Complex simplex numerals

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Introduction

Simplex numerals

Complex numerals

Structures

Spellout
Two functions of numerals
Bultinck (2005), Rothstein (2013, 2017)
Two functions of numerals
Bultinck (2005), Rothstein (2013, 2017)

- **abstract counting** ⇒ reference to a number concept

(1)  
\[ \begin{align*} 
  & a. \text{ Ten divided by } \textcolor{blue}{\text{five}} \text{ equals two.} \\
  & b. \text{ Five is a Fibonacci number.} 
\end{align*} \]
Two functions

Two functions of numerals
Bultinck (2005), Rothstein (2013, 2017)

► **abstract counting** \(\Rightarrow\) reference to a number concept

(1)  
   a. Ten divided by **five** equals two.  
   b. **Five** is a Fibonacci number.

► **object counting** \(\Rightarrow\) quantification over entities

(2)  
   a. **five** cats  
   b. the **five** girls
The main claim

Question

► what is the relationship between object-counting and abstract-counting numerals?
The main claim

Question

► what is the relationship between object-counting and abstract-counting numerals?

Answer

► object-counting numerals both syntactically and semantically contain abstract-counting numerals
The main claim

Question
- what is the relationship between object-counting and abstract-counting numerals?

Answer
- object-counting numerals both syntactically and semantically contain abstract-counting numerals

Data
- we look at morphological relations between the two types of numerals
Distinguishing the two functions

Abstract number concepts
Rothstein (2013, 2017)

- distinct properties than pluralities of individuals

- Five is prime.
- Five is odd.
- Five is a Fibonacci number.

- #Five things are prime.
- #Five things are odd.
- #Five things are a Fibonacci number.
Distinguishing the two functions

Abstract number concepts
Rothstein (2013, 2017)

- distinct properties than pluralities of individuals

(3)   a. Five is prime.
      b. Five is odd.
      c. Five is a Fibonacci number.
Distinguishing the two functions

Abstract number concepts
Rothstein (2013, 2017)

- distinct properties than pluralities of individuals

(3)  
  a. *Five* is prime.  
  b. *Five* is odd.  
  c. *Five* is a Fibonacci number.

(4)  
  a. #*Five* things are prime.  
  b. #*Five* things are odd.  
  c. #*Five* things are a Fibonacci number.
Distinguishing the two functions

Abstract number concepts
Rothstein (2013, 2017)

- compatibility with mathematical contexts
Distinguishing the two functions

Abstract number concepts
Rothstein (2013, 2017)

- compatibility with mathematical contexts

(5)  
  a. Five times two equals ten.
  b. Five is smaller than six.
  c. Johnny can count up to five.

(6)  
  a. #Five things times two things equals ten things.
  b. #Five things are smaller than six things.
  c. #Johnny can count up to five things.
Distinguishing the two functions

Abstract number concepts
Rothstein (2013, 2017)

► compatibility with mathematical contexts

(5)  a. Five times two equals ten.
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(6)  a. #Five things times two things equals ten things.
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Distinguishing the two functions

Modification by numeral modifiers


▶ only object-counting numerals allow for modification
Distinguishing the two functions

Modification by numeral modifiers

► only object-counting numerals allow for modification

(7) 
  a. More than five cities were destroyed.
  b. At least five children got sick.
  c. All five cats who live in the barn are crazy.
Distinguishing the two functions

Modification by numeral modifiers


- only object-counting numerals allow for modification

(7)  
  a. More than five cities were destroyed.  
  b. At least five children got sick.  
  c. All five cats who live in the barn are crazy.

(8)  
  a. #More than five is a Fibonacci number.  
  b. #At least five times two equals ten.  
  c. #All five is odd.
Morphological marking patterns

Meaning/form correspondences


- languages mark the distinction in various ways
Morphological marking patterns

Meaning/form correspondences

- languages mark the distinction in various ways

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<tr>
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<td>OBJECT</td>
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Morphological marking patterns

Meaning/form correspondences

▶ languages mark the distinction in various ways

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Morphological marking patterns

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syncretism    stacking
Morphological marking patterns

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Languages mark the distinction in various ways:

- syncretism
- stacking
- suppletion
Morphological marking patterns

Meaning/form correspondences


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Morphological marking patterns

Meaning/form correspondences


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Introduction

Simplex numerals

Complex numerals

Structures

Spellout
**Syncretism**: object counting = abstract counting


- both functions expressed by the same formal exponent
Syncretism: object counting = abstract counting

- both functions expressed by the same formal exponent

(9)  
a. five cats  
b. Ten divided by five equals two.
Syncretism: object counting = abstract counting


- both functions expressed by the same formal exponent

(9)  
  a. five cats
  b. Ten divided by five equals two.

