WORD SEGMENTATION SKILL IN INFANTS AND ITS INFLUENCE ON VOCABULARY DEVELOPMENT: A REVIEW

BEBEKLERDE SÖZCÜK AYRIŞTIRMA BECERİSİ VE SÖZ VARLIĞI GELİŞİMİNE ETKİSİ: BIR İNCELEME

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Abstract

Language development and cognitive development are closely interconnected. In particular, vocabulary development in children below the age of three plays a significant role in determining their future learning capabilities. More specifically, the size of their productive vocabulary greatly influences their cognitive skills and academic achievement later in life. However, infants must first acquire the ability to separate words from continuous speech before they can begin comprehending their initial words. The ability to segment words directly impacts both overall language progression and vocabulary expansion. Hence, gaining insight into how infants begin and progress with word segmentation will significantly contribute to their vocabulary acquisition. In consideration of these factors, this work seeks to examine infant word segmentation from different perspectives through a review of existing literature with the aim of advancing understanding of the topic. The research findings indicate that word segmentation starts around 6 months and continues to improve. Infants use prosody, phoneme distribution, and syllable transition probabilities for word segmentation. Exposure to high-quality linguistic input, especially infant-directed speech, strengthens these skills. IDS offers benefits such as exaggerated prosody and frequent word repetition, making learning easier for babies. Similar to eye contact, bonding between the mother and baby also increases the impact of IDS. In conclusion, it is apparent that intervention programs related to word development in infants should consider the findings of the word segmentation process.

Keywords: word segmentation, infant-directed speech, vocabulary development.

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Özet

Dil gelişimiyle bilişsel gelişim arasında güçlü bir ilişki bulunmaktadır. Bu bağlamda üç yaş altı çocuklardaki söz varlığı gelişimi ilerideki öğrenme gücünü belirlemede anlamlı bir role sahiptir. Özellikle üretimsel söz varlığının büyüklüğü, çocukların bilişsel becerileri ve akademik başarılarında çok etkilidir. Bununla birlikte, bebeklerin ilk sözcükleri anlamaya başlayabilmeleri için öncelikle kelimeleri sürekli konuşmadan ayırma becerisini kazanmaları gerekir. Sözcükleri bölümlere ayırma becerisi, hem genel dil gelişimini hem de söz varlığının genişlemesini doğrudan etkiler. Bu nedenle, bebeklerin sözcük ayrıştırmaya nasıl başladıkları ve ne şekilde ilerleme gösterdiklerini anlamak, onların sözcük dağarcığı edinimlerine önemli ölçüde katkı sağlayacaktır. Bu bilgiler ışığında hazırlanan çalışma, konunun daha iyi anlaşılması için hazırdaki alanyazını gözden geçirerek bebeklerdeki sözcük ayrıştırma sürecini farklı açılardan incelemeyi amaçlamıştır. İncelemenin ardından elde edilen bulgulara göre, bebeklerde sözcük ayrıştırma yaklaşık olarak 6 aylıkken başlıyor ve gelişimini sürdürüyor. Bu süreçte, prozodi, sesbirimsel dağılım ve hece geçiş olasılıkları kullanılıyor. Nitelikli dilsel girdi, özellikle bebeğe yönelik konuşma, sözcük ayrıştırma becerisinin gelişimini olumlu yönde etkiliyor. Abartılı prozodi ve sık tekrarlanan sözcükleri içeren bebeğe yönelik konuşma, bebeklerin öğrenmelerini kolaylaştırıyor. Bebeğe yönelik konuşmanın etkisi, özellikle göz teması gibi anne-bebek bağının sürece eklenmesiyle birlikte daha da artıyor. Sonuç olarak, bebeklerde söz varlığı gelişimine yönelik müdahale programlarının sözcük ayrıştırma sürecinin bulgularını dikkate alması gerektiği açıktır.

Anahtar Kelimeler: Sözcük ayrıştırma, bebeğe yönelik konuşma, söz varlığı gelişimi.

Introduction

The development of language in infants interacts with cognitive development (Weinert, 2006). Therefore, early language development plays a significant role in shaping children's potential for later learning (Toppelberg & Shapiro, 2000). Research in this area has demonstrated that children who experience cognitive developmental challenges also encounter difficulties in the process of language acquisition (Weinert & Grimm, 2012). Language development problems that arise during the early childhood period (under three years of age) are strongly linked to later academic failure in school (Ward, 1999).

In particular, in the context of the relationship between language and cognitive development, word development holds significant importance. The relationship between vocabulary and cognitive abilities is seen as a supporting element, analogous to the zipper (Weinert, 2004). In this respect, enriching the vocabulary also contributes to the development of children's cognitive competence. Thinking is one of the cognitive competencies. In this context, the impact of vocabulary on cognitive abilities can be concretized in terms of thinking skills as follows: Thinking is generally the process of establishing relationships between concepts. Each word corresponds to a concept. The more words are acquired, the more concepts are gained, leading to a broader and better foundation for thinking.

