy Constraint (SEC)
  - SEC blocks the wide scope constraint as the numeral becomes redundant: the meaning of any sentence containing a numeral reduces to universal quantification

$\exists$ component + domain implicature is equivalent to (16).

(15) $[\![$EXH any two books$_D$ λ_1 must$_C$ Bill read t$_1$ $]\!]$ =
$\underbrace{[\Box_C R(a \oplus b) \wedge \Box_C R(b \oplus c) \wedge \Box_C R(a \oplus c)]}_{\exists\ +\ \text{domain implicature}} \wedge \neg \Box_C R(a \oplus b \oplus c)$

(16) $\Box_C R(a) \wedge \Box_C R(b) \wedge \Box_C R(c)$

- First conjunct in (15) $\Rightarrow$ (16) since 'read' is a distributive predicate.
- (16) $\Rightarrow$ first conjunct in (15) due to the cumulativity of the predicate and the universal modal.

No contradiction or violation of the Scale Economy Constraint if numeral *any* scopes under $\Box$.

(17) $[\![$EXH must any two books λ_1 Bill read $t_1]\!]$ =
$[\Box[R(a \oplus b) \vee R(b \oplus c) \vee R(a \oplus c)]] \wedge$
$\neg\Box_C[R(a \oplus b) \vee R(b \oplus c)] \wedge$
$\neg\Box_C[R(a \oplus b) \vee R(a \oplus c)] \wedge$
$\neg\Box_C[R(a \oplus c) \vee R(b \oplus c)]$

w_1	$R(a \oplus b) \wedge \neg R(b \oplus c) \wedge \neg R(a \oplus c)$
w_2	$R(b \oplus c) \wedge \neg R(a \oplus b) \wedge \neg R(a \oplus c)$
w_3	$R(a \oplus c) \wedge \neg R(a \oplus b) \wedge \neg R(b \oplus c)$

Viability Constraint Analysis

The Viability Constraint (VC) Analysis (Dayal, 2013)

- *Any* is also existential quantifier that introduces pre-exhaustified domain alternatives.
- The *Viability Constraint* serves to regulate the licensing of *any* by considering the satisfiability of the PDAs across the modal base.

The Viability Constraint (VC) Analysis (Dayal, 2013)

- In episodic sentences and when *any* scopes under a modal, *Viability* requires all PDAs to be true in the same world.
  - $\rightsquigarrow$ *Viability* fails in these cases since the alternatives are mutually exclusive.
- When *any* outscopes the modal, *Viability* requires that every PDA be satisfiable in some subdomain of the modal.
  - $\rightsquigarrow$ Can be done with possibility modals, but not with necessity modals.

The Viability Constraint (VC) Analysis (Dayal, 2013)

When *any* $> \Box$, Viability fails:

strengthening (18) conveys (19), which entails that all PDAs are false in all $C' \subset C$.

(18) any book_D λ_1 must_C Bill read t_1

(19) $\Box_C R(a) \wedge \Box_C R(b)$

(20) $\{\Box_C R(a) \wedge \neg\Box_C R(b), \Box_C R(b) \wedge \neg\Box_C R(a)\}$ (PDAs)

The Viability Constraint (VC) Analysis (Dayal, 2013)

Numeral *any* is split (num + *any*), *any* scopes under $\Box$.

(21) $[\![$two λ_2 must$_C$ [any t$_2$-MANY books$_D$] λ_1 Bill reads t$_1]\!] =$
$\Box_C[R(a \oplus b) \vee R(b \oplus c) \vee R(a \oplus c)]$

This derives the same interpretation as the WSCA.

Viability is satisfied in models below that satisfy universal permission:

w_1	$R(a \oplus b) \wedge \neg R(b \oplus c) \wedge \neg R(a \oplus c)$
w_2	$R(b \oplus c) \wedge \neg R(a \oplus b) \wedge \neg R(a \oplus c)$
w_3	$R(a \oplus c) \wedge \neg R(a \oplus b) \wedge \neg R(b \oplus c)$

Assessing the analyses

Collective predicates

The WSCA and VCA make different predictions when numeral *any* combines with collective predicates, as in (22):

(22) John must mix any two drinks

Collective predicates: the WSCA

(23) John must mix any two drinks.

Predicted to convey:

1. that J. is required to mix all pairs of drinks ((24-a) & (24-b))
2. that he is not required to mix a larger group of drinks (24-c)

(24) a. $\Box M(a \oplus b) \vee \Box M(b \oplus c) \vee \Box M(a \oplus c)$ (assertion)
b. $\Box M(a \oplus b) \leftrightarrow \Box M(b \oplus c) \leftrightarrow \Box M(a \oplus c)$ (domain implicature)
c. $\neg\Box M(a \oplus b \oplus c)$ (negation of scalar implicature)

Collective predicates: the WSCA

Scale Economy Condition does not block wide scope with collectives:

(25) John must mix any two drinks.

⇝ J. is required to mix all pairs of drinks and he is not required to mix a larger group of drinks.

(26) John must mix any three drinks.

⇝ J. is required to mix all groups of three drinks and he is not required to mix a larger group of drinks.

No reason to reconstruct below the modal and violate the Wide Scope Constraint.

Collective predicates: the WSCA

(27) John must mix any two drinks.

- John is required to mix all pairs of drinks (and not required to mix a larger group of drinks).

(28) *Bar tender competition (I). Do all cocktails.* There is coke, whiskey, and gin. John is required to mix coke and whiskey, coke and gin, and whiskey and gin.

(29) *Bar tender competition (II). Choose your cocktail.* Same drinks. John is permitted to mix any couple of drinks. He is required to mix at least one pair, but not required to mix any particular pair.

(27) predicted to be true in (28), false in (29).

Collective predicates: the VCA

(30) John must mix any two drinks.

VCA predicts (30) to assert (31-a) and implicate (31-b). VC requires all terms of the biconditional to be false.

- John is required to mix a couple of drinks, not required to mix any particular group, and permitted to mix any.

(31) a. $\Box[M(a \oplus b) \vee M(b \oplus c) \vee M(a \oplus c)]$
b. $\Box M(a \oplus b) \leftrightarrow \Box M(b \oplus c) \leftrightarrow \Box M(a \oplus c)$
c. $\neg\Box M(a \oplus b \oplus c)$

Collective predicates: the VCA

(32) John must mix any two drinks.

- John is required to mix a couple of drinks, not required to mix any particular group, and permitted to mix any.

(33) *Bar tender competition (I). Do all cocktails.* There is coke, whiskey, and gin. John is required to mix coke and whiskey, coke and gin, and whiskey and gin.

(34) *Bar tender competition (II). Choose your cocktail.* Same drinks. John is permitted to mix any couple of drinks. He is required to mix at least one pair, but not required to mix any particular pair.

(32) predicted to be true in (34), false in (33).

Assessing the predictions

In scenarios like the previous ones, our informants side with the VCA rather than with the WSCA. In other words, numeral *any* + collective predicates derive an existential requirement rather than a universal requirement (i.e. mixing all drinks is required).

Open questions

Crosslinguistic variation

The contrast between *any* and 'numeral *any*' is not universal.

XX: in Farsi, numeral *any* behaves as predicted by the WSCA with collective predicates.

What lies behind the attested cross-linguistic variation?

Thanks!

References

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