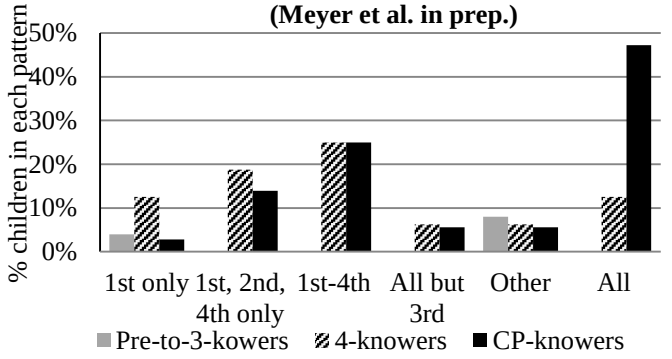
**Transparency matters: the acquisition of synthetic and analytic ordinals in Dutch**

Caitlin Meyer (University of Amsterdam), Sjef Barbiers (Meertens Institute) & Fred Weerman (University of Amsterdam)

This paper argues on the basis of novel Dutch data that linguistic knowledge influences the development of ordinal concepts, and that ordinal acquisition benefits from a transparent relationship between a cardinal numeral and the form used to express an ordinal meaning. In other words, (ir)regular ordinal forms influence the patterns we see in ordinal acquisition. This is in contrast to what has been claimed for the acquisition of cardinals: while the timing may be influenced by language-specific factors, effects of linguistic knowledge are not visible in the pattern of cardinals, as children from a variety of cultures go through the same phases when acquiring the exact meaning of cardinals. They slowly learn cardinals *one* through *four* one by one, before they infer the meanings of all numerals in their count list and master the cardinality principle, thereby becoming CP-knowers (e.g. Carey 2009, Le Corre & Carey 2007, Sarnecka et al. 2007, Almoammer et al. 2013).

Interestingly, ordinal acquisition does not mimic this pattern in German or Dutch (Koch et al. 2013, Meyer et al. submitted). Instead, as Figure 1 shows for Dutch, children acquire *eerste* 'first', then simultaneously *tweede* 'second' and *vierde* 'fourth', but irregular *derde* 'third' follows later. Whereas failure on a low cardinal is typically said to reflect a conceptual deficit, Meyer et al. (submitted) argue that children's initial failure on ordinal *derde* 'third' is purely linguistic in nature: most ordinals in Dutch are formed by adding a suffix *–de* or *–ste* to a cardinal base, but in *derde* we see root allomophy (the cardinal is *drie* 'three', not **der*). This allomorphy makes the relationship between the cardinal and the ordinal (and hence the meaning of the ordinal) more opaque, and thus more difficult to acquire. That *eerste* 'first' is not problematic is due to *eerste* having the properties of a superlative rather than an ordinal (Barbiers 2007). Superlatives are easier than ordinals: even the youngest children in the Meyer et al. study were able to identify superlative items (e.g. *de dikste poes* 'the fattest cat') at ceiling level.

**Figure 1: Ordinal-knower patterns (Meyer et al. in prep.)**




This reasoning leads to clear predictions, which we will show are borne out. If failure on irregular *derde* 'third' is indeed linguistic in nature, rather than conceptual, we expect children who fail on such forms to perform better when the irregularity or opacity is resolved. In other words, if children derive ordinals via morphological rules, children who fail on the synthetic ordinal *derde* should be able to pass on the ungrammatical yet regular **drie–de* 'three–th', as well as on the analytic form *auto drie* 'car three'. This has not been tested before. We do not expect any other performance differences between synthetic and analytic ordinals, despite the fact that these two ordinal types are not identical in frequency or in use.

We built on Meyer et al. (submitted) and used a Give-X type task (see e.g. Wynn 1992) in which 56 Dutch monolinguals (2;8–4;11) were told a story about going on vacation, with different objects getting in line to jump into a suitcase. We asked children to pack certain items in the suitcase, such as *drie t-shirts* 'three t-shirts', *de tweede slee* 'the second sled' and *konijn drie* 'bunny three'. We tested one–four, six, eight and nine, and their synthetic and analytic ordinal counterparts. We also included three ungrammatical yet regular stimuli: *eende* 'one–th', *eenste* 'one–est' and *driede* 'three–th'. This allows us to compare performance on cardinal and synthetic ordinals with previous work, and provides novel data comparing different types of ordinals.

**Figure 2: CP-knowers performance on synthetic and analytic ordinals**

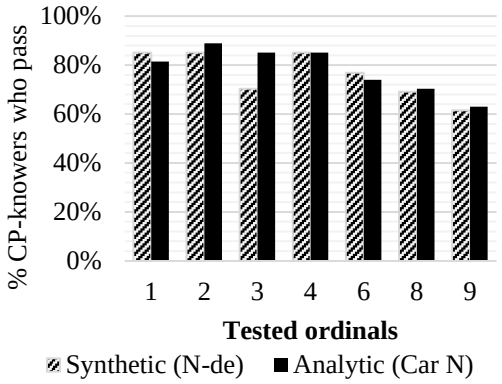
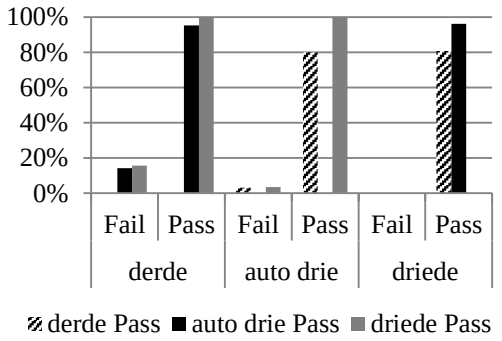



**Figure 3: Performance on *derde, auto drie, *driede* ('third', 'car three', 'threeth')**




Our results, illustrated in Figures 2 and 3, confirm the hypothesis above. Figure 2 shows that the percentage of CP-knowers who pass on synthetic ordinals hardly differs from those who know the analytic ordinals (i.e. there is no difference in performance on *de vierde beer* 'the fourth bear' and *kabouter vier* 'gnome four'). The only exception is in the case of ordinals for three: performance on analytic forms (e.g. *konijn drie* 'bunny three') is better than on synthetic ones (e.g. *de derde auto* 'the third car'). Moreover, performance on this analytic form does not differ from its neighbors, whereas *de derde auto*–type items were harder than items requesting the second or fourth item. This suggests that allomorphy hinders acquisition of *derde* 'third'. The absence of other differences between synthetic and analytic ordinals shows they are acquired simultaneously, despite (possible) differences in use, frequency and ordinal type. Figure 2 also shows that the use of different suffixes (*–de* and *–ste*) does not pose a problem, as *achtste* 'eighth' does not differ from *zesde* 'sixth' or *negende* 'ninth'.

Figure 3 underlines the allomorphy issue. Children who can find the *tweede* 'second' and *vierde* 'second' but not the *derde* 'third', are able to find the *driede* 'threeth', in line with what we see for the analytic form. The reverse, comprehension of the grammatical synthetic ordinal but not the others, (almost) never occurs. This means children may indeed have a morphological rule with which they derive ordinals from cardinals. Data for regularized *eenste* and *eende* are less clear, and we argue that the comparison is more complex: *eerste* 'first' is a case of suppletion (not allomorphy), as regular ordinal formation is incompatible with the feature composition of ONE (Barbiers 2007).

This talk discusses patterns and processes in, as well as further predictions for, the development of ordinals and ordinality. We especially emphasize the vital role that linguistic knowledge plays.

**Selected references** Almoammer, A., J. Sullivan, C. Donlan, F. Marušič, R. Žaucer, T. O'Donnell & D. Barner. (2013). Grammatical morphology as a source of early number word meanings. *Proceedings of the National Academy of Sciences*, 110, 18448–18453. | Barbiers, S. (2007). Indefinite numerals ONE and MANY and the cause of ordinal suppletion. *Lingua* 117, 859–880. | Carey, S. (2009). *The origin of concepts*. NY: OUP. | Koch, C., A. Thiel, E. Sanfelici & P. Schulz (2015). On the acquisition of ordinal numbers in German. In E. Ruigendijk & C. Hamann (eds.), *Proceedings of GALA 2013*. Cambridge. MA: Cambridge Scholar Publishing. | Le Corre, M. & S. Carey (2007). One, two, three, four, nothing more: An investigation of the conceptual sources of the verbal counting principles. *Cognition* 105, 395–438. | Sarnecka, B., V. Kamenskaya, Y. Yamana, T. Ogura & Y. Yudovina (2007). From Grammatical Number to Exact Numbers: Early Meanings of One, Two, and Three in English, Russian and Japanese. *Cognitive Psychology* 55(2), 136–168. | Meyer, C., S. Barbiers & F. Weerman (submitted) *Ordinal concepts and linguistic knowledge: the acquisition of (cardinals and) ordinals in Dutch.* | Wynn, K. (1992). Children's acquisition of the number words and the counting system. *Cognitive Psychology*, 24, 220–251.