Polysemy and degree scales in Logoori[*]

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1 Introduction

- This talk addresses a polysemous verb, *kudoka*, in Logoori (Bantu, JE 41; ISO rag), which has (at least) a three-way polysemy:

1. *'to arrive'*   SPATIAL USE

    (1) Sira **a-dok-i**   (Nairobi)
         1Sira 1SM-DOK-FV Nairobi

         'Sira **arrived** (at Nairobi).'[1]

2. *'to be enough'*   DEGREE USE

    (2) Sira a-v-i   na   vutambe **vu-dok-an-a**   (ku-lol-a)
         1Sira 1SM-COP-FV with 13height 13SM-DOK-PL-FV 15-see-FV

         'Sira is tall **enough** (to see, e.g. over the fence).'

3. *'must'*   MODAL USE

    (3) (ku maragoo) **ku-dok-a** Sira a-zi-e   yeeng'o
         to 6law   15-DOK-FV 1Sira 1SM-go-SBJV home

         '(According to the law), Sira **must** go home.'

- We pose the question of whether all the meanings of the verb can be semantically united: If so, how? What does this tell us about cross-categorial gradability?

[1]We use the following abbreviations: 1/2/3... noun classes; AC 'anticausative,' CAUSE 'causative,' COMP 'complementizer,' COP 'copula,' FUT 'future,' FV 'final vowel,' MOD 'modal element,' NEG 'negative,' PASS 'passive,' REC 'reciprocal,' SBJV 'subjunctive,' SG/PL 'singular/plural,' and SM 'subject marker.' We assume the standard Logoori orthography; *<ng'>* represents a phonemic velar nasal /ŋ/ and *<ny>* represents a phonemic palatal nasal /ɲ/. Logoori has a two-tone system (Samuels and Paster 2015), which is not represented in this orthography.

- We argue that these three observed meanings of *kudoka* can be unified in a single semantic denotation.

- We propose that the data in (1)-(3) supports the inclusion of cross-categorial measure functions in our semantics.

  – The spatial use of *kudoka* involves a scale of locations on a path.
  – The degree use of *kudoka* involves a property scale of e.g. height.
  – The modal use of *kudoka* involves a scale of e.g. goodness or likelihood.

- We propose that a measure function introduced by *kudoka* maps an item to a value on one of these scales.

- *Kudoka* itself relates this value to the value of a contextual "threshhold."

- We show the Logoori data in §2, give our analysis in §4, and provide some commentary on it in §4.4.

- In §4.5.2, we show that similarly polysemous lexical items are observed in unrelated languages, and speculate about the diachronic relationship between the different meanings.

2 Logoori data

2.1 Spatial use ('to arrive'/'to reach')

- When *kudoka* occurs in its spatial use ('to arrive'/'to reach'), the "goal" can optionally occur overtly.

(4) Sira a-dok-i
     1Sira 1SM-DOK-FV
     'Sira arrived.'

(5) Sira a-dok-i   Nairobi
     1Sira 1SM-DOK-FV Nairobi
     'Sira arrived at Nairobi.'
     'Sira reached Nairobi.'

2.2 Degree use ('to be enough')

- Logoori Property Concept Lexemes (PCLs; Dixon 1982) can be nouns, verbs, or adjectives.

- Nominal PCL predicates have the form "be with PCL".[2]

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[2]This construction is also used to express possession; see Francez and Koontz-Garboden (2015) for discussion of "possessive predication":

(6) Sira a-v-i   na   mudoga
     1Sira 1SM-COP-FV with car
     'Sira has a car.'
     Lit. 'Sira is with a car.'

(7)   a.   Sira a-v-i   na   vutambe.
           1Sira 1SM-COP-FV with 13height
           'Sira is tall.'
           Lit. 'Sira is with height.'

      b.   Sira a-v-i   na   vutambe vu-dok-an-a
           1Sira 1SM-COP-FV with 13height 13SM-DOK-PL-FV
           'Sira is tall enough.'
           Lit. 'Sira is with a height that reaches.'

- In its degree use ('to be enough'), *kudoka* occurs inside a relative clause modifying a nominal PCL that is the predicate of the matrix clause. This is reflected by noun class agreement.[3]

- An optional infinitival clause can further specify the height, temperature, etc. that must be reached to count as 'enough.'

(8)   Sira a-v-i   na   vutambe vu-dok-an-a   ku-lol-a   luvega lu-ndi
      1Sira 1SM-COP-FV with 13height 13SM-DOK-PL-FV 15-see-FV 5side   5-other
      lwa lugaga
      5of 5fence
      'Sira is tall enough to see over the fence.'
      Lit. 'Sira is with a height that reaches seeing the other side of the fence.'