(10)  
  a. pět koček
      five cats
      ‘five cats’
  b. Dva plus pět je sedm.
      two plus five is seven
      ‘Two plus five is seven.’
Stacking: object counting > abstract counting


▶ attested in many classifier languages but also in Yoruba
Stacking: object counting > abstract counting
▶ attested in many classifier languages but also in Yoruba

(11) a. *go-no ringo
    five-GEN apple
b. go-ko-no ringo
    five-CL-GEN apple
    ‘five apples’

Japanese
Stacking: object counting > abstract counting

- attested in many classifier languages but also in Yoruba

(11) a. *go-no ringo
five-GEN apple
b. go-ko-no ringo
five-CL-GEN apple
‘five apples’

(12) a. juu waru go-wa ni-da.
ten divide.by five-TOP two-COP
‘Ten divided by five is two.’
b. #juu-ko waru go-ko-wa ni-ko-da.
ten-CL divide.by five-CL-TOP two-CL-COP
Suppletion

**Suppletivism:** object counting ≠ abstract counting

- morphologically independent forms for 2 in Maltese

a. *tnejn* two
   *nisa* women
   **‘two women’** Maltese

b. *żewġ* two
   *nisa* women

---

(13)

---

(14)

---

(12) / 43
Suppletion

**Suppletivism:** object counting ≠ abstract counting


► morphologically independent forms for 2 in Maltese

(13)  

a. *tnejn* nisa  
  two women

b. żewġ nisa  
  two women  
  ‘two women’  
  Maltese
Suppletion

**Suppletivism**: object counting ≠ abstract counting

▶ morphologically independent forms for 2 in Maltese

(13) a. *tnejn nisa
two women
b. żewġ nisa
two women
‘two women’

(14) a. Tnejn u tnejn jagħmlu erbgħa.
two and two they-make four
‘Two and two make four.’
b. *Żewġ u żewġ jagħmlu erbgħa.
two and two they-make four
Introduction

Simplex numerals

Complex numerals

Structures

Spellout
Syncretism

Numerals in Shuhi (Qiangic)
Qi & He (2019)
Syncretism

Numerals in Shuhi (Qiangic)

Qi & He (2019)

(15) a. ʁɔʔ₃₅ ʥi⁶⁵-ko⁶⁵
    horse one-cl
    ‘one horse’

b. ȵu⁵⁵ ɡu³¹ 饬i³³-ly⁵⁵
    cloth one-cl
    ‘one cloth’

c. ɫa³³ re⁵⁵ 饬i³³-ʈʃu⁵⁵
    towel one-cl
    ‘one towel’
Syncretism

Numerals in Shuhi (Qiangic)
Qi & He (2019)

(15)  a. \( \text{rɔ}^{35}\text{dzi}^{33}\text{-ko}^{35} \)
     horse one-CL
     ‘one horse’

  b. \( \text{nɯ}^{55}\text{gu}^{31}\text{dzi}^{33}\text{-ly}^{55} \)
     cloth one-CL
     ‘one cloth’

  c. \( \text{la}^{33}\text{re}^{55}\text{dzi}^{33}\text{-ţshu}^{55} \)
     towel one-CL
     ‘one towel’

(16)  \( \text{dzi}^{33}\text{-ko}^{35}\text{-re}^{33}\text{dzi}^{33}\text{-ko}^{35}\text{-ho}^{\sim33}\text{me}^{33}\text{-ba}^{33}\text{-le}^{55}\text{ŋe}^{33}\text{-ko}^{35} \)

     one-CL-ABL one-CL-LOC DIR-add-AUX two-CL

     le^{33}\text{-zi}^{33}\text{-dzi}^{33}\text{-ţshu}^{55} .
     DIR-become-DUR
     ‘One plus one is two.’

