Disjunction is not Boolean: novel evidence from Tiwa

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Overview. I provide novel cross-linguistic evidence that disjunction in natural language is not the Boolean join, but is better modeled as alternative-denoting (e.g. Simons 2005, Alonso-Ovalle 2006, Aloni 2007). This evidence comes from narrow scope disjunction in Tiwa (Tibeto-Burman; India): while its obligatory narrow scope initially suggests a Boolean analysis is appropriate, a Boolean approach cannot handle scopal restrictions on disjunctions of individuals, which do not behave as GQs as required on a Boolean account. I provide an alternatives-based analysis, and discuss implications for theories of (exceptional) scope (e.g. Charlow 2014, to appear): alternatives and scopal flexibility do not always go together.

Background. It has been standardly assumed that disjunctive particles in natural language, such as English *or*, correspond to the (inclusive) disjunctive operator of propositional logic (i.e. the Boolean join). Cross-categorially, disjunction amounts to set union (Partee & Rooth 1983, a.o.). Despite its appeal, however, the Boolean view of English *or* faces problems. One concerns scope (Rooth & Partee 1982): disjunctions robustly have wide scope readings where conjunctions do not, including from inside islands (Schlenker 2006). If *or* uniformly denotes the Boolean join and *and* the Boolean meet, this asymmetry is difficult to explain. Additionally, even in narrow scope contexts the Boolean analysis faces problems: it cannot capture the free choice readings *or* receives under modals and imperatives (Simons 2005, Aloni 2007, a.o.), and does not derive the correct truth conditions in counterfactual conditionals (Alonso-Ovalle 2006). These facts together suggest that *or* is not the Boolean join, but rather denotes a set of alternatives.

***ba* disjunction.** Tiwa has a disjunctive particle *ba* (1) that must take narrow scope with respect to any other operator in the clause. This is illustrated for negation in (2), comparatives in (3) below, and also holds with respect to quantifiers, conditionals, attitude verbs and modals. *ba* disjunctions are, aside from their scope, otherwise like English *or*: semantically inclusive (but implicate exclusivity), cross-categorial, and do not require licensing (e.g. by negation, or a modal; data omitted due to space). (These data were collected by the author in Assam, India, 2016-2018, via semantic fieldwork (Matthewson 2004) with two speakers.)

(1) Lastoi [khónana **ba** sónena]   phi-w.
     Lastoi [tomorrow or next.day] come-NEUT
     'Lastoi will come tomorrow or the next day.'

(2) Sonali [Mansing **ba** Milton]-go   lak mán-ya-m.
     Sonali [Mansing or Milton]-ACC meet-NEG-PST
     'Sonali didn't meet Mansing or Milton.'
     ✓ Sonali met neither Mansing nor Milton.
     ✗ Either Sonali didn't meet Mansing, or she didn't meet Milton, but the speaker can't remember who.

Since *ba* disjunctions do not receive wide scope readings, which prove problematic for Boolean analyses of English *or*, *ba* initially seems like a plausible candidate for the Boolean join in natural language. I provide novel evidence against this analysis from disjunctions of individuals.

Disjunctions of individuals. Under a Boolean analysis, where disjunction is treated as set union, coordinated DPs must be treated as generalized quantifiers (i.e. sets of properties); elements of type *e* are not conjoinable (Partee & Rooth 1983). The disjunction of names in (2), e.g., must be interpreted as $\lambda P. P(Mansing) \vee P(Milton)$. If the Boolean analysis is correct, disjunctions of names should behave like GQs with respect to their scope taking abilities. This is not the case for *ba* disjunction in Tiwa. First, bona fide GQs such as *sharpha* 'someone' can take wide scope with respect to negation via QR. (Evidence for the GQ status of *sharpha* is provided in the talk.) If *ba* disjunctions of names were of GQ type, they too should be able to take wide scope with respect to negation. (1) shows this is impossible.

A similar argument comes from phrasal comparatives, which take an individual- (rather than degree predicate-)denoting standard (Bhatt & Takahashi 2011). (Evidence against a reduced clausal comparative analysis comes from independent ellipsis facts, and GQ scope.) In phrasal comparatives, two individuals are compared directly: $[\![COMP]\!] = \lambda x.\lambda P_{\langle d,et\rangle}.\lambda y.\exists d[P(y,d) \mathrel{\&} \neg P(x,d)]$. When the standard of comparison is a GQ, it must QR to a higher position in order to resolve the type-mismatch between it and the comparative morpheme. The result is an obligatory wide scope reading of the standard with respect to the comparative.