(9)   liboksi li-v-i   na   vwangu   vu-dok-an-a   ku-geng-w-a
      box   5SM-COP-FV with 13lightness 13SM-DOK-PL-FV 15-lift-PASS-FV
      'The box is light enough to be lifted.'

(10) inyingu i-v-i   na   vuritu   vu-dok-an-a   ku-vunyany-a emesa
      9pot   9SM-COP-FV with 13heaviness 13SM-DOK-PL-FV 15-break-FV   9table
      'The pot is heavy enough to break the table.'

(11) Sira a-v-i   na   vuyaanzi   vu-dok-an-i   ku-morom-a na   Imali
      1Sira 1SM-COP-FV with 13happiness 13SM-DOK-PL-FV 15-talk-FV   with 1Imali
      'Sira is happy enough to talk to Imali.'

- The *kudoka*-relative clause can also modify a mass or count noun predicate.[4] We refer to this as its "amount" reading. We set this usage aside for now in our analysis of *kudoka*.

(12) ku-v-i   na   amaaze ga-dok-an-i   ku-menyel-a
      1PL-COP-FV with 6water 6SM-DOK-PL-FV 15-survive-FV
      'We have enough water to survive (e.g. in the desert).'
      Lit. 'We are with water that reaches surviving.'

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[3]Degree uses of *kudoka* host the event pluralizing suffix *-an*. We do not presently have an explanation for why this is.

[4]We use "mass" and "count" terminology for descriptive purposes. It is unclear if mass/count is a meaningful distinction for Logoori nouns. Noun class 13 mostly consists of mass abstract nouns (e.g. *vwangu* 'lightness,' *vuyaanzi* 'happiness'), though nouns that we typically think of as "mass" (non-discrete entities, measured with rational numbers) can also belong to other noun classes (e.g. *amaaze* 'water' in noun class 6).

(13) n-v-iy-i   na zisindi zi-dok-an-a   ku-gor-a mudoga
      1SG-COP-ASP-FV with 10money 10SM-DOK-PL-FV 15-buy-FV 3car
      'I have enough money to buy a car.'

(14) Sira a-v-i   na mavoyo ga-dok-an-a   ku-romb-a ichai
      1Sira 1SM-COP-FV with 6egg   6SM-DOK-PL-FV 15-make-FV 9tea
      'Sira has enough eggs to make breakfast.'
      Lit. 'Sira is with eggs reaching making tea.'

(15) n-v-iy-i   na zikarama zi-dok-an-i   daave
      1SG-COP-ASP-FV with 10pencil 10SM-DOK-PL-FV NEG
      'I don't have enough pencils.'

- *Kudoka* is only grammatical in combination with nominal PCL predicates; to express 'to be enough' with verbal and adjectival PCL predicates, Logoori speakers must use a different strategy.[5]

2.3   Modal use ('must')

- In its modal use, *kudoka* typically occurs in its infinitival form.[6] It may occur either clause initially or directly after the subject.

- The embedded clause occurs in the subjunctive.

(20) a. (ku maragoo) ku-dok-a Sira a-zi-e   yeng'o
         to 6law   15-DOK-FV 1Sira 1SM-go-SBJV home
      'According to the law, Sira must go home.'

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[5]Speakers use *sam* (also *samu*) with adjectival and verbal PCL predicates. Like *kudoka*-expressions, *sam*-expressions can also be modified by an optional infinitival clause.

(16) liboksi ni   li-angu {samu / *vu-dok-an-a   / *ku-dok-a} ku-geng-a
      5box   COP 5-light SAM   / 13SM-DOK-PL-FV / 15-DOK-FV 15-lift-FV
      'The box is light enough to lift.' (compare to (9))

Sam lacks the spatial and modal polysemies of *kudoka*. *Sam*-expressions also have an associated value judgment that the degree of the gradable predicate is pleasant/good. When it combines with mass/count noun predicates, it can only refer to the quality of the item, not its amount, unlike *kudoka*.

(17) ni   m-ng'afu sam
      COP 1-slender SAM
      'S/he is pleasingly slender.'

(18) Sira a-v-i   na mavoyo samu ku-romb-el-a   ichai
      1Sira 1SM-COP-FV with 6egg   SAM 15-make-APPL-FV 9tea
      'Sira has the perfect eggs to make breakfast with.'
      Not available: 'Sira has enough/the right amount of eggs to make breakfast with.'

[6]In its modal use, *kudoka* can also occur in an "impersonal" form in which it takes an event pluralizer (*-an*) (Gluckman 2018) and either noun class 6 (*ga-*) or noun class 9 (*e-*) subject agreement (Gluckman and Bowler 2016).

(19) ga-dok-an-a   ndee avarwaye va-v-e   na kibande chya kivitale kurora mwahi
      6SM-DOK-REC-FV that 2patient 15SM-COP-SBJV with 7card   15of 7identity 15see 1doctor
      'It's necessary that patients have a hospital ID to see a doctor.'

    b. (ku maragoo) Sira ku-dok-a   a-zi-e   yeng'o
      to 6law   1Sira 15-DOK-FV 1SM-go-SBJV home

      'According to the law, Sira must go home.'