Shuhi (Qiangic)
Stacking

Numerals 1–5 in Vera’a (Vanuatu)
Schnell (2011)
Stacking

Numerals 1–5 in Vera’a (Vanuatu)

Schnell (2011)

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<td>vō-ruō</td>
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<td>3</td>
<td>vō-’ōl</td>
<td>vag-’ōl</td>
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<tr>
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Numerals 1–5 in Vera’a (Vanuatu)
Schnell (2011)

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(17) vēvē-gi ne lukun ēn naw, din ēn vō-‘ōl... mother-3SG TAM count ART wave reach ART NBR-three ‘Then his mother counted the waves reaching (the number) three...’ Vera’a (Vanuatu)
Stacking

Numerals 1–5 in Vera’a (Vanuatu)
Schnell (2011)

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(17) vēvē-gi ne lukun ēn naw, din ēn vō-’ōl...
mother-3SG TAM count ART wave reach ART NBR-three
‘Then his mother counted the waves reaching (the number)
three...’ Vera’a (Vanuatu)

(18) ēn woqe’enge ne vō-ru
ART tree LIG NBR-two
‘two trees’ Vera’a (Vanuatu)
Suppletion

Abkhaz (Northwest Caucasian)


- suffix -ba ⇒ abstract counting
- suffix -j°ó(k’) ⇒ numerals counting humans
- twist: -ba also on numerals used to count non-human objects

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<td>x°-j°ó(k’)</td>
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<td>f-j°ó(k’)</td>
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<td>bəž’-j°ó(k’)</td>
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<td>8</td>
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## Summary

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Introduction

Simplex numerals

Complex numerals

**Structures**

Spellout
Universal semantic features

Key intuition concerning numerals

- numerals are at their core scalar entities
Universal semantic features

Key intuition concerning numerals

- numerals are at their core scalar entities
- each numeral $\Rightarrow$ interval on the number scale
Universal semantic features

Key intuition concerning numerals

- numerals are at their core scalar entities
- each numeral ⇒ interval on the number scale
- non-arbitrary starting point ⇒ 0
Universal semantic features

Key intuition concerning numerals

- numerals are at their core scalar entities
- each numeral ⇒ interval on the number scale
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Motivation

Universal semantic features

Key intuition concerning numerals

- numerals are at their core scalar entities
- each numeral ⇒ interval on the number scale
- non-arbitrary starting point ⇒ 0

Motivation


- research on spatial/directional numeral modifiers

(19)  

a.  above five  
b.  between five and eight
Universal semantic features

Key intuition concerning numerals

- numerals are at their core scalar entities
- each numeral $\Rightarrow$ interval on the number scale
- non-arbitrary starting point $\Rightarrow 0$

Motivation


- research on spatial/directional numeral modifiers

(19) a. above five
    b. between five and eight

- interval-based semantics of degree

(20) a. Anne is taller than everybody else is.
    b. Anne has more cats than everybody else.
Universal semantic features

Standard approach to classifiers
  ▶ mass-like semantics of nouns in classifier languages
  ▶ classifiers compensate semantic deficits of nouns
Universal semantic features

Standard approach to classifiers

► mass-like semantics of nouns in classifier languages
► classifiers compensate semantic deficits of nouns

Alternative view

► different semantics of numerals in classifier languages
► classifiers compensate semantic deficits of numerals
Universal semantic features

Standard approach to classifiers
  ▶  mass-like semantics of nouns in classifier languages
  ▶  classifiers compensate semantic deficits of nouns

Alternative view
  ▶  different semantics of numerals in classifier languages
  ▶  classifiers compensate semantic deficits of numerals

Counting via measure functions
Krifka (1989)
  ▶  natural unit/object unit operation
  ▶  \( #(P) \) maps a plurality to a number of individuals
Universal semantic features

Three semantic primitives

- closed interval ⇒ set of numbers

(21)  
a. \[ [\text{SCALE}_m]_{(n,t)} = \lambda n [0 \leq n \leq m] \]
b. \[ [\text{SCALE}_5] = [0, 5] \]
Universal semantic features

Three semantic primitives

- closed interval ⇒ set of numbers

(21)  
  a. \( \left[ \text{SCALE}_m \right]_{\langle n,t \rangle} = \lambda n \ [0 \leq n \leq m] \)  
  b. \( \left[ \text{SCALE}_5 \right] = [0, 5] \)

