Numerals and number concepts in Shua (Khoe-Kwadi)
Structure of paper

• Introduction
• Shua numerals
  – Traditional system of cardinal numerals
  – Ordinals
  – Extensions of the system
    • Borrowings
    • Terms for monetary units
• Handsigns for numbers
• Conclusions
• Acknowledgements
• Shua is an endangered Khoe-Kwadi language

– Spoken by a few thousand people, most of who reside in the area of the Makgadikgadi Pans in Botswana

– This paper is based on field work conducted in Nata, 2010-2011, @ 3 months per year
Genetic structure of Khoe-Kwadi family after Güldemann & Elderkin (2010)
• My research is part of the EuroBabel project

The Kalahari Basin area: a ‘Sprachbund’ on the verge of extinction (KBA)

– Where it is IP1, A documentation and description of Shua (East Kalahari Khoe)

• Main foci of IP1:

  – Description and documentation of Shua
  – Spatial and numerical language and cognition
• My main purposes in this paper are modest:

  – To describe the numeral system of the Shua language
    • Traditional
    • Modern elaborations
  – To say a little about uses and senses of numerals
  – To describe gestured numerals
• I will not be dealing with the original planned topic

  – Exact and approximate arithmetic in Shua

    • I conducted a set of experimental stimuli designed by Pierre Pica and Stanislas Dehaene
    • These were performed with half a dozen or so speakers

• Because only a small part has been transcribed I decided to focus instead on the numerals

  – And incorporate only some of the most obvious findings from the experimental stimuli

• Caution: there are a number of aspects of Shua phonology that are not yet sorted out, including tones

  – Indicated here only where I am fairly sure of them
Shua numerals

• Shua has a word ko: ‘number’, as in /uːiː ko/: ‘same number’
• This word forms compounds
  – Interrogative – involving ma: found in many other interrogatives
    • ma:ko ‘how many, how much’

  ma:ko /oː-a-ren /oa tya: hã:
  how:many child-PL COM you be
  ‘How many children do you have?’

  • Compare ma:ngka ‘how much’ – used in respect of mass quantities

 ma:ngka ?o tsha: sekutili ?a hã:
  how:much in water basin LOC be
  ‘How much water is in the basin?’

  – Definite determiner eku-ko (their-number) ‘that many, thus many’
The traditional system of cardinal numerals

• Shua has a “restricted numeral system” characteristic of many hunter-gatherer societies

<table>
<thead>
<tr>
<th>lu̅ˌi̅</th>
<th>‘one’</th>
</tr>
</thead>
<tbody>
<tr>
<td>lam</td>
<td>‘two’</td>
</tr>
<tr>
<td>ngona:, ǁobe̅ːː</td>
<td>‘three’</td>
</tr>
<tr>
<td>hatsa:</td>
<td>‘four’</td>
</tr>
<tr>
<td>gudoˌ tshau̅</td>
<td>‘five’ (‘baboon hand’)</td>
</tr>
<tr>
<td>ǀora:</td>
<td>‘few’</td>
</tr>
<tr>
<td>ǁhara:</td>
<td>‘many’</td>
</tr>
<tr>
<td>nyã̅ˌō̅</td>
<td>‘many’ (possibly Pandamatenga dialect)</td>
</tr>
</tbody>
</table>
Source: WALS online, Feature 131A: Numeral Bases

http://wals.info/feature/131A?z1=2995&v2=cf6f&v1=c00d&s=20&v3=cd00&v4=cccc&v5=cf00&v6=cf&z5=3000&z6=2997&z4=2999&z2=2996&z3=2998&tg_format=map&lat=5.5&lng=152.58&z=2&t=m
• These lexemes appear to be numerals

  – I don’t believe they are indefinite determiners (as per e.g. Hale 1975:295 for Warlpiri)
  – Or that they are non-cardinal quantifiers (as per Everett on Pirahã)

• This is my **belief** – I acknowledge evidence needs to be amassed (cf. my arguments for numerals in Australian languages)

  – Certainly unlikely to have been used in counting sequences, though there is some evidence of this usage today
  – This does not mean that they are not numerals, denoting cardinalities.