- Modal uses of *kudoka* are compatible with all Kratzerian flavors of necessity modality (Kratzer 1991, 1981).[7]

(21) Epistemic necessity: *Kageha is in the library. She sees that the people who are coming into the library are carrying wet umbrellas, and that their clothes are wet. Kageha thinks:*

ku-dok-a   imbula i-v-i   ne-i-kubanga
15-DOK-FV 9rain   9SM-COMP-SBJV COMP-9SM-beat

'It must be raining.'

Lit. 'The rain must be beating.'

(22) Deontic necessity: *In Kenya, the law states that when you ride a motor bike:*

ku-dok-a   w-evek-e   igudwe
15-DOK-FV 2SG-wear-SBJV 9helmet

'You must wear a helmet.'

(23) Teleological necessity: *AFC Leopards (Ingwe) are playing in a tournament. In order to advance:*[8]

ku-dok-a   Ingwe va-leg-e   Gor Mahia
15-DOK-FV 9Ingwe 2SM-beat-FV Gor Mahia

'Ingwe must beat Gor Mahia.'

(24) Circumstantial necessity: *You are on a bus to Nairobi. You have not had a chance to go to the toilet for 6 hours, and your bladder is full. You text your friend:*

ku-dok-a   inz-inyaal-e
15-DOK-FV 1SG-urinate-SBJV

'I have to pee.'

3   Intuitive analysis

- Our goal is a unified semantics for the uses of *kudoka* in §2.

- We take as a starting point for our analysis the observation that all three uses of *kudoka* refer to gradable scales.

  - The spatial use ('to arrive'/'to reach') involves movement along a scale of locations on a path in space.

  - The degree use ('to be enough') involves obtaining a certain degree on an ordered property scale of e.g. height, or temperature.

  - The modal use ('must') involves obtaining a certain (high) degree of goodness or likelihood, assuming that propositions can be ordered on a scale of goodness/likelihood/etc.

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[7]Our elicitation of modality in Logoori was guided in part by Vander Klok (2014).

[8]*Ingwe* is the name of the football/soccer team from Kakamega County. It is primarily made up of Luyia, who have a (friendly) rivalry with the neighboring Luo represented by Gor Mahia. The word *ingwe* means 'leopard' in Logoori.

4   Analysis

- We use tools from degree semantics to capture the data in §2.[9]

- Degrees have been posited to account for gradability in language, initially for gradable adjectives like *big* and *tall* (Cresswell 1976, Bierwisch 1989, Kennedy 1999, among many others).

- Such analyses of gradable adjectives generally posit:

  - A downward monotonic scale consisting of a dense set of degrees that are totally ordered with respect to some lexically specified dimension (e.g. height, temperature)[10]

  - A measure function relating the argument of the gradable adjective to a degree on the scale[11]

  - Gradable adjectives are context-dependent (what counts as *tall* in one context might not count as *tall* in another); there is some way of relating the degree picked out by the measure function to the degree of the contextual "standard" (e.g. POS)[12]

(29)   Context: John is 6 feet tall.
  a.   John is 12 years old.
       "John is tall" = true
  b.   John is a professional basketball player.
       "John is tall" = false

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[9]We use tests from Beck et al. (2009) to argue that Logoori should be analyzed as having degrees in its semantic ontology. For instance, Logoori has measure phrases, differential comparatives, subcomparatives, and degree questions:

(25)   Sira a-v-i   na   vutambe vwa vireng'ge sita.
       1Sira 1SM-COP-FV with 13height 13of 13foot   six
       'Sira is six feet tall.' (Lit. 'Sira is with a height of six feet.')

(26)   Sira ni mutambe ku-vet-a   Imali na   kereng'ge kila.
       1Sira COP height 15-surpass-FV 1Imali with foot   one
       'Sira is one foot taller than Imali.' (Lit. 'Sira is tall surpassing Imali with one foot.')

(27)   lidirisha li-v-i   na   vuvambaru vu-vit-i   vutambe vwa muliangu
       5window 5-COP-FV with 13width   13SM-surpass-FV 13height 13of 3door

       'The window is wider than the door is tall.'
       (Lit. 'The window is with a width that surpasses the height of the door.')

(28)   Sira a-v-i   na   vutambe vu-ri?
       1Sira 1SM-COP-FV with 13height 13-which
       'How tall is Sira?' (Lit. 'Sira is with which height?')

[10]Downward monotonicity: If a degree d is included in a set of degrees, $d-1$ is also included in the set.
Density: For any two degrees d, d', there exists a degree d'' that occurs between them on the scale.