- maximization operator ⇒ name of a number concept

(22)  
  a. \( \left[ \text{NUM} \right]_{\langle \langle n,t \rangle, n \rangle} = \lambda P \langle n,t \rangle [\text{MAX}(P)] \)  
  b. \( \left[ \text{NUM} \right] (\left[ \text{SCALE}_5 \right]) = 5 \)
Universal semantic features

Three semantic primitives

- closed interval ⇒ set of numbers

(21)  

  a.  \([\text{SCALE}_m]_{(n,t)} = \lambda n [0 \leq n \leq m]\)  
  b.  \([\text{SCALE}_5] = [0, 5]\)

- maximization operator ⇒ name of a number concept

(22)  

  a.  \([\text{NUM}]_{(n,t),n} = \lambda P_{(n,t)}[\text{MAX}(P)]\)  
  b.  \([\text{NUM}]([\text{SCALE}_5]) = 5\)

- classifier semantics ⇒ shift to a predicate modifier

(23)  

  a.  \([\text{CL}]_{n,(e,t),(e,t)} = \lambda n \lambda P_{(e,t)}\lambda x[\#P(x) \land \#(P)(x) = n]\)  
  b.  \([\text{CL}]([\text{NUM}]([\text{SCALE}_5])) = \lambda P_{(e,t)}\lambda x[\#P(x) \land \#(P)(x) = 5]\)
Universal semantic features

Structures
- abstract-counting numerals
Universal semantic features

Structures

- abstract-counting numerals

(24)

\[
\begin{array}{ccc}
\text{NUMP}_n & \text{SCALE}_5 & \text{NUMM}\langle\langle n,t\rangle,n \rangle \\
5 & \lambda n \cdot [0 \leq n \leq 5] & \lambda P_{\langle n,t\rangle}[\text{MAX}(P)]
\end{array}
\]
Universal semantic features

Structures

- object-counting numerals
Universal semantic features

Structures

- object-counting numerals

(25)

\[ \text{CLP} \langle \langle e, t \rangle, \langle e, t \rangle \rangle \]
\[ \lambda P_{\langle e, t \rangle} \lambda x \ P(x) \land \#(P)(x) = 5 \]

\[ \text{CL} \langle n, \langle \langle e, t \rangle, \langle e, t \rangle \rangle \rangle \]
\[ \lambda n \lambda P_{\langle e, t \rangle} \lambda x \ P(x) \land \#(P)(x) = n \]

\[ \text{NUMP} n \]
\[ 5 \]

\[ \text{NUM} \langle \langle n, t \rangle, n \rangle \]
\[ \lambda P_{\langle n, t \rangle} [\text{MAX}(P)] \]

\[ \text{SCALE} 5 \langle n, t \rangle \]
\[ \lambda n [0 \leq n \leq 5] \]
Introduction

Simplex numerals

Complex numerals

Structures

Spellout
Nanosyntax

Starke (2009, 2018), Caha (2009), Baunaz & Lander (2018), Caha et al. (2019)

▶ realizational model of morphology
Nanosyntax

Starke (2009, 2018), Caha (2009), Baunaz & Lander (2018), Caha et al. (2019)

- realizational model of morphology
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- maps structures to their pronunciation using lexical entries
- phrasal spellout
- cyclic
- spellout driven movement
- deriving different lexicalizations ⇒ account for the typology
**Simplex numerals: Syncretism**

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</table>
Simplex numerals: Syncretism

(26)  CLP $\Leftrightarrow$ /five/

```
   CLP
     / /
   /     \\
 NUM   SCALE
    / \
   NUM
```

...
Simplex numerals: Syncretism

(26) \[ \text{CLP} \iff /f\text{ive}/ \]

\[
\begin{align*}
\text{CL} & \quad \text{NUMP} \\
\text{NUM} & \quad \text{SCALE}_5 \\
\text{...} \\
\end{align*}
\]

(27) **THE SUPerset PRINCIPLE** (Starke 2009):
A lexically stored tree L matches a syntactic node S iff L contains the syntactic tree dominated by S as a subtree.
Simplex numerals: Syncretism

(26) \[ \text{CLP} \iff /five/ \]

\[
\text{CL} \quad \text{NUMP}
\]

\[
\text{NUM} \quad \text{SCALE}_5
\]

\[
\ldots
\]

