

Immediate lexical integration of novel word forms



Efthymia C. Kapnoula^{a,*}, Stephanie Packard^a, Prahlad Gupta^a, Bob McMurray^{a,b}

^a Dept. of Psychology, University of Iowa, United States

^b Dept. of Communication Sciences and Disorders, University of Iowa, United States

ARTICLE INFO

Article history:

Received 16 May 2013

Revised 9 September 2014

Accepted 17 September 2014

Keywords:

Word learning

Lexical engagement

Inter-lexical inhibition

Spoken word recognition

Eye-tracking

Visual world paradigm

ABSTRACT

It is well known that familiar words inhibit each other during spoken word recognition. However, we do not know how and under what circumstances newly learned words become integrated with the lexicon in order to engage in this competition. Previous work on word learning has highlighted the importance of offline consolidation (Gaskell & Dumay, 2003) and meaning (Leach & Samuel, 2007) to establish this integration. In two experiments we test the necessity of these factors by examining the inhibition between newly learned items and familiar words immediately after learning.

Participants learned a set of nonwords without meanings in active (Experiment 1) or passive (Experiment 2) exposure paradigms. After training, participants performed a visual world paradigm task to assess inhibition from these newly learned items. An analysis of participants' fixations suggested that the newly learned words were able to engage in competition with known words without any consolidation.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

A critical component of learning a new word is binding the elements of its sound pattern (i.e. the phonological representation, or *word form*) together into something more abstract that can ultimately be associated with a meaning. This is often intuitively thought of as acquiring knowledge about the sound pattern of a word. However, decades of work in spoken word recognition (Dahan, Magnuson, Tanenhaus, & Hogan, 2001; Dahan, Magnuson, & Tanenhaus, 2001; Luce & Pisoni, 1998; McClelland & Elman, 1986) suggest that this knowledge is embedded in complex ways in the lexical processing system. As a consequence, lexical representations interact with each other and with sublexical phonological representations during spoken word recognition. In this light, learning a word requires not only the acquisition of knowledge about the

word's form and meaning, but also embedding this information in multiple components of the system to enable these complex interactions during word recognition. The goal of this study is to investigate the conditions under which such embedding occurs as words are learned, and in particular to determine whether this embedding can occur within the same set of experiences by which subjects learn a word form, or whether it requires additional knowledge (in particular, the meaning of the word) or additional processes (such as consolidation or interleaved exposure).

1.1. Lexical properties and their acquisition

Fig. 1 offers a loosely connectionist framing of spoken word recognition. The lower layer comprises sublexical phonological representations and the upper layer lexical-phonological representations. Each level of representation contains many elements and, within each level, representations could be virtually anything: completely localist, completely distributed, somewhere in between, or a

* Corresponding author at: E11 Seashore Hall, Iowa City, IA 52242-1409, United States. Tel.: +1 319 383 9022.

E-mail address: ekapnoula@iowa.uiowa.edu (E.C. Kapnoula).

combination (though we represent them as localist here for ease of exposition). Independently of how the individual elements are represented, learning a novel word requires the adjustment of connections between these sublexical and lexical representations, depicted in terms of bottom-up connections (upward arrows in Fig. 1). Thus, what we think of as “knowledge” of a word form consists of the entire system of representational levels, but, especially, the weighted connections between them that allow a listener to access the word form when the sound pattern is heard. This system of knowledge is clearly a crucial property of a word and must be acquired during the learning process.

However, these are not the only connections involved in recognizing a word. There is evidence for competition or inhibition *between* word forms (instantiated by the connections within the word form layer in Fig. 1), such that active words suppress activation of less-active competitors (Dahan, Magnuson, Tanenhaus, et al., 2001; Luce & Pisoni, 1998). There is also evidence for feedback between word forms and sublexical representations (via the top-down connections in Fig. 1), by which information can travel from higher to lower levels of processing. This top-down flow of information can influence perceptual processing over the long term as a form of learning (Norris, McQueen, & Cutler, 2003), and may also influence word recognition in real time (Magnuson, McMurray, Tanenhaus, & Aslin, 2003; McClelland, Mirman, & Holt, 2006; but see Norris, McQueen, & Cutler, 2000). In spoken word recognition frameworks, these inhibitory and feedback interactions are usually conceptualized within a localist scheme