[11]This measure function can be encoded as part of the gradable adjective, which relates degrees to sets of individuals (Cresswell 1976, among many others; type $\langle d,\langle e,t\rangle\rangle$). Bartsch and Vennemann (1972) and Kennedy (1999) take gradable adjectives themselves to denote measure functions from individuals to degrees (type $\langle e,d\rangle$).
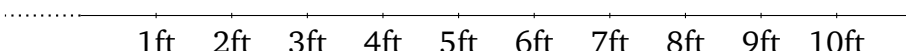
[12]This context-dependence disappears in certain environments (e.g. in comparatives, with measure phrases) (Rett 2015). However, it is recognized as a property of positive expressions like *John is tall*.

(30) ⟦ tall ⟧ = $\lambda d \lambda x.$ **tall**$(x) \geq d$
       (where **tall** is a measure function that maps x to a degree on a scale of height)

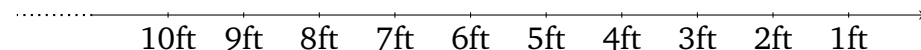(31) ⟦ POS ⟧ = $\lambda G_{\langle d \langle e,t \rangle \rangle} \lambda x. \exists d[G(d)(x) \ \& \ d > standard_G]$

- We assume that antonyms involve reversing the order of the scale (Kennedy 2001).
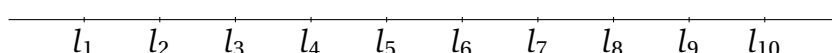
(32)

scale of *tall* ....

| | 1ft | 2ft | 3ft | 4ft | 5ft | 6ft | 7ft | 8ft | 9ft | 10ft |

(33)

scale of *short* ....

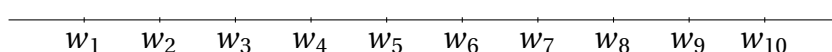| | 10ft | 9ft | 8ft | 7ft | 6ft | 5ft | 4ft | 3ft | 2ft | 1ft |

$\longrightarrow$
increasing on the relevant scale

- We assume a type l for locations; spatial paths consist of ordered sequences of locations (Hohaus 2018).

(34)

| l_1 | l_2 | l_3 | l_4 | l_5 | l_6 | l_7 | l_8 | l_9 | l_{10} |

- We assume that worlds can also be ordered (Lewis 1973, Kratzer 1991, Lassiter 2017). An attitude holder's belief worlds form a scale with respect to how well they conform with particular wishes/laws/expectations/etc.

(35)

| w_1 | w_2 | w_3 | w_4 | w_5 | w_6 | w_7 | w_8 | w_9 | w_{10} |

- Both sets of ordered locations and sets of ordered possible worlds share many structural properties with degree scales.[13]

- **Components of our analysis:**

1. Contextually determined "threshhold" (type d)

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[13]Though see Lassiter (2014, 2017) for discussion of the similarities and differences between degree scales and world rankings. For example, Lassiter notes that worlds can only be partially, not totally ordered; he derives a total ordering of scalar values associated with worlds by mapping worlds to totally ordered values on scales (§4.3).

- The spatial use invokes a locational threshhold (beyond which the location of the subject counts as being in e.g. Nairobi)

- The degree use invokes a threshhold on the degree scale of the gradable predicate (beyond which the subject can e.g. see over the fence)

- The modal use invokes a threshhold on the scale of possible worlds (beyond which are all the most "ideal" worlds)

- This threshhold can be realized overtly, as in *Nairobi* in (5) and *ku maragoo* 'according to the law' in (20)

2. Spatial and modal uses: Measure function (μ_Σ) that maps sets of locations or worlds to degrees; since scales are downward monotonic, this picks out the maximal degree[14]

(36) ⟦ μ_Σ ⟧ = $\lambda\alpha$. degree of α on a scale Σ
      where α is of type $\langle l,t \rangle$ or $\langle s,t \rangle$

3. *kudoka*: Expresses a relation between degrees

(37) ⟦ *kudoka* ⟧ = $\lambda C_d \lambda d.\ d \geq C$
      where C is the contextually determined threshhold

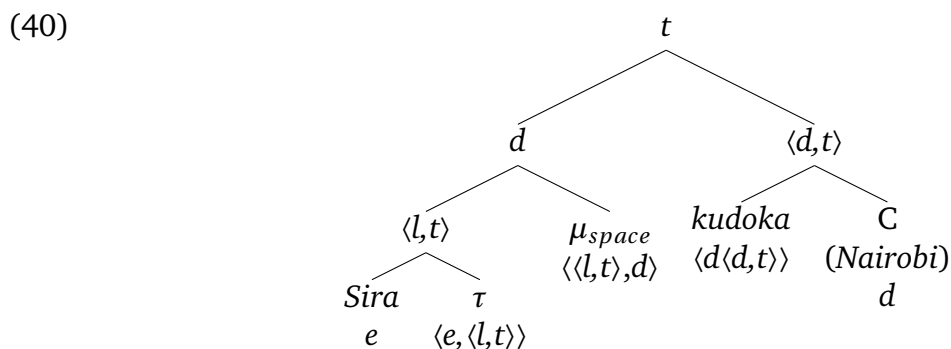4. Spatial use: Location function (τ) that maps individuals to their locations

(38) ⟦ τ ⟧ = $\lambda x \lambda l.\ l$ is a location of x

4.1   Spatial use

(39) Sira a-dok-i   (Nairobi)
      1Sira 1SM-DOK-FV Nairobi
      'Sira arrived (at Nairobi).'

