

Language as a source of numerical concepts

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Children learn how to count fairly quickly, but it takes time before they really know what the list of numbers they recite means (Carey 2004).

knower level	age	know the meaning	duration
1-knower	~2;0 to 2;5	'one'	6 to 9 m.
2-knower	~2;6 to 3;3	'one' and 'two'	~ 2 months
3-knower	~2;8 to 3;5	'one', 'two', and 'three'	a couple of months
4/5-knower	~2;8 to 3;0	'one', 'two', 'three', 'four' (and 'five')	a couple of months
CP-knower	~3;0 <	fully competent counters	

one-knower stage is longer than the two-knower stage
→ we should find **more one-knowers than two-knowers** in a random age-weighted sample of children between ages 2 and 4.

Methods:
71 Slovenian children in daycares in Ljubljana, SI – ages 2;0-5;0 (M=3;2)
79 English speaking children in daycares in San Diego, USA – ages 2;0-5;0, (M=3;5)
Tasks: Give-a-number, What's-on-the-card, Counting-Assessment

Give-a-number - test comprehension of number words:
- children presented with 10 objects & asked to give *N* items
- no noun in the question: "Can you put *N* in the red circle?"
- they said they're done, then were asked "Is that *N*?"
- if the number incorrect: "Can you count and make sure?"
- each number came up three times, in pseudo-random order