• All can be used in NPs to express **cardinal quantification**, when they normally precede the head N, except in pronominal NPs where they normally follow the head pronoun

\[
\text{ta: } \text{||obe}^{-:-} \text{ dji: } \text{\textquoteright}e: \text{ ?a } \text{tyanaha}
\]

I three stick fire LOC put
‘I put three sticks on the fire.’
• The numerals admit a certain amount of morphological modification
  – None of which appears to be peculiar to them
    • Though many of the specific senses and meaning modifications probably are
      – Doubtless there are also differences amongst the numerals as to the morphological processes admitted, and their senses
      – The following are attested
• Addition of the adverbialising derivational morpheme \( -se \):

- \( ȕȉ-se \) ‘alone, by self’
- \( am-se \) ‘(two) together, by selves’
- \( hara:-se \) ‘(many) as a group’
- \( ma: ko-se \) ‘how many together (did something)’

• Negative \( -m \), as in \( hara:-m \) ‘not many, a few’

- Which can be used in contrast with \( hara: \) ‘many’
  - ‘this side are many, that side are few’
• The morpheme –ose – possibly –o-se ‘in-ADV’ – can be added to a numeral to indicate number of times:

  – ǁhara:-ose ‘many times’

• It is also attested on mass quantifiers:

  – ma:ngka-ose ‘how long (spatial and temporal), how far’

  • Also given was ma:ngka o e for ‘how long’
• A “PGN” can apparently be added to some numerals:

– ǀu̯i̯-ma (one-MAS) ‘other one’

• Evidently this has a non-predictable effect

– Presumably more such constructions are possible, including

• With the plural on ‘one’ – giving ‘ones’ (one on a number of occasions)
• Reduplication of numerals has a distributive sense:

  – /u̱i̱ /u̱i̱ ‘one by one’
  – /am/am ‘two by two’ – /am-se also allegedly admits this sense
  – Also retriplication: ngona:ngona:ngona: ‘three by three’

• Reduplication – or repetition? – may have other uses as well

  – /u̱i̱e /u̱i̱ ‘exactly, the exact one’ – used in the context of enquiring about the best example of colour names
Senses of the numerals

• All of the items listed above have cardinal senses

  – Including exact cardinal specification

• The extent to which they admit approximate senses – e.g. *ngona*: ‘three’ for ‘few’ – is not known

  – This type of data is not easily or reliably elicited
  – Should come from usage, and usually requires a largish corpus
• Other uses and senses are attested
• Possibly they (or some of them) can be used in specification of mass quantification

  – ǁhara: for ‘large’, as well ‘many’
  – A possible bridging context for cardinal to mass:

    • On one occasion I enquired whether in the compound we were sitting there were more or fewer piles of sand than the other day
    • Previously there had been three piles, which had been made into one, and more added
    • The speaker replied that there were more (ǁhara:)

      – On enquiring about it, I was informed that the present big pile was made up of a number of small piles, and more – so more now

• Possibly there is some use of mass quantifiers in expression of vague cardinalities

  • tyːː ‘big’ and tyõ̊ẽ ‘small’ can be used in reference to cardinalities, ‘many’ and ‘few’

    – For example, tyõ̊ẽ ‘small’ was used in the context of the numerical stimuli in reference to smaller cardinalities of dots
• Let’s look at the most frequent of the numerals, and its attested senses: \( u\bar{i} \) ‘one’

– ‘same’:

\[
\text{esara } u\bar{i} \ kua \ i: \\
\text{they one like be} \\
\text{‘they are the same, alike’}
\]

– Also \( u\bar{i} -m \) (one-not) ‘not alike, different’ and \( u\bar{i} \ kua \ i:-m \) ‘different’

\[
\text{tsam } ku\bar{r}i\bar{i} -na \ u\bar{i} -m \\
\text{we year-PL one-NEG} \\
\text{‘We are different ages.’}
\]
— ‘only, just’

\[
ema \ aba:-n \ \text{\textasciitilde}a \ \text{\textasciitilde}i\text{-h\textasciitilde}:
\]
he  dog-PL with one  exist
‘He has only dogs (no cats)’

\[
Pono-\text{\textasciitilde}a \ \text{\textasciitilde}a \ \text{\textasciitilde}i\text{-\textasciitilde} \ ?\text{\textasciitilde}
\text{\textasciitilde}\text{\textasciitilde}
\]
Pono-FEM Pono-FEM one  be
‘Pono is just Pono.’