- *Kudoka* expresses that the degree of Sira's location on a path meets or exceeds the degree of the threshhold of being in Nairobi.

- We treat "Nairobi" as an area in space with a crisp threshhold that defines whether or not one is in Nairobi. This threshhold can vary contextually; sometimes it might include the outskirts, while sometimes it might only include the city center.

- The location function τ raises Sira to the set of his locations, and the measure function μ_{space} maps this set to a degree on a scale of space.

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[14]This use of a type-shifter associating a set of locations or worlds with a degree is in the same spirit as type-shifters used to account for the ability of numerals to measure plural nouns (type $\langle e,t \rangle$), e.g. *three cats* (Rett 2018, 12); this suggests a possible route for extending this analysis to the nominal data in (12)-(15).

(40)

$$
\begin{array}{c}
t \\
\diagup \quad \diagdown \\
d \qquad\qquad \langle d,t \rangle
\end{array}
$$

```
                               t
                    ╱                    ╲
              d                           ⟨d,t⟩
          ╱       ╲                    ╱        ╲
      ⟨l,t⟩     μ_space          kudoka        C
    ╱    ╲      ⟨⟨l,t⟩,d⟩      ⟨d⟨d,t⟩⟩    (Nairobi)
  Sira    τ                                    d
   e    ⟨e,⟨l,t⟩⟩
```

- (39) is true iff the degree of Sira's location on a path of ordered locations meets or exceeds the contextual value of the threshhold of being in Nairobi.

- The change of location meaning arises from a requirement that the set of Sira's locations is not a singleton set.[15]

4.2 Degree use

(42) a. inyingu i-v-i   na   vuritu
          9pot   9SM-COP-FV with 13heaviness
          'The pot is heavy.'

      b. inyingu i-v-i   na   vuritu   vu-dok-an-a   ku-vunyany-a
          9pot   9SM-COP-FV with 13heaviness 13SM-DOK-PL-FV 15-break-FV
          imesa
          9table
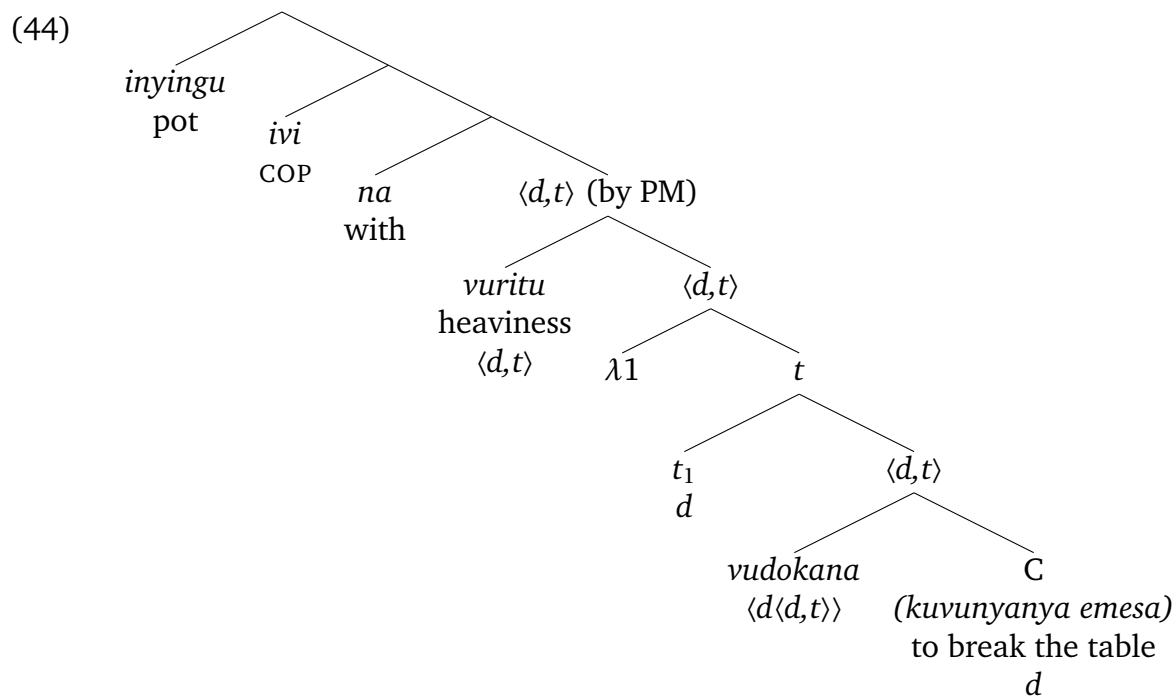   'The pot is heavy enough to break the table.'