(27) **The Superset Principle** (Starke 2009):
A lexically stored tree \( L \) matches a syntactic node \( S \) iff \( L \) contains the syntactic tree dominated by \( S \) as a subtree.
Simplex numerals: Syncretism

(26) \( \text{*ClP*} \leftrightarrow /\text{five}/ \)

\[
\begin{array}{c}
\text{*Cl*} \quad \text{*Nump*} \\
\text{*Num*} \quad \text{*Scale}_5* \\
\text{...} \\
\end{array}
\]

(27) **The Superset Principle** (Starke 2009):
A lexically stored tree \( L \) matches a syntactic node \( S \) iff \( L \) contains the syntactic tree dominated by \( S \) as a subtree.
Simplex numerals: Syncretism

(26)  \[ *\text{Cl}P* \iff /five/ \]

(27)  **THE SUPerset PRINCIPLE** (Starke 2009):

A lexically stored tree L matches a syntactic node S iff L contains the syntactic tree dominated by S as a subtree.
Simplex numerals: Syncretism

(26) \[ \text{CLP} \iff /five/ \]

\[
\begin{array}{c}
\text{CL} \\
\text{NUMP} \\
\text{NUM} \\
\text{SCALE}_5 \\
\triangle \\
\end{array}
\]

\[
\begin{array}{c}
\text{NUMP} \\
\text{NUM} \\
\text{SCALE}_5 \\
\triangle \\
\end{array}
\]

(27) **The Superset Principle** (Starke 2009):
A lexically stored tree L matches a syntactic node S iff L contains the syntactic tree dominated by S as a subtree.
Simplex numerals: Syncretism

(26) \[ \text{ClP} \Leftrightarrow /five/ \]

\[
\begin{array}{c}
\text{Cl} \\
*\text{NUMP}*
\end{array}
\]

\[
\begin{array}{c}
*\text{NUM}*
\end{array}
\]

\[
\begin{array}{c}
\text{SCALE}_5
\end{array}
\]

(27) **THE SUPERTSET PRINCIPLE** (Starke 2009):
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(26) \[ \text{ClP} \iff /five/ \]

```
Cl
  *NUMP*
    *NUM* SCALE5
```

(27) **The Superset Principle** (Starke 2009):

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Simplex numerals: Syncretism

(26) \[ \text{CLP} \iff /five/ \]

\[
\begin{array}{c}
\text{CL} \\
*\text{NUMP}* \\
*\text{Num}* \\
\text{SCALE}_{5} \\
\end{array}
\]

\[
\begin{array}{c}
*\text{SCALE}_{5}* \\
\end{array}
\]

(27) \[
\begin{array}{c|c|c}
\text{ABSTRACT} & \text{OBJECT} \\
\hline
\text{SCALE} & \text{NUM} & \text{SCALE} & \text{NUM} & \text{CL} \\
\hline
five & \text{ENG 5} & \text{five} & \\
\end{array}
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Simplex numerals: Suppletion

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<tr>
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<tr>
<td></td>
<td><strong>żewğ</strong></td>
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(28)
Simplex numerals: Suppletion

(29) \[ \text{NUMP} \iff /\text{tnejn}/ \]

(30) \[ \text{CLP} \iff /\text{żewgi}/ \]
Simplex numerals: Suppletion

(29) \[ \text{NUMP} \iff /tnejn/ \]
(30) \[ \text{CLP} \iff /żewg/ \]
Simplex numerals: Suppletion

(29) \[ \text{*NUMP*} \iff /\text{tnejn}/ \]

\[
\text{*NUM*} \quad \text{*SCALE}_2 \quad \triangle
\]

\[
\ldots
\]

(30) \[ \text{CLP} \iff /\text{żewg}/ \]

\[
\text{CL} \quad \text{*NUMP*}
\]

\[
\text{*NUM*} \quad \text{*SCALE}_2 \quad \triangle
\]

\[
\ldots
\]

(31) **THE ELSEWHERE CONDITION** (Kiparsky 1973):
When multiple items match, chose the more specific one (it has fewer superfluous features).
Simplex numerals: Suppletion

(29)  
\[ *\text{NUMP}^* \iff /\text{tnejn}/ \]
\[ *\text{NUM}^* \quad *\text{SCALE}_2^* \]
\[ \quad \quad \quad \quad \downarrow \]
\[ \quad \quad \quad \quad \quad \text{...} \]

