Early word segmentation ability is related to later word processing skill

Since infants mainly hear multi-word utterances, segmenting words from continuous speech is vital for vocabulary acquisition. Further, the segmentation ability is a predictor of later language development (Newman et al., 2006). The main paradigm to study word segmentation in infants is the behavioral headturn-preference method (Jusczyk & Aslin, 1995). Infants are first familiarized with words in isolation and then tested for a preference for these words versus unfamiliar words in passages, or vice versa. Kooijman et al. (2005) developed an ERP analogue, which provides an online measure of word segmentation.

The present study extends this use of ERPs to measure whether 30 Dutch 10-month-olds were able to segment words from continuous speech and recognize them in novel utterances. To study the relationship between word segmentation skill and later word-processing, the same infants participated in a preferential-looking study at 16 months for familiar- and novel-word processing.

Figure 1 shows the two observed ERP effects for the 10-month-olds. In the time window 200-500ms there is a broadly distributed effect of familiarity ($F(1,29) = 4.192$; $p = .050$), sensitive to speech processing (Kooijman et al. (2005), Mills et al. (1997)). The time window 600-800ms shows a significant instance of the Nc-effect (Nelson, 1994), indexing attention or stimulus preference ($F(1, 29) = 7.607$, $p = 0.01$) .

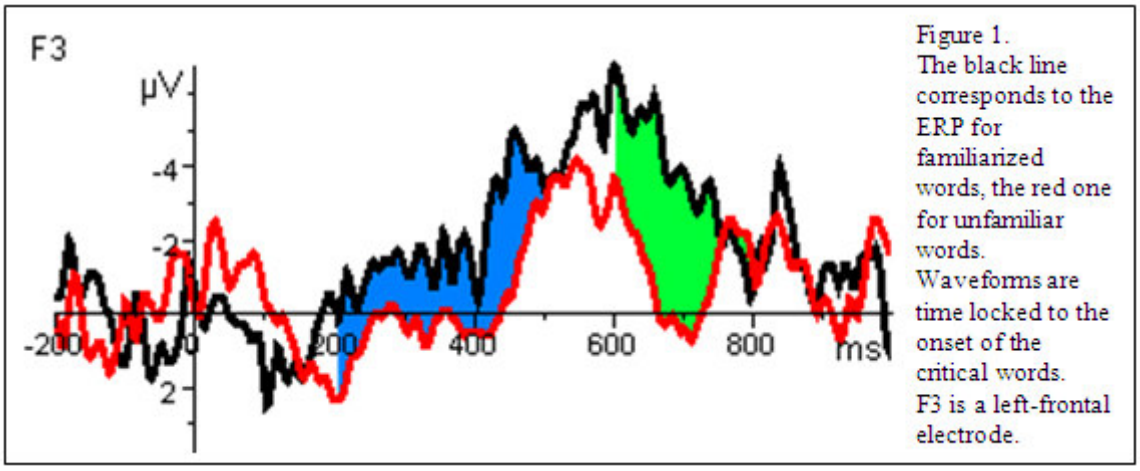

Figure 1. The black line corresponds to the ERP for familiarized words, the red one for unfamiliar words. Waveforms are time locked to the onset of the critical words. F3 is a left-frontal electrode.

At 16 months, the infants did not show any learning of the novel words, but looked significantly longer when hearing a familiar word. We subsequently investigated the relationship between word segmentation at 10 months and familiar-word processing at 16 months by dividing them into two groups, based on increase of looking at familiar objects. Figure 2 illustrates that for infants with a strong familiar-word processing skill, the early familiarity effect is more localized to left temporal electrodes, whereas for infants with a weak word processing skill, this is more broadly distributed (significant interaction of Familiarity x Group x Quadrants: $F(3,84) = 186.40$; $p = .043$). Both groups did not differ in the 600-800ms time window. These findings support the hypothesis that infants with higher language skills have a more focal distribution of language-related brain activity (Mills et al., 2005).

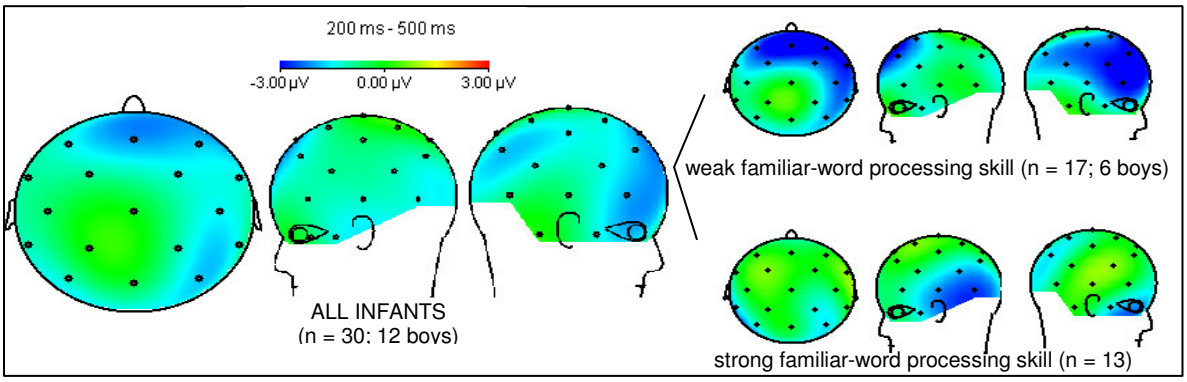

Figure 2. Mean distribution plots for the ERP effect of familiarity (familiarized - unfamiliar words). The smaller plots divide the 10-month-olds into two groups based on the familiar word-processing skills at 16 months.

Hence, the distribution of speech processing at 10 months is related to familiar-word processing at 16 months: the more focal the distribution for word segmentation was at 10 months, the better infants at 16 months were at looking at objects corresponding to familiar words.

Word count abstract 396 words.