- We assume that PCLs like *vuritu* 'heaviness' denote portions of degree scales ($\langle d,t \rangle$).

(43) ⟦ *vuritu* ⟧ = λd. d is a degree of heaviness

- We do not give an explicit semantics for the PCL predication in (42a); see Francez and Koontz-Garboden (2015) for discussion of possessive predications.

- The nominal PCL heads a relative clause, formed by movement and lambda-abstraction.

- *Kudoka* contributes that the degree of heaviness meets or exceeds the degree of the threshhold of breaking the table.

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[15]A reviewer points out that by positing a location function, we predict that it should be possible to predicate individuals of locations (assuming locations are type *l*). For example, *Sira is England* is predicted to be able to mean "Sira is in England." This prediction is borne out.

(41) Sira a-v-i   vuIngereza vula
      1Sira 1SM-COP-FV 13England 13DEM
      'Sira is in England.'

(44)

```
            inyingu
            pot     ivi
                    COP
                        na      ⟨d,t⟩ (by PM)
                        with
                              vuritu      ⟨d,t⟩
                              heaviness
                              ⟨d,t⟩    λ1        t
                                           t₁            ⟨d,t⟩
                                           d
                                                vudokana            C
                                                ⟨d⟨d,t⟩⟩      (kuvunyanya emesa)
                                                             to break the table
                                                                    d
```

- (42b) is true iff the pot's degree of heaviness meets or exceeds the contextual threshhold of heaviness at which the table will break.

- Our assumption about antonyms involving scale reversal (from Kennedy 2001) accounts for the interpretation of negative PCLs in *kudoka*-expressions.

(45) liboksi li-v-i   na   vwangu   vu-dok-an-a   ku-geng-w-a
      box   5SM-COP-FV with 13lightness 13SM-DOK-PL-FV 15-lift-PASS-FV
      'The box is light enough to be lifted.'

- The interpretation of (45) is that the degree of the box's lightness exceeds the degree of the threshhold at which it can be lifted. Lightness and weight are inversely correlated.

4.3 Modal use

(46) ku maragoo ku-dok-a Sira a-zi-e   yeng'o
      to 6law   15-DOK-FV 1Sira 1SM-go-SBJV home
      'According to the law, Sira must go home.'

Traditional Kratzerian view (Kratzer 1981, 1991):

- The modal base contains propositions, i.e., sets of possible worlds.

- Worlds in the modal base are ordered according to an ordering source (e.g. expectations, wishes, laws). The ordering source picks out the best worlds.

- If all the best worlds in the modal base relative to the ordering source are worlds in which a proposition p is true, then p is a necessity. That is, p is a necessity if all of the best worlds are p-worlds.
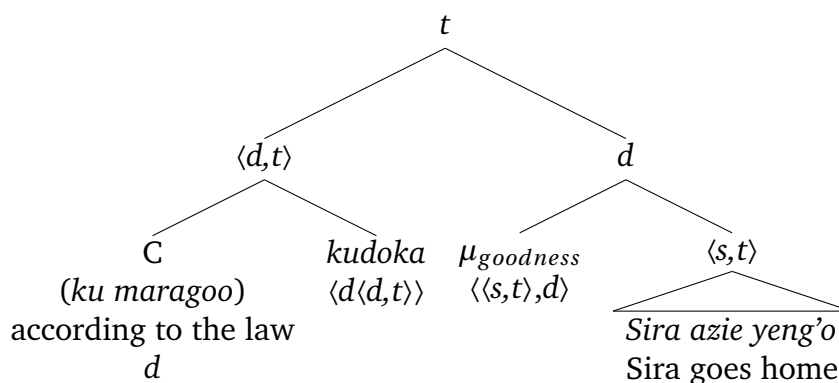
(47)
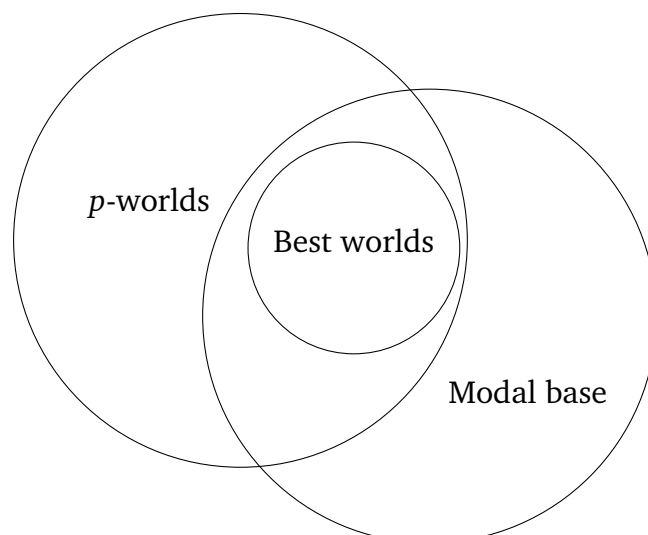
Our view (following Lassiter 2017):

