Spatial, temporal, and degree ranges in Ktunaxa

Ktunaxa, a language isolate spoken in Interior BC and the northwestern United States, has a dedicated set of morphemes to express ranges spatially (*from Vancouver to Toronto*), temporally (*from Monday to Friday*), and in the degree domain (*from 3 to 5*). Gobeski & Morzycki (2024, cf. Gobeski & Morzycki 2022) argue the semantics of degree range constructions is distinct from other numeral modifiers such as *at least* or *at most* and derived from spatial range expressions via a generalized crosscategorial notion of PATHS (Zwarts 2017 and references there). Ktunaxa shows overt evidence for both of these points. It lacks numeral modifiers altogether, and spatial and degree ranges are built with some shared morphemes, but they also differ. Only spatial ranges use spatial deixis demonstratives. We analyze all three range constructions as denoting start points and end points to paths. Spatial ranges encode the additional presupposition that the arguments can be located physically in relation to the speaker. Collectively these steps provide further evidence for extending paths beyond spatial semantics and demonstrate that complex measure expressions can occur even in languages without straightforward modified numerals.

As in English, Ktunaxa locative range constructions occur as VP and NP adjuncts. They take the form DEM-***s-¢*** *NP* ***¢*** DEM *NP*. A demonstrative marked with obviative *s* and coordinator *¢* introduces the start of the range, and coordinator *¢* with a demonstrative mark the end of it. As Morgan (1991) and Huijsmans & Birdstone (2018) observe, some Ktunaxa demonstratives encode spatial deixis. Accordingly the demonstratives used in the relevant range construction depend on the location of the speaker. In (1a), the speaker is in Vancouver, so the proximal demonstrative *na* is used to introduce the start point of the path, whereas Toronto is far, so the distal demonstrative *qu* is used to introduce the end of the path. In (1b), the speaker is in Toronto, so *qu* is used to mark the start of the range while *na* is used to mark its end:

(1) a. *You're in Vancouver telling your friends a story of how you once visited Toronto.*
Ma-hu ɬ̓inax-i na-s-¢ Vancouver ¢ qu Toronto.
PST-1.SUBJ go-IND P.DEM-OBV-AND Vancouver AND D.DEM Toronto.
'I went from Vancouver to Toronto.'

b. *You're in Toronto telling your friends how you came here from Vancouver.*
Ma-hu ɬ̓inax-i qu-s-¢ Vancouver ¢ na-s Toronto.
PST-1.SUBJ go-IND D.DEM-OBV-AND Vancouver AND P.DEM-OBV Toronto.
'I went from Vancouver to Toronto.'

The first demonstrative that introduces the start point can also be neutral *ʔi*. The second demonstrative used to mark the endpoint, however, is obligatorily present and deictic.

Degree range constructions make use of many of the same morphological ingredients, but they are mostly incompatible with spatial deixis demonstratives. They take the form DEM-***s-¢*** DEG ***¢*** DEG. The demonstrative in the start of the range is obligatorily *ʔi*, which does not encode spatial deixis. Proximal *na* or distal *qu* cannot occur here. The phrase marking the end of the path is only the coordinator *¢*. Unlike the spatial examples, a deictic demonstrative is ungrammatical after *¢*.

(2) *You're playing a guessing game with numbers.*
Hu s-iɬ kniɬwiytiyat-i k'up¢itiɬ ʔi-s-¢ ʔuki-s ¢ ʔit'wu-s
1.SG PROG-IND think-IND number DEM-OBV-and one-OBV and ten-OBV
'I'm thinking of a number from one to ten.'

Temporal ranges also take the form DEM-***s-¢*** TIME ***¢ (***DEM***)*** TIME, but the demonstratives used are flexible in this construction. It is possible to use distal *qu* or proximal *na* with respect to the distance from the utterance time, but unlike spatial ranges, this is not obligatory. In (3), proximal demonstrative *na* can be used before the end of the temporal range, but the structure is also

grammatical without it:

(3) *La·t wanted to be healthier, so he did not eat cheese for the first three months of the year.*
qa ʔik-ni ¢is ʔi-s-¢ kmitxałtitnam-s ¢ (na-s) ɬiḵuq̓-s
NEG eat-IND cheese DEM-OBV-and January-OBV and (P.DEM-OBV) March-OBV
'He didn't eat cheese from January to March.'