Figure 1: Distribution of *n*-knowers among English-speaking children

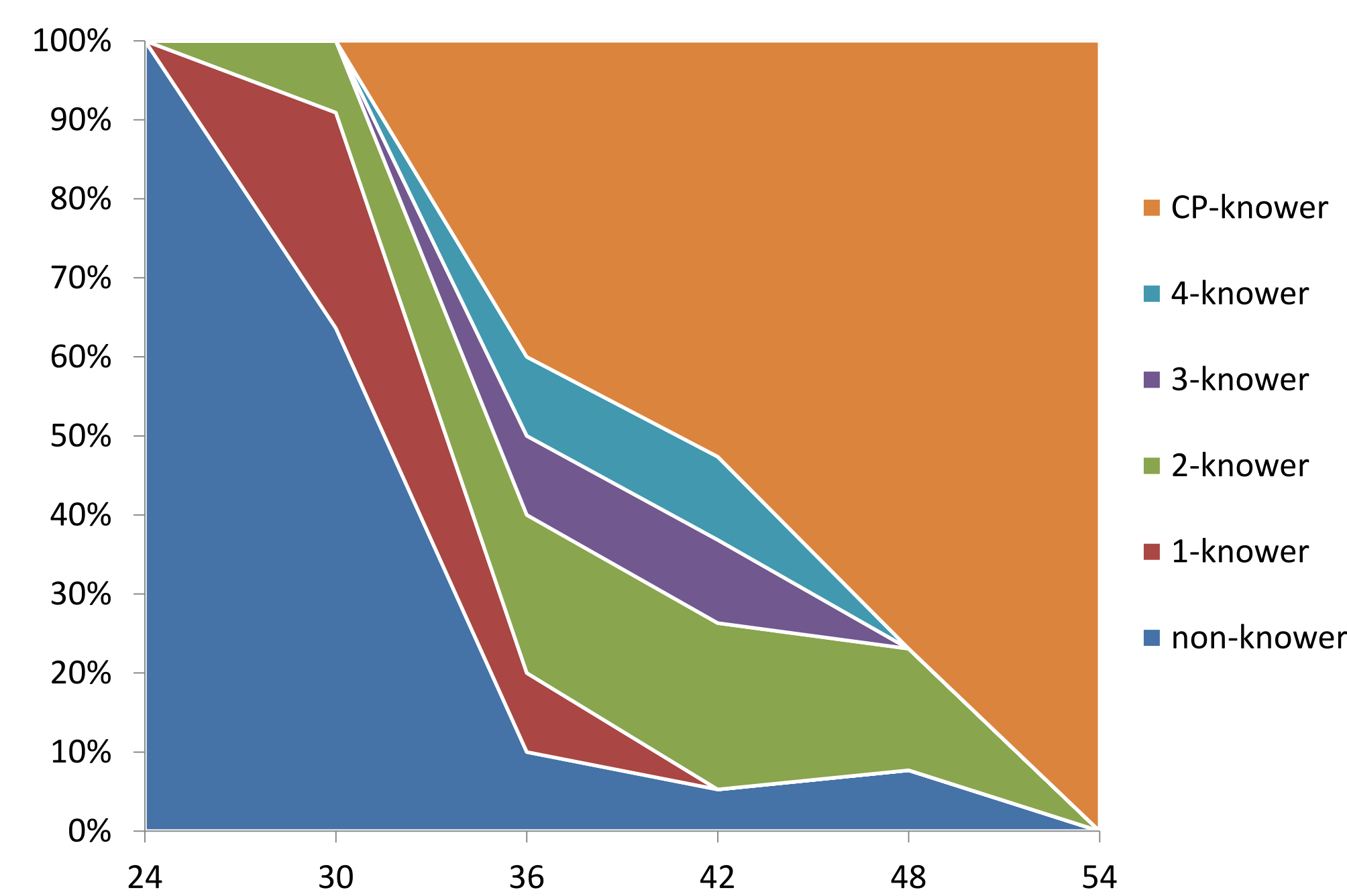
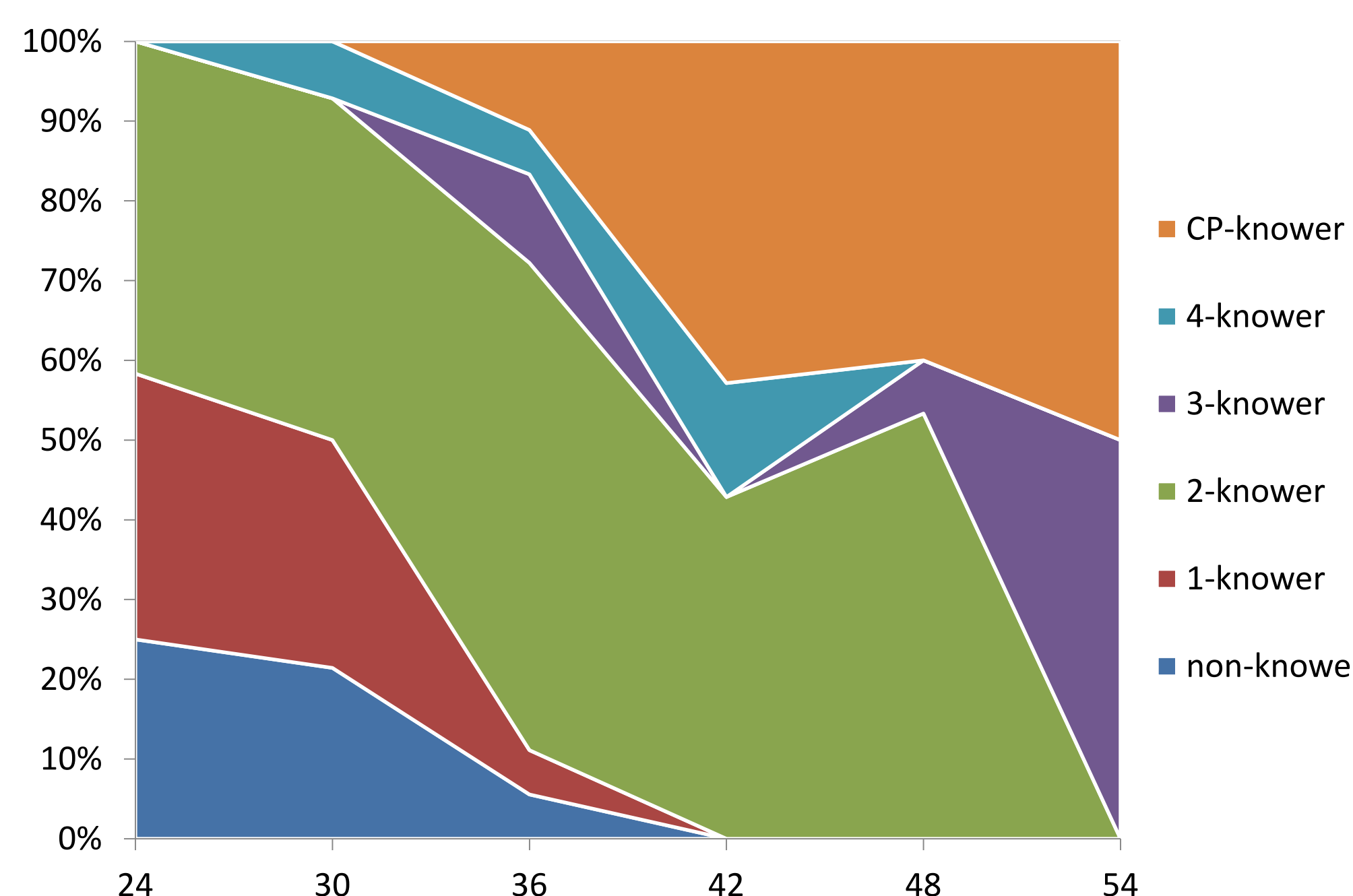