• Also available when attached to verbs: \textit{me}: \textit{\textasciitilde}i\text{-\textasciitilde} ‘just say’

— ‘be one (in number)’ – in “predicate” function

\[
\text{\textasciitilde}i\text{-\textasciitilde} \ ?\text{\textasciitilde} \ t\text{\textasciitilde}y\text{\textasciitilde}-ma \ \text{\textasciitilde} \ \text{\textasciitilde} \ \text{\textasciitilde} \ \text{\textasciitilde}
\]
one  be  eye-MAS  isn’t:it
‘I only have one good eye, don’t I.’
• There is some evidence that it can be used in the sense ‘the certain/particular one’ – but this usage is rare, and somewhat uncertain

/u-/e ti-/am a ta: e
one it my taste LOC I it
‘The one I tasted …’
• Also worthy of remark are unattested uses in Shua:

– Indefinite pronominal usage (‘someone’), as in ‘one should never tell the truth’

• Here *khoe* ‘person’ is invariably used in Shua

– ‘a little bit’ – a sense of ‘one’ in a number of languages with restricted numeral systems

– As a “substitute” (as per Halliday & Hasan 1976):
As already mentioned, the Shua system of numerals was presumably not used in counting.

- They don’t smell like counting numerals
- The quantities can be determined by subitising

There is some evidence that today they are used marginally in counting, though borrowings seem to be more frequently found in counting sequences.

- Everyone I worked with was proficient in counting – albeit not always very accurate
  - Evidently learnt in school
  - And everyone was able to count using eye saccades rather than pointing
• Observed naturalistic instances of counting are rare
• One of the few occasions I observed counting was:
  – A woman counting bricks that had been recently made and laid out on the ground in rows
  – She was observed to point successively at each brick in the arrangement
  – In response to ma:ko I was informed 28 (English), and /am broken
• There is a verb *ngǁeː* ‘to count’ (also ‘to reckon, to read’)

\[nyũ: \text{setina-na ma:ko Ÿë} \]
this brick-PL how:many be
‘how many bricks are here?’

\[\parallel hara: o Ÿë\]
many LOC be
‘there are many.’

\[to: ke nyũ: \text{setina-na ngǁeː-ʃa ma:ko Ÿë}\]
you PRES this brick-PL count-TEM how:many be
‘when you count them, how many bricks are here?’

\[u⁻i⁻ g|aro Ÿë\]
one ostrich be
‘there are twenty.’

My guess is that the ‘reckon’ sense is earlier, and that the ‘read’ and ‘count’ senses are recent.
• When asked how she counted the bricks, the speaker replied that she did not count, but got the number by just looking

– Clearly impossible to subitise this number
– The speaker responded immediately – evidently she had been expecting this question, and had prepared herself

• She did not use any obvious pointing gestures
• My guess is that she went successively through the bricks with (voluntary) eye saccades
Ordinals

• Use of spatial terms for ordinal placements, especially in reference to entities arranged in space (e.g. in a line)
  – k’ayo-ka (front-INS) ‘front, first’, also k’ay
  – tya:kua ‘middle’
  – nydjoro-ka (back-INS) ‘back, behind, last’ and /ho: ‘finish, last’ (as in last born child, last in a sequence)

• Ordinals can also be formed from the cardinals by addition of –odi (≈ -di POS?) – attested only for 2 and 3:

| lament-odi (loma) | 2
| ngona:-odi (loma) | 3
| 2rd in a sequence, including in birth sequence | 3rd (including in birth sequence) |
Note also that ordinal position can be used in identification

- ła-yi-di-ła ~ ła-yi-di ‘front one’
- ły-doro-di-ła ‘end one, last one’
- Also ᵁho: ᵃ’e oka and ᵁho: ᵃ’e di ‘last one’

 Likewise with numerals

- ᵇongona:ka-di ~ ᵇongona:-odzi-ała ~ ᵇ obe-odzi-ała ‘third one’
- ᵇam-odzi-ała ‘second one’
• Borrowing of ordinals

– From English – *number one*, meaning ‘first’
– Also from Setswana (in contrast to the situation for cardinal numerals)

• *yantha ~ wantha* ‘first one’
• *wabobedi* ‘second one’
• *waboraro* ‘third one’
• *yabugelo* ‘last one’
• A few non-cardinal quantifiers are attested:

  – \( i^-\overline{e} \) ‘all’
  – \( ine \) ‘some’, as in \( ine \ khoena \) ‘some people’
  – \( nganu \) ‘enough, sufficient’