(30)  
\[ \text{CLP} \iff /\text{żewg}/ \]
\[ \text{CL} \quad *\text{NUMP}^* \]
\[ *\text{NUM}^* \quad *\text{SCALE}_2^* \]
\[ \quad \quad \quad \quad \downarrow \]
\[ \quad \quad \quad \quad \quad \text{...} \]

(31)  
THE ELSEWHERE CONDITION (Kiparsky 1973):
When multiple items match, chose the more specific one (it has fewer superfluous features).
**Simplex numerals: Suppletion**

(29) \[\text{NUMP} \Leftrightarrow /tnejn/\]

\[
\begin{array}{c}
\text{NUM} \\
\text{SCALE}_2
\end{array}
\]

\[\Rightarrow /tnejn/\]

(30) \[\text{CLP} \Leftrightarrow /żewęd/\]

\[
\begin{array}{c}
\text{CL} \\
\text{NUMP}
\end{array}
\]

\[
\begin{array}{c}
\text{NUM} \\
\text{SCALE}_2
\end{array}
\]

\[\Rightarrow /żewęd/\]

(31) **THE ELSEWHERE CONDITION** (Kiparsky 1973):

When multiple items match, chose the more specific one (it has fewer superfluous features).
Simplex numerals: Suppletion

(29) \[ \text{NUMP} \iff /tnejn/ \]

\[ \text{NUM} \quad \text{SCALE}_2 \]

\[ \triangle \]

\[ \ldots \]

(30) \[ \text{*CLP*} \iff /żewǧ/ \]

\[ \text{*CL*} \quad \text{*NUMP*} \]

\[ \text{*NUM*} \quad \text{*SCALE}_2* \]

\[ \triangle \]

\[ \ldots \]

(31) **THE ELSEWHERE CONDITION** (Kiparsky 1973):
When multiple items match, chose the more specific one (it has fewer superfluous features).
Simplex numerals: Suppletion

(29) NUMP ↔ /tnejn/
    NUM SCALE₂
    △ ...

(30) *CLP* ↔ /żewg/
    *CL* *NUMP*
    *NUM* *SCALE₂*
    △ ...

(31) THE ELSEWHERE CONDITION (Kiparsky 1973):
When multiple items match, chose the more specific one (it has fewer superfluous features).
Simplex numerals: Suppletion

(29) \[ \text{NUMP} \leftrightarrow /\text{tnejn}/ \]

(30) \[ \text{*CLP*} \leftrightarrow /\text{żewğ}/ \]

(31)

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Simplex numerals: Stacking

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</table>
Simplex numerals: Stacking

(33) \( \text{NUMP} \iff /go/ \)

\[ \text{NUM} \quad \text{SCALE}_5 \]

(34) \( \text{CLP} \iff /ko/ \)

\[ \text{CL} \]
Simplex numerals: Stacking

(33) NUMP $\Leftrightarrow /go/$

\[
\begin{array}{c}
\text{NUM} \\
\triangle \\
\cdots \\
\text{SCALE}_5
\end{array}
\]

(34) CLP $\Leftrightarrow /ko/$

\[
\begin{array}{c}
\text{CL} \\
\text{CLP}
\end{array}
\]

(35) Merge F and

a. Spell out FP
b. If (a) fails, move the complement of F, and retry (a)
Simplex numerals: Stacking

(33) \[ \text{*NUMP*} \iff /go/ \]

(34) \[ \text{CLP} \iff /ko/ \]

(35) Merge F and
   a. Spell out FP
   b. If (a) fails, move the complement of F, and retry (a)
Simplex numerals: Stacking

(33)  

(34)  CLP $\iff /ko/$

(35)  Merge F and

a. Spell out FP
b. If (a) fails, move the complement of F, and retry (a)
Simplex numerals: Stacking

(33) \[ \text{NUMP} \Leftrightarrow /go/ \]
    \[
    \begin{array}{c}
    \text{NUM} \\
    \text{SCALE}_5
    \end{array}
    \]

(34) \[ \text{CLP} \Leftrightarrow /ko/ \]
    \[
    \begin{array}{c}
    \text{CL} \\
    \text{NUMP} \Rightarrow /go/ \\
    \Delta
    \end{array}
    \]