In sum, Ktunaxa ranges are built with demonstratives, obviation, and a coordinator. Spatial ranges use spatial deixis demonstratives obligatorily, temporal uses optionally, and degree uses not at all.

One might imagine a line of analysis that relates range expressions to modified numerals such as *at least 7* or *at most 10*. Ranges resemble modified numerals in that they both mark bounds of scales and license ignorance inferences (Nouwen 2010, Rett 2014). Gobeski & Morzycki (2022, 2024) observe, though, that only ranges can be non-numeric and have a dedicated set of predicates that select for them (e.g. *range*, *span*). This leads them to pursue an analysis in terms that are not crucially numeric. Ktunaxa provides further evidence in favor of this route, as it lacks modified numerals altogether. There is no direct way to express *at least*. Instead, the modal *paɬ* is used to express uncertainty about the amount. However, this doesn't explicitly mark the lower bound of the scale as *at least* does.

Gobeski & Morzycki (2024) instead pursue a route that derives degree ranges from locative ranges, which is especially well-suited for Ktunaxa because the morphemes used for the two forms overlap. In the same spirit, we will assume a representation that includes paths, which can be construed as sets of points with a direction (Zwarts 2005, 2017 a.o.; variables $p, p', \ldots$). The functions **start** and **end** apply to p and yield its start and end points, respectively. Because English uses *from...to* for spatial and degree ranges, Gobeski & Morzycki (2024) propose parallel but different denotations for the degree and locative versions of this construction, construing paths as ordered sets of locations, individuals, times, or degrees. Ktunaxa uses the same morphemes temporal and degree ranges and uses additional morphology for the spatial variants, so we treat the overlapping morphemes as type flexible, able to apply to individuals, times, and degrees—*ʔis-s-¢ ¢* applies to two arguments, α and β and a path, p. The value of β is at the start of p and that of α at its end, and a path argument is introduced:

(4) a. $[\![$ *ʔi-s-¢ ¢ 'from to'* $]\!] = \lambda\alpha \in D_e \cup D_i \cup D_d \,.\, \lambda\beta \in D_e \cup D_i \cup D_d \,.\, \lambda p[\textbf{start}(p) = \beta \wedge \textbf{end}(p) = \alpha]$
b. $[\![$ *ʔi-s-¢ ʔu·ki-s ¢ ʔitwu-s 'from one to ten'* $]\!] = \lambda p[\textbf{start}(p) = 1 \wedge \textbf{end}(p) = 10]$

The path argument is ultimately either saturated or existentially closed, depending on the example.

If the range expression includes proximal *na* or distal *qu*, its denotation is the same as above but with a presupposition that locates the start point of p relative to the speaker S:

(5) $[\![$ *na-s-¢ ¢ qu 'from to'* $]\!]^S = \lambda\alpha\lambda\beta\lambda p : \textbf{start}(p)$ *is proximal to* S $[\textbf{start}(p) = \beta \wedge \textbf{end}(p) = \alpha]$

These demonstratives are incompatible with degree ranges because the speaker has spatiotemporal location on a degree scale. One the other hand, a speaker has a location in space and in time.

The morphological architecture of Ktunaxa ranges reveals deep connections between the spatial, temporal, and degree domains. The shared morphemes are no lexical accident—rather, they reflect that all of these types are similar in that they can be ordered. There are nevertheless important differences between these domains, and Ktunaxa makes that clear with what demonstratives are possible where. Also, *ʔis¢* is used to mark standards in degree constructions, which Bertrand (in progress) independently analyzes with tools derived from spatial semantics. Ktunaxa's strategy for building ranges relies crucial on conjunction, which distinguishes it from ranges in more widely-studied languages. These facts collectively constitute further evidence that ontological structures used in spatial semantics play an important role in other domains. They may also shed light on the the grammar of deixis and spatial expressions in Ktunaxa and more generally, and on how complex measure expressions work in languages without a modified numeral system.

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