• Unlike the numerals, \( i^-\overline{e} \) ‘all’ normally follows the head N, and can “float”, and need not be adjacent to the nominal it quantifies:

• Also have uses other than quantification:

\[
\text{nynye eʃi: } i^-\overline{e} \text{ eʃi: } ?i: \ ?i: \ ?e \\
\text{this her all her like like be}
\]

‘that’s the way she is (there is nothing that can be done about it)’
Extensions of the system

• Speakers play with the system, constructing new forms to express higher numerals

  – This occasionally happens in linguistic interview sessions
  – For instance:

    • gudo_ tshau^ ngona: tshau^ /oa hai 8
    • /am gudo_ tshau^ 10

  – I have not observed this used for numbers beyond about 10

  • And reactions of speakers suggest that it is often taken in a humorous/non-serious way
• In everyday modern contexts, the numeral system is extended in two main ways

  – By borrowings
  – Usage of terms for monetary units

• These extensions are common and used regularly in Shua speech
Borrowings

• All borrowings of numerals are from English

  – No evidence of use of Setswana numerals, except for *lesome tshao* (‘ten hand’) 100

• Note also that in Setswana speech there is also a high incidence of borrowing of English numerals:

  – In giving phone numbers – invariably English

    » Ditto in Shua

  – In stating prices of commodities

  – For most modern artefacts borrowings are from Setswana, not English
<table>
<thead>
<tr>
<th>Language</th>
<th>Value</th>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>fo:</td>
<td>4</td>
<td>toenti</td>
<td>20</td>
</tr>
<tr>
<td>faiv(i)</td>
<td>5</td>
<td>toenti oan</td>
<td>21</td>
</tr>
<tr>
<td>sikisi</td>
<td>6</td>
<td>toenti tu:</td>
<td>22</td>
</tr>
<tr>
<td>seben(e)</td>
<td>7</td>
<td>toenti tri:</td>
<td>23</td>
</tr>
<tr>
<td>eiti:</td>
<td>8</td>
<td>toenti eiti:</td>
<td>28</td>
</tr>
<tr>
<td>naini:</td>
<td>9</td>
<td>se:ti ~ θe:ti</td>
<td>30</td>
</tr>
<tr>
<td>ten(i)</td>
<td>10</td>
<td>se:ti naini:</td>
<td>39</td>
</tr>
<tr>
<td>leben</td>
<td>11</td>
<td>fo:ti</td>
<td>40</td>
</tr>
<tr>
<td>thoelf</td>
<td>12</td>
<td>fifti:</td>
<td>50</td>
</tr>
<tr>
<td>se:tin</td>
<td>13</td>
<td>sikst:</td>
<td>60</td>
</tr>
<tr>
<td>fo:ti:n(i)</td>
<td>14</td>
<td>seventi</td>
<td>70</td>
</tr>
<tr>
<td>fifti:n(i)</td>
<td>15</td>
<td>eiti:</td>
<td>80</td>
</tr>
<tr>
<td>siksti:n</td>
<td>16</td>
<td>nainth:</td>
<td>90</td>
</tr>
<tr>
<td>sebenti:n</td>
<td>17</td>
<td>hunderete</td>
<td>100</td>
</tr>
<tr>
<td>eiti:n</td>
<td>18</td>
<td>fo: hunderete</td>
<td>400</td>
</tr>
<tr>
<td>naint:n</td>
<td>19</td>
<td>tauzande</td>
<td>1000</td>
</tr>
</tbody>
</table>

These appear to be homophonous
• The borrowed terms are used in indicating times according to the clock – generally with addition of –ka INS

  – ngona:-ka (three-INS) ‘three o’clock’
  – ma: ‘head’ is used to indicate precise time point

• The term zero is also found

  – Recorded in the morphological form zero-na
  – This was used in the context of getting zeros in exams – zero as a result on more than one occasion
• The Botswanan coins and notes have Shua descriptive names

  – And by implication to numbers corresponding to the value

• For instance, in counting bricks

  – Recall example given earlier for ‘twenty bricks’
# Bank notes

<table>
<thead>
<tr>
<th>Gloss</th>
<th>Value (PU)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>pa:lamente</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>faiv ponto</td>
<td>10 (£1=2PU)</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>aru</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ua koa i:</td>
</tr>
<tr>
<td>Gloss</td>
<td>Value (PU)</td>
<td>Comment</td>
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<tr>
<td>------------</td>
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<td>--------------------------------------------------------------</td>
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<tr>
<td></td>
<td></td>
<td>om koa i:</td>
</tr>
<tr>
<td>sky like</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>I think ‘zebra’ but I can’t find it in my field notes</td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>
• Other quantities can be specified by quantifying these terms:

  – \( \text{lam } g\text{aru} \) (two ostrich) = 40

  • Unquantified, the sense is 1 unit

• Other expressions are possible, at least in the context of quantifying money:

  – \( \text{ll'}ua \text{ koa i: g\text{ana e nyam a h\~a: }\text{e}} \) (‘fifty that has a leaf on top’) 60

• The degree of conventionalisation of these expressions is uncertain
Just for the record ...
Handsigns for numbers

• Shua speakers use relatively conventionalised handsigns for the numbers 1 to 10

  – When they use them is not certain, and I did not observe “natural” usage – despite plenty of opportunities
  – There is a good deal of inter-speaker agreement regarding the signs

• But also some degree of variation
The oldest speaker I worked with showing the signs 1-10
• Some observations:

– All speakers began by raising small finger, continuing to raise fingers in sequence to the thumb of the same hand

– All speakers continued on second hand with thumb, proceeding to raise digits until all raised

– Most began with left hand, and continued on right

• A few began with right

• In one case, the speaker used only the right hand for indicating 6-10
– Considerable variation in orientation of the hands, even for a single signer
– The palm of the hand often faces the addressee
– Usually the fingers are simply extended as the person goes through the counting sequence

• But the oldest speaker used the index finger of the right hand successively on the raised fingers of the left hand in the sequence shown in the slides

– But he did not always do so
• The gestures I recorded were all part of a counting sequence
• I was unable to elicit signs for the quantities outside of the sequence

  – When I did ask for e.g. 8 by itself, this was misunderstood

• I tried also to get signs for larger numbers – without success

  – Here is one attempt for 20:
• I was told that one might use toes as well as fingers to indicate 20, but no one did so
• One speaker said 20 could be represented by bringing the two hands together

  – But she also said that this represented 10
  – Clapping once indicates 10 in the Bantu language Čiluba (Democratic Republic of the Congo) (Lukusa 2007)
However, the oldest speaker did on occasions use the signs for numbers 1-10 for the same number of tens

– E.g. 60 by the sign for 6
• There is much variation in handsigns for numbers in Africa – Zaslavsky 1979; Lukusa 2007

  – E.g. use of thumb, index finger, little finger for representing 1

    • Are the other two ever used?

• Setswana handsigns are very similar to the ones used by Shua (Lukusa 2007)

  – But apparently more consistent:

    • Hand faces addressee
    • Same sequence of digit extensions
    • Start on the non-dominant hand (it appears)
• This suggests borrowing of the handsigns from Setswana into Shua

  – Lesser consistency is suggestive of this direction of borrowing

• BK sometimes used the thumb for 1, and follow a sequence as in mainland Europe

  – Influence from South Africa, where he studied as a university student?

In contrast to spoken numerals, which are not borrowed from Setswana
Conclusions

• This paper has described the numeral system of Shua

  – The traditional “restricted” system
  – The extensions of modern times

• Which are characterised by borrowings (from English) rather than neologisms (or combinations of existing forms), and extensions from terms for banknotes

• I have described the limited set of numeral gestures, which are evidently borrowed from Setswana (not English)
• A lot remains to be done, including:

  – To motivate the claim that the lexical items in question are numerals
    
    • Which demands an answer to the question “what is a numeral?”
      
      – No requirement of exactitude of cardinality representation
      – No requirement of usage in counting (a process of determining cardinality of somewhat limited usage)
    
    • Do numerals form an emic subset of the lexemes of a language?
  
  – To examine more closely the usage of the lexical items in question
    
    • Identifying their range of senses
    • Distinguishing their core (semantic) meanings from their pragmatic (inferred) meanings
– Situating the Shua system with respect to the systems of other Khoe-Kwadi languages
  
  • Leading to reconstruction of the proto-system

– Situating it in relation to other languages of the region (Bantu, Tuu, Taa)
  
  • What areal influences can be identified?
  • How far back can these be traced?

– Exploring arithmetical cognition of Shua
  
  • Role and methods of quantification employed (e.g. subitising, counting, others?)
  • Their performance on Pica-Dehaene stimuli

– Examining links between cardinality and mass quantity in both language and cognition
Acknowledgements

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