Figure 2: Distribution of *n*-knowers among Slovenian-speaking children



The acquisition of the meaning of numerals is bootstrapped from the knowledge of grammatical number (Carey 2004, etc.)

In the early stages of number acquisition, the interpretation of **numbers is bootstrapped** from children's understanding of the difference between singular and plural **morphology**.

- Sarnecka et al. (2007), Li et al. (2003): the rate of number acquisition depends on linguistic backgrounds.
 - English- & Russian-speaking children were faster in acquiring the number system than Japanese & Chinese children.
- difference in grammatical number marking
 - Russian and English - overt morphology on nouns to mark plurality
 - Chinese and Japanese no overt morphosyntax to mark plurality

Children with **different language backgrounds exhibit different learning rates**, but at the same time, they eventually all reach the same final stage.

What's-on-this-Card - test production of Sg/Du/Pl morphology:

- children shown images of 1, 2, 3, 5, or 8 items (each item on five trials, once in each possible set size; two series)
- children were asked: "What's on this card?"
- if they only used a numeral without a noun (eg. *dva* "two"), they were prompted with "two what?"; if they only used the noun, they were prompted for the numeral.

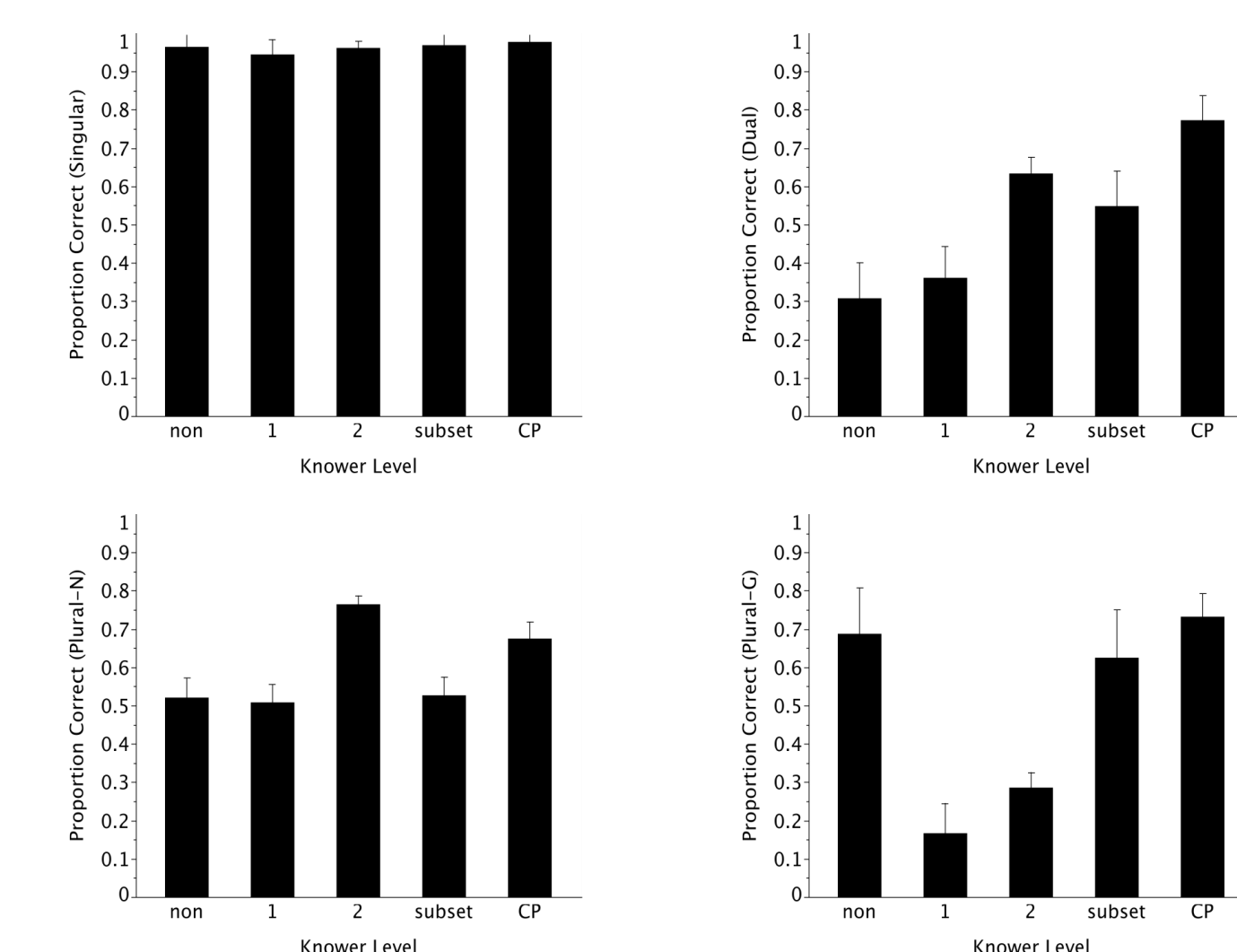


Figure 3: Correct usage of Sg/Du/Pl morphology for each knower level

Counting assessment - test children's ability to count:

- children were asked to count as high as they could
- the highest number to which they counted without mistakes was recorded.