In Tiwa, "More children read every Tiwa book than every English book" is judged felicitous in a context in which "every book" (*mile lái*) outscopes "more" (*parâ*): each Tiwa book was read by more children than each English book (i.e. the least-read Tiwa book was read by more children than the most-read English book). It is judged infelicitous in a context in which "more" outscopes "every book": every child read every Tiwa book, but only a few read every English book. (Note that the opposite holds for the English translation; English lacks direct individual comparison of the sort considered here.)

If *ba* disjunctions of names denote a GQ, they are predicted to pattern with GQs in taking wide scope over COMP to yield a reading in which the comparison holds of one disjunct, or it holds of the other. The opposite is true: *ba* disjunctions of names must take narrow scope in comparatives (3), yielding a reading in which the comparison holds of both disjuncts. To get this reading, the *ba* disjunction must be able to compose *in situ* with the comparative morpheme (i.e. it must in some sense be individual-denoting).

(3) Mukton [$_{\text{DEGP}}$ [$_{\text{PP}}$ [Tonbor **ba** Lastoi] -na   khúli] **parâ**] chu-w.
   Mukton   [Tonbor or Lastoi] -DAT than   COMP tall-NEUT
   'Mukton is taller than Tonbor or Lastoi.'
   ✓ Mukton is taller than both Tonbor and Lastoi.
   ✗ Mukton is taller than Tonbor, or he's taller than Lastoi, but we can't remember which.

This argument from disjunctions of individuals is supported by the familiar FC effects one: like English *or*, *ba* disjunctions give rise to FC effects under modals and in imperatives. I conclude that *ba* is not the Boolean join, and consequently that there is still yet no positive evidence for the Boolean join in natural language.

Analysis. Building on alternatives-based approaches to disjunction in English, I analyze *ba* disjunctions as denoting a set of alternatives made up of the individual disjuncts. E.g., *Mansing ba Milton* in (2) denotes the set {Mansing, Milton}. These alternatives compose pointwise with other material to form higher-typed sets of alternatives, which are subject to existential closure. This is illustrated for (1):

(4) $[\![(1)]\!] = \lambda w.\exists p \in \{\lambda w.\text{Lastoi comes tomorrow in } w, \lambda w.\text{Lastoi comes the day after in } w\}[p(w)=1]$

Under an alternatives based approach, there are two ways of ensuring obligatory narrow scope: the alternatives are existentially closed under the scope of the higher operator (e.g. Alonso-Ovalle 2006, Charlow to appear), or the alternatives are directly quantified over by the higher operator (e.g. Simons 2005, AO 2006). I argue for a mixed account for *ba* (cp. AO's (2006) account of English *or*): I propose that the alternatives are existentially closed in upward-entailing environments (modals, nuclear scope of a quantifier), but otherwise universally quantified over directly by other operators (negation, comparatives, conditionals, restrictor of quantifier) (cp. AO's (2006) analysis of conditionals). I propose a type shift rule (5) that provides the universal quantification, allowing the operator to compose with the alternative set (i.e., the unshifted operators do not compose pointwise with the alternatives (cf. Simons 2005).)

(5) *Type shift rule:* $\lambda f_{\langle \alpha, \beta \rangle}.\lambda A_{\{\alpha\}}.\forall a \in A[f(a)]$, where $A_{\{\alpha\}}$ is a set of elements of type α

(6) a. $[\![\text{-ya}_{\text{ALT}} \text{ 'NEG'}]\!] = \lambda A_{\{t\}}.\forall p \in A[\neg p]$

   b. $[\![\text{parâ}_{\text{ALT}} \text{ 'more'}]\!] = \lambda A_{\{e\}}.\lambda P_{\langle d,et \rangle}.\lambda y.\forall x \in A[\exists d[P(y,d) \& \neg P(x,d)]]$

(7) a. $[\![(2)]\!] = \forall p \in \{\text{Sonali met Mansing, Sonali met Milton}\}[\neg p]$

   b. $[\![(3)]\!] = \forall x \in \{\text{Tonbor, Lastoi}\}[\exists d[\text{tall(Mukton, d)} \& \neg\text{tall(x, d)}]]$

This mixed approach is necessary: because *ba* in some cases must denote a set of individuals when met by another operator (e.g. the comparative) a pure existential closure approach is ruled out.

The alternatives-based approach to disjunction, independently argued for for English *or*, captures the behavior of *ba* disjunction in Tiwa: unlike the Boolean approach, it allows for disjunctions of type *e* elements distinct from disjunctions of generalized quantifiers. The Tiwa facts thus lend support to the alternatives-based approach to natural language disjunction over a traditional Boolean approach.

Implications for theories of scope. *ba*'s scopal inflexibility combined with its alternative-denoting nature has implications for theories of (exceptional) scope which tie the availability of wide scope readings to the alternative-denoting nature of disjunction (e.g. Simons 2005, Charlow 2014, to appear): that *ba* is alternative-denoting but unable to take wide scope shows that these are independent properties.