In a long-term study conducted with children on this subject, a significant relationship was found between the vocabulary they produce at 20 months and their reading proficiency when they reach the age of 8 (Bockmann, 2008). Similar research has shown that the size of a child's productive vocabulary is one of the most important factors in shaping their future cognitive abilities and academic success (Toppelberg & Shapiro, 2000).

The development of vocabulary, which is influenced by various factors, varies among children. Individual differences become more pronounced as children grow older. While some may have 3000 words when they start primary school, others

may possess a vocabulary eight times larger (Demir & Küntay, 2012, in: Veryeri Alaca & Küntay, 2019). When each word is considered to correspond to a concept, it becomes clear how significant the difference can be in shaping children's perception of what is happening in the world.

The developmental level of productive vocabulary is directly proportional to that of receptive vocabulary. Infants articulate their first words at 10–14 months of age. Thus, productive word development begins on average around the 12th month. In contrast, babies begin to understand their first words at an earlier stage, approximately at 9 months (Grimm, 2012).

Infants should display another skill before they start understanding their first words and then expressing them through speech. This prerequisite skill for receptive and productive vocabulary development is word segmentation (Johnson et al., 2014).

Infants demonstrate word segmentation ability in the form domain before they begin to understand a word. They acquire the concept of the word separately from its form. After the first stage, where form and concept are acquired separately, infants combine these two aspects in their minds during the second stage (the comprehension stage) to create an actual word. Consequently, when they hear this word spoken by others in specific contexts, infants will understand it. In the third stage, not only do infants comprehend the same words but also start expressing them. These stages are shown in Figure 1.
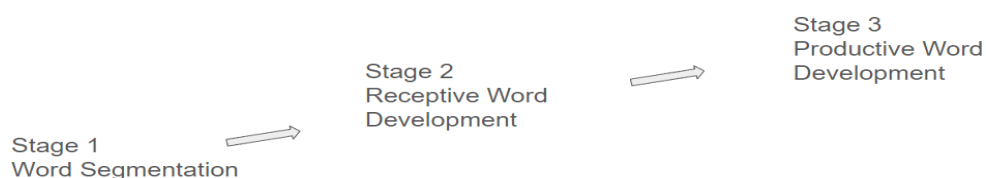
Stage 1
Word Segmentation

Stage 2
Receptive Word
Development

Stage 3
Productive Word
Development

Figüre 1. Stages of Word Development

Individual differences exist in the development of word segmentation skills, and these individual differences in infants emerge as an important factor in later periods, both in the development of vocabulary (Newman et al., 2012) and generally in language development (Junge et al., 2012).

A study on this topic revealed a strong correlation between infants' word segmentation skills at 7 months and their productive vocabulary at 24 months. The findings indicated that infants with different word segmentation abilities exhibited varied vocabulary outcomes early on, highlighting the critical role of early language skills in shaping later language development (Singh et al., 2012).

In this case, providing answers to the questions of when the process of word segmentation begins and how its development unfolds will greatly contribute to supporting infants' vocabulary development. This review aims to contribute to a

better understanding of the topic by examining infants' word segmentation ability from different perspectives based on a literature review.

This review is important in the context of supporting vocabulary development in children under the age of three, emphasizing the need to consider the ages at which receptive vocabulary development and even more importantly, word segmentation skills begin. It will also contribute to highlighting this work for countries where language support for children under three is not yet emphasized.

Word Segmentation in Infants

This section focuses on when infants begin to segment words, the strategies they employ in segmentation, and how the quality of linguistic input can be enhanced.

Word Segmentation Skills in Infants

When babies are around 9 months old, it has been emphasized that they need to start parsing the sound chain of words before being able to understand their first words. Therefore, the process of parsing should begin during a period earlier than the 9th month. Some babies may even begin to understand some words at 6–7 months of age (Bergelson & Swingley, 2012).

Research in this area indicates that when individual differences are considered, infants can begin to segment words from fluent speech at approximately 6 months of age (Hennon et al., 2000). The ability to segment words, which starts at a low level at 6 months, becomes more prominent during the 7-8 month period. This indicates that babies can now segment words more easily (Johnson 2005). Segmentation ability continues to strengthen; however, even by the time infants reach 9 months of age, prosody remains prominent (Männel & Friederici, 2013).

At the age of 10 to 11 months, infants can show increasing proficiency in word segmentation. For instance, by the time they reach their 11th month, infants have been observed to be able to segment familiar words from continuous speech without waiting for the end when they hear them as linguistic input (Thierry et al., 2003).

In addition to initiation of competency development, it is also important to know the strategies that babies use for word segmentation to support their vocabulary development.