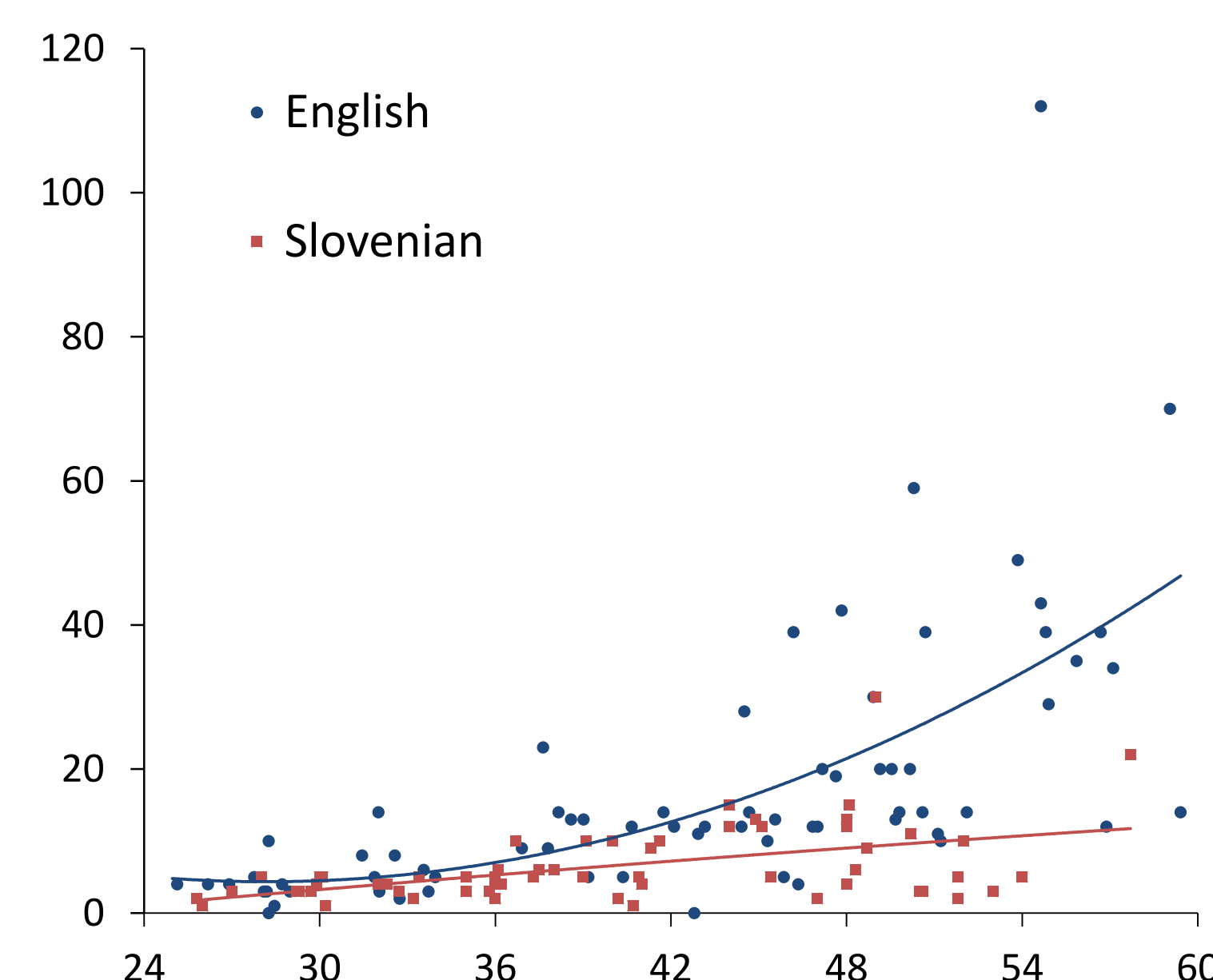


Figure 4: Comparison of English-speaking and Slovenian-speaking children's counting ability

Central Slovenian number system:
- singular – dual – plural; marked on N, Adj, Num, V

	Numeral	Adj	Noun	Verb
Singular	<i>en</i>	<i>rdeč</i>	<i>gumb</i>	<i>manjka</i>
	one _{SG}	red _{SG}	button _{SG}	miss _{SG}
Dual	<i>dva</i>	<i>rdeča</i>	<i>gumba</i>	<i>manjkata</i>
	two _{DU}	red _{DU}	button _{DU}	miss _{DU}
Plural	<i>trije</i>	<i>rdeči</i>	<i>gumbi</i>	<i>manjkajo</i>
	three _{PL}	red _{PL}	button _{PL}	miss _{PL}

- English-speaking children learn 'one' faster than Japanese-speaking children because of sg-pl distinction (Barner et al. 2009, Sarnecka et al. 2007)
- English-speaking children often take many months to differentiate between 'two' and 'three' because of their shared morphology (Wynn 1992, Le Corre & Carey 2007)
→ **Slovenian-speaking children should learn 'two' faster than English-speaking children**



Children were taken to a quiet corner of their classroom and presented with the tasks in the form of a game

Similar study on Saudi Arabic, another singular-dual-plural language (Almoammer 2011) – converging results