- Worlds in the modal base are ranked according to the ordering source, and given a value on a scale of goodness (deontic modality), likelihood (epistemic modality), etc. (Lassiter, 2017, 186ff).

- Similarly, propositions can be assigned a value depending on how good/likely/expected they are. This can be done by looking at all of the worlds in p, assigning a value to each of these, and then averaging those values (see Lassiter 2017).

- If p's value is greater than or equal to that of the least-best world (the sufficiently ideal world), then p is a necessity.

- That is, p is a necessity if it's at least as good as the least-best world (i.e., the threshhold for best-ness).

(48)
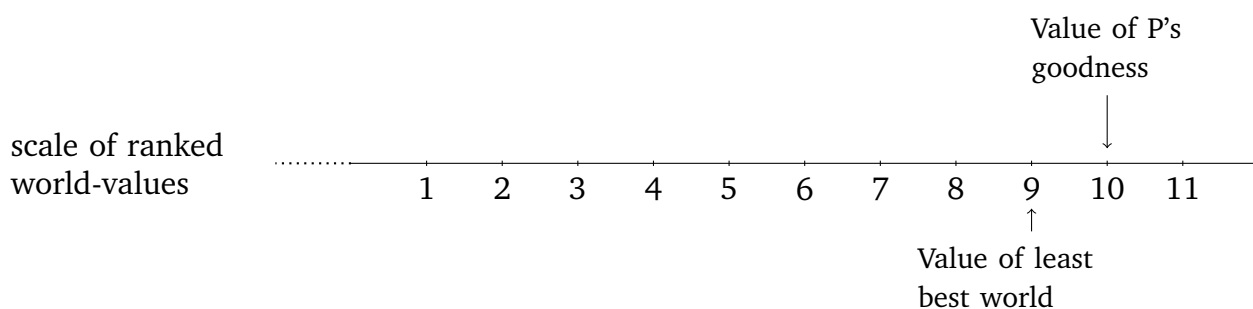
- We take this threshhold for best-ness to be the contextual degree argument of *kudoka*.

- The measure function μ_Σ takes the main proposition and maps it to a degree on a scale of e.g. goodness, likelihood, etc.

- *Kudoka* asserts that the degree of the main proposition p meets or exceeds the contextual threshhold of best-ness on the relevant scale; i.e., p is a necessity.

(49)

```
                                    t
                          /                    \
                     ⟨d,t⟩                        d
                   /        \                /        \
                  C        kudoka      μ_goodness      ⟨s,t⟩
             (ku maragoo)   ⟨d⟨d,t⟩⟩    ⟨⟨s,t⟩,d⟩       /    \
          according to the law                    Sira azie yeng'o
                  d                                Sira goes home
```

- (46) is true iff the degree of goodness of Sira going home exceeds the threshhold for best possible worlds according to the law.

4.4 Commentary

- Our semantics for *kudoka* is analogous to semantics proposed for POS.

(50) ⟦ *kudoka* ⟧ = $\lambda C_d \lambda d.$ **d** ≥ **C**

(51) ⟦ POS ⟧ = $\lambda G_{\langle d\langle e,t\rangle\rangle}\lambda x. \exists d[G(d)(x)$ & **d** > **standard**$_G]$

- These items differ with respect to their "exceed" relation.

  – Some proposals for POS (e.g. Kennedy 1999) require that *d significantly* exceeds the contextual standard.

  – *Kudoka* doesn't have any differential requirement.

- These items also differ in the value of the contextual degree that *d* must exceed.

  – For POS, this is the degree of the contextual standard of the scale associated with *G* (above which *G(x)* is true).

  – For *kudoka*, C is not the contextual standard of *G*.[16]

(52) Context: *Sira is 4 feet tall (i.e., Sira is short).*
  a. # Sira   a-v-i   na   vutambe
       1Sira 1SM-COP-FV with 13height

       'Sira is tall.'
  b. Sira   a-v-i   na   vutambe vu-dok-an-a   ku-lol-a   luvega
       1Sira 1SM-COP-FV with 13height 13SM-DOK-PL-FV 15-see-FV 5side
       lu-ndi   lwa lugaga
       5-other 5of 5fence

       'Sira is tall enough to see over the fence.'
       Lit. 'Sira is with a height that reaches seeing the other side of the fence.'