(35) Merge F and
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(33) \[
\text{NUMP} \iff /go/
\]

(34) \[
\text{CLP} \iff /ko/
\]

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(33) \( \text{NUMP} \leftrightarrow /\text{go}/ \)

\[
\begin{array}{c}
\text{NUM} \\
\text{SCALE}_5 \\
\end{array}
\]

(34) \( \text{CLP} \leftrightarrow /\text{ko}/ \)

\[
\begin{array}{c}
\text{CLP} \\
\text{CL} \\
\end{array}
\]

(35) Merge F and

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Simplex numerals: Stacking

(33) \( \text{NUMP} \iff /go/ \)

\[
\begin{array}{c}
\text{NUM} \\
\text{SCALE}_5
\end{array}
\]

(34) \( *\text{CLP}* \iff /ko/ \)

\[
\begin{array}{c}
*\text{CL}* \\
*\text{CLP}*
\end{array}
\]

(35) Merge F and

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Simplex numerals: Stacking

(33) \[\text{NUM} \iff /go/\]

(34) \[*\text{CLP}* \iff /ko/\]

(35) Merge F and

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(33)  NUMP ⇔ /go/

(34)  CLP ⇔ /ko/

(35)  

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Complex numerals: Syncretism

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<td><em>go</em></td>
</tr>
<tr>
<td>ŋe³³</td>
<td>ko³⁵</td>
<td>SHU 1</td>
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</table>
Complex numerals: Syncretism

(36) \( \text{SCALE}_1 \iff /\eta e^{33} / \)

(37) \( \text{CLP} \iff /ko^{35} / \)

\[
\begin{array}{c}
\text{CL} \\
\downarrow \\
\text{NUMP} \\
\downarrow \\
\text{NUM}
\end{array}
\]
Complex numerals: Syncretism

(36) \[ \text{SCALE}_1 \iff /\eta e^{33}/ \]

(37) \[ \text{CLP} \iff /ko^{35}/ \]

\[ \begin{array}{c}
\text{CL} \\
\text{NUMP} \\
\text{NUM}
\end{array} \]

(38) a. Spell out FP
b. If (a) fails, attempt movement of the spec of the complement of F, and retry (a)
c. If (b) fails, move the complement of F, and retry (a)
Complex numerals: Syncretism

(36) \[ \text{*SCALE}_1^* \Leftrightarrow /\eta e^{33} / \text{ *SCALE}_1^* \]

(37) \[ \text{CLP} \Leftrightarrow /ko^{35}/ \]

(38) a. Spell out FP
b. If (a) fails, attempt movement of the spec of the complement of F, and retry (a)
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Complex numerals: Syncretism

(36) \[ *\text{SCALE}_1^* \leftrightarrow /\eta e^{33} / \quad *\text{SCALE}_1^* \supseteq /\eta e^{33} / \]

(37) \[ \text{CLP} \leftrightarrow /ko^{35} / \]

(38) a. Spell out FP
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(36) \( \text{SCALE}_1 \iff /\eta e^{33}/ \)

(37) \( \text{CLP} \iff /ko^{35}/ \)

(38) a. Spell out FP
    b. If (a) fails, attempt movement of the spec of the complement of F, and retry (a)
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Complex numerals: Syncretism

(36) \( \text{SCALE}_1 \iff /\eta e^{33}/ \)

(37) \( \text{CLP} \iff /ko^{35}/ \)

(38) a. Spell out FP
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    c. If (b) fails, move the complement of F, and retry (a)
Complex numerals: Syncretism

\[
\begin{align*}
(36) \quad \text{SCALE}_1 & \iff \eta e^{33} / \\
& \uparrow \\
& \ldots \\
(37) \quad \text{CLP} & \iff ko^{35} / \\
& \text{CL} \quad \text{NUMP} \\
& \quad \text{NUM}
\end{align*}
\]

(38)

a. Spell out FP
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Complex numerals: Syncretism

(36) \[ \text{SCALE}_1 \iff /\eta e^{33}/ \]

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(38)

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(36) \[ \text{SCALE}_1 \leftrightarrow /\eta e^{33}/ \]

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Complex numerals: Syncretism

(36) \[ \text{SCALE}_1 \leftrightarrow \eta e^{33} \]

(37) \[ \text{CLP} \leftrightarrow ko^{35} \]

(38)

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Complex numerals: Syncretism

(36) \( \text{SCALE}_1 \leftrightarrow /\eta e^{33} / \)

(37) \( \text{CLP} \leftrightarrow /ko^{35} / \ /\eta e^{33} / \leftrightarrow \text{SCALE}_1 \ /ko^{35} / \)

(38) a. Spell out FP
b. If (a) fails, attempt movement of the spec of the complement of F, and retry (a)
c. If (b) fails, move the complement of F, and retry (a)
Complex numerals: Syncretism

(36) \[ \text{SCALE}_1 \iff /\eta e^{33} / \]

\[ \triangle \ldots \]

(37) \[ \text{CLP} \iff /ko^{35} / /\eta e^{33} / \iff \text{SCALE}_1 \leftarrow \text{NUMP} \rightarrow /ko^{35} / \]

\[ \text{CL} \quad \text{NUMP} \]

\[ \triangle \quad \ldots \quad \text{NUM} \]

(38) a. Spell out FP
b. If (a) fails, attempt movement of the spec of the complement of F, and retry (a)
c. If (b) fails, move the complement of F, and retry (a)
Complex numerals: Syncretism

(36) \( \text{SCALE}_1 \leftrightarrow /\eta e^{33} / \)

(37) \( \text{CLP} \leftrightarrow /ko^{35} / \quad /\eta e^{33} / \leftarrow \text{SCALE}_1 \Rightarrow /ko^{35} / \)

(38) a. Spell out FP
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(36)  \[ \text{SCALE}_1 \leftrightarrow /\eta e^{33}/ \]

(37)  \[ \text{CLP} \leftrightarrow /ko^{35}/ \]

(38)  a. Spell out FP
b. If (a) fails, attempt movement of the spec of the complement of F, and retry (a)
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Complex numerals: Syncretism

(36) \[ \text{SCALE}_1 \iff \eta_{e}^{33} / \]

(37) \[ \ast C_{LP}^* \iff \eta_{o}^{35} / \]

(38) a. Spell out FP
b. If (a) fails, attempt movement of the spec of the complement of F, and retry (a)
c. If (b) fails, move the complement of F, and retry (a)
Complex numerals: Syncretism

(36) $\text{SCALE}_1 \iff /\eta e^{33}/$

(37) $*\text{CLP}^* \iff /ko^{35}/$

(38) a. Spell out FP
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c. If (b) fails, move the complement of F, and retry (a)
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(37) $^*\text{CLP}^* \iff /ko^{35}/$

(38) a. Spell out FP
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# Complex numerals: Suppletion

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<td></td>
<td></td>
</tr>
<tr>
<td>go</td>
<td>JPN 5</td>
<td>go</td>
<td>ko</td>
<td></td>
</tr>
<tr>
<td>x°</td>
<td>ba</td>
<td>x°</td>
<td>j°ød(k’)</td>
<td></td>
</tr>
</tbody>
</table>

(39) \(\text{SCALE}_5 \iff /x°/\)

(40) \(\text{NUMP} \iff /ba/\)

(41) \(\text{ClP} \iff /j°ød(k’)/\)
### Complex numerals: Stacking

<table>
<thead>
<tr>
<th>Abstract</th>
<th>Object</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scale</strong></td>
<td><strong>Num</strong></td>
</tr>
<tr>
<td>five</td>
<td>ENG 5</td>
</tr>
<tr>
<td>tnejn</td>
<td>MLT 2</td>
</tr>
<tr>
<td>go</td>
<td>JPN 5</td>
</tr>
<tr>
<td>dzi³³</td>
<td>ko³⁵</td>
</tr>
<tr>
<td>x°</td>
<td>ba</td>
</tr>
<tr>
<td>ruō</td>
<td>vō</td>
</tr>
</tbody>
</table>
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Question

▷ what is the relationship between object-counting and abstract-counting numerals?
Conclusion

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Answer

▷ object-counting numerals both syntactically and semantically contain abstract-counting numerals!
Conclusion

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- lexical items pronounce structures built out of semantic atoms

Typology

- variation in the complexity of numerals reduces to lexical items
- the crucial factor is how many meaning components each morpheme pronounces
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References


References II


References III


References IV


Thanks!