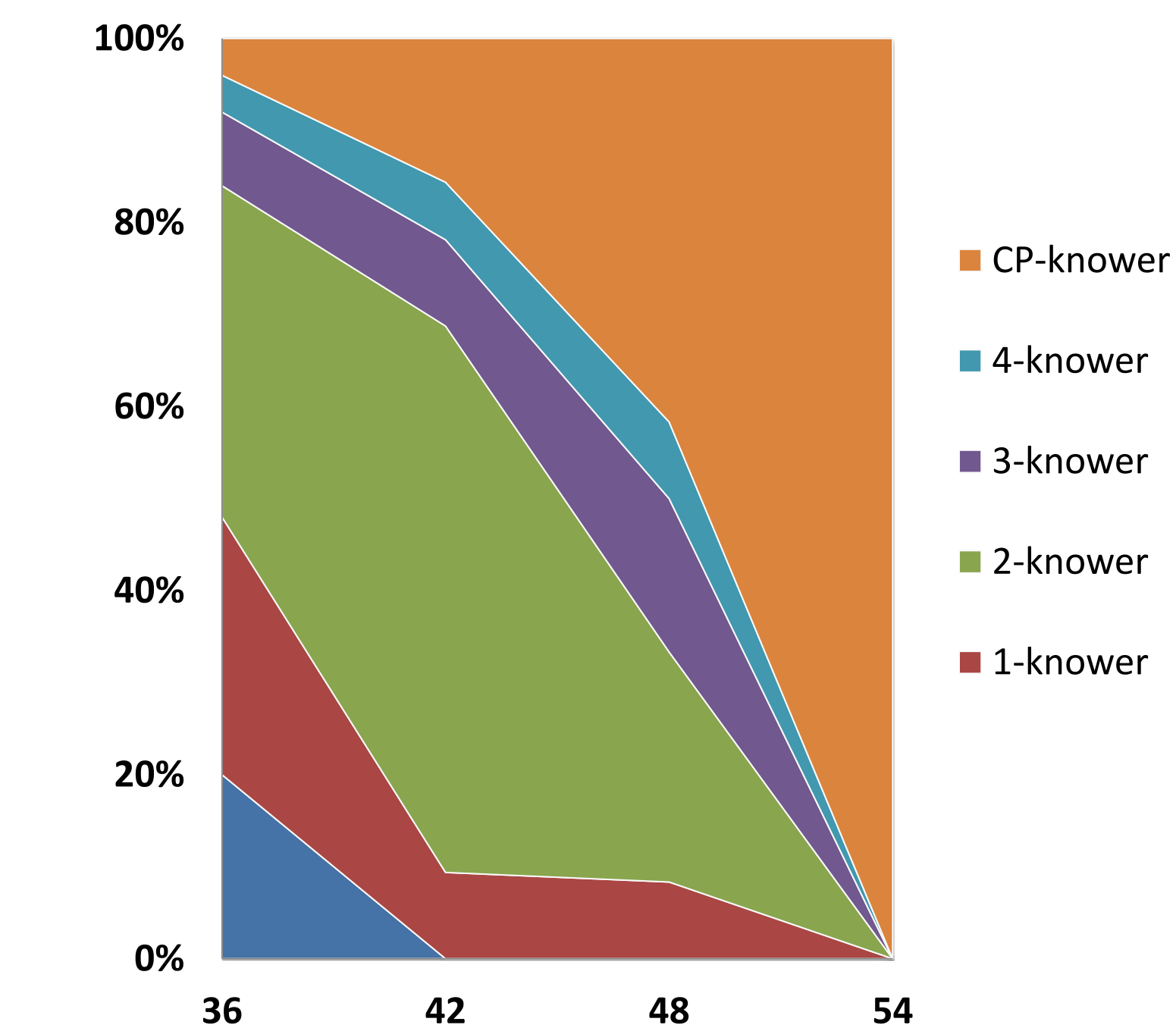


Figure 5: Distribution of *n*-knowers among Saudi-Arabic-speaking children, as reported in Alhanouf Almoammer (2011, UCL MA thesis).

CONCLUSION

Slovenian children were faster to become 2-knowers but slower to advance from 2-knowers on

- The presence of dual morphology speeds up the attainment of the 2-knower level
- Slovenian children get less training in the counting routine → they are not as fast to advance