---

[16]However, our intuitions about English *enough*-expressions are that they differ in evaluativity (in Rett 2015's terminology) based on the predicate. For example, *The water is cold enough to drink* seems infelicitous in a context in which the water is still very warm (80F). This could have to do with the availability of other, less extreme temperature expressions (e.g. *cool*).

- Instead, C is simply some contextual value that can be lexically specified, and that *d* must meet or exceed.

- This raises the question of how much work the context can do.

- Meier (2003) proposes that English *enough*-expressions contain a covert conditional with a covert or overt possibility modal.

(53)   Bertha is old enough to drive a car.
       ≈ If Bertha is *d*-old, she is able to drive a car

- We don't think Meier (2003)'s analysis is appropriate for the Logoori data; for instance, the spatial usage of *kudoka* ('to arrive') does not have any intuitively conditional or modal meaning.

4.5   Support for a unified semantics

4.5.1   Language internal evidence

- An unrelated lexical item in Logoori shows the same polysemies as *kudoka*.

- The preposition *mpaka* has spatial, degree, and modal polysemies:[17]

(54)   Sira   a-zi-i   **mpaka** Nairobi
       1Sira 1SM-go-FV MPAKA   Nairobi
       'Sira went **until/up to** Nairobi.'   SPATIAL USE

(55)   kitabu ni   ki-doto sana **mpaka** vuri   msomi   a-nyal-a   ku-ki-som-a
       7book COP 7-easy very MPAKA   every 1student 1SM-can-FV 15-7OM-read-FV
       'This book is easy **enough** that every student can read it.'
       'The book is so easy, every student can read it.'
       Lit. 'This book is very easy until/up to every student can read it.'   DEGREE USE

(56)   **mpaka** Sira   a-zi-e   Nairobi
       MPAKA   1Sira 1SM-go-SBJV Nairobi
       'Sira **must** go to Nairobi.'   MODAL USE

- This data suggests that the spatial, degree, and modal meanings are truly underlyingly related, and that they are not just a lexical quirk of *kudoka*.

4.5.2   Cross-linguistic evidence

- Other Luyia languages have lexical items with both spatial and modal uses; we have informal reports that the degree use is also available (Gluckman et al. 2017).

(57)   'to arrive' / 'must'
       a. *kwenyekha, khoya*   Lubukusu
       b. *okhwola*   Lunyore

---

[17]*Mpaka* is borrowed from Swahili. In Swahili, it has a prepositional meaning ('until') and a nominal meaning ('border'). We have anecdotal evidence that *mpaka* may be used as a necessity modal in Swahili as well.

    c. *kukhoyera*   Lusaamia

    d. *khutukha*   Lutiriki

    e. *okhula*   Luwanga

- Only Lutiriki *khutukha* 'to arrive'/'must' is clearly cognate with Logoori *kudoka*. This again suggests that the polysemy is not just a lexical quirk of *kudoka*.[18]

- A spatial/degree polysemy is also observed in Tatar (Turkic) *citergä* (the modal use is unavailable).

(58) xat   irtägä   kil-ep   **cit-eçek-**∅
     letter tomorrow come-IP CIT-PROSP-3SG
     'The letter **will arrive** tomorrow.'   SPATIAL USE

(59) bu qader su   **cit-eçek-**∅.
     this much water CIT-PROSP-3SG
     'This much water **will be enough**.'   DEGREE USE

5   Conclusion

- Logoori *kudoka* displays a three-way polysemy suggesting that spatial paths, degree scales, and ordered possible worlds can be treated similarly in the grammar.

- We speculate that the three meanings form a scale from least to most complex: spatial, degree, and modal.[19]

- We take the spatial meaning of *kudoka* as its most basic usage, from which the other meanings arise.

- In future work, we would like to explore what *kudoka* can tell us about semantic change, in particular as it relates to sources of modality and degree expressions.

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[18]Lubukusu *kwenyekha* is cognate with Logoori *kwenya*; in Logoori, this lexical item expresses 'to want'/'should' (Gluckman et al. 2017).

[19]This is weakly supported by the fact that Tatar (Turkic) *citergä* has the spatial and degree meanings, but lacks the modal meaning.

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Appendix: Additional *kudoka* data

- We include here a few additional, peripheral uses of *kudoka* which may be subsumable under the present analysis.

(60)   *'to fit'*

mwigizi a-dok-a   mu zing'ovo
1teacher 1SM-DOK-FV in   10clothes

'The teacher fits in the clothing.'

(61)   *'to suit'*

Sira a-duk-an-a   kulia mandazi
1Sira 1SM-DOK-PL-FV 15eat 9mandazi

'Sira is suited to eat mandazi.'