Infants' Word Segmentation Strategies

During their first year of life, infants acquire many skills in cognitive, communicative, and linguistic areas before developing their vocabulary. One of these skills is the ability to segment words from fluent speech. The most important strategy that infants use in word segmentation is using the prosody of the language they have acquired (Weinert, 2006).

Infants begin to perceive the prosody of the language they acquire at birth, including its specific rhythm, emphasis, and intonation. This allows them to first acquire phonemes and then start parsing words, as mentioned earlier. Prosody in this context helps in understanding the beginning or ending points of words within flowing speech. Babies can also parse words from other languages as long as they match the prosody of their acquired language (Orena & Polka, 2019).

Another segmentation strategy alongside prosody is word segmentation based on the distribution of phonemes. Infants implicitly acquire the phonological distribution characteristics of the language to which they are exposed over the course of months. Each language's unique conditions determine how often

phonemes come together, and infants eventually start using the phonemic system of their acquired language in word segmentation (Shukla et al., 2006).

Infants also use another strategy in word segmentation by taking advantage of syllable transition probabilities. For example, during speech with a baby, most babies implicitly know that when they hear the "pre" syllable as in the word "pretty", the "ty" syllable will follow (Saffran, 2003).

Infants' word segmentation strategy, whether it is prosodic, phonological, or syllable-based, reveals familiarity as a significant factor in all processes. Research has shown that infants are able to distinguish between familiar words they have been exposed to previously and newly encountered words, indicating that this ability is a reflection of the statistical learning process (Goldman, 2014).

However, infants find it easier to differentiate new words that contain sounds similar to those they are familiar with compared with those that do not show such similarity (Conboy & Montanari, 2016).

At this stage, the frequency of linguistic input appears to stand out in terms of familiarity. The following part of the review provides information on increasing the quality of this linguistic input.

Improving Linguistic Input Quality

It was observed that infant-directed speech (IDS) stands out in enhancing the quality of linguistic input. IDS stands for Infant-Directed Speech, also known as motherese or baby talk. It is a speech register characterized by higher pitch, exaggerated intonation, simplified language, and emotional expression that adults use when communicating with infants. IDS plays a crucial role in capturing infants' attention, promoting language development, and fostering social interactions (Saint-Georges at al., 2013).

Numerous studies have indicated that IDS contributes to infants' success in word segmentation (Thiessen et al., 2005). In a study conducted by Menn et al. (2022) with 9-month-old infants, it was observed through instant EEG measurements during mother– infant interaction that linguistic inputs from IDS triggered more brain activity in babies compared to those coming from adult-directed speech, and the factor triggering this was found to be prosody reflecting wide-ranging pitch variation.

Exaggerated prosody-focused IDS plays a significant role in the acquisition of phonemes (Goldstein & Schwade, 2008). As a result, word segmentation strategies focusing on phonemic and syllable distributions are positively influenced by IDS.

Compared to adult-directed speech, in IDS, sentence length is shorter and the number of words is fewer in IDS. This both increases the frequency of words (statistical learning) and provides easier access for babies to the beginning and end of short sentences (Johnson et al., 2014). Thus, infants who are more comfortable in linguistic processing also perform better in word segmentation.

The connection between the mother and baby is an important factor in enhancing the quality of IDS that affects word segmentation. Infant- directed speech promotes a strong emotional connection between mothers and their babies by employing higher pitch, exaggerated intonation, and clear articulation. This speaking style helps to capture the baby's attention, facilitate language development, and encourage social interaction, ultimately improving communication and emotional involvement between caregivers and infants (Mani & Pätzold, 2016). In a study conducted on this subject, it was observed that the simultaneous presence of IDS

and eye contact during mother– infant interaction significantly increased brain activity during word segmentation (Lloyd-Fox et al. 2015).

Conclusion

So far, the information that has been presented can be summarized as follows to clarify the results of the review:

This review highlights the crucial role of word segmentation in infants' vocabulary development and how supporting this skill benefits cognitive abilities and future academic success.

- Word segmentation starts around 6 months and gradually improves until 11 months and beyond.

- Infants use prosody, phoneme distribution, and syllable transition probabilities to segment words.

- Frequent exposure to high-quality linguistic input, especially infant-directed speech, strengthens segmentation skills.

- IDS offers advantages like exaggerated prosody, shorter sentences, and more frequent word repetition—making learning easier for babies.

- The mother– infant connection further enhances the effectiveness of IDS through eye contact during interaction.

As a result; intervention programs prepared without considering the word segmentation skill will lead to difficulties in achieving effective and desired results. Therefore, programs should be designed based on the information that word development in infants begins with word segmentation and continues with receptive and productive word development. More importantly, taking into account that IDS is the most important factor in terms of quality linguistic input during this process, intervention programs prepared accordingly will truly yield the desired results.

In light of all this information, it can be said that interaction programs for mothers and babies starting from infancy will greatly accelerate the improvement of education quality, especially for countries where not enough focus has been put on the language development of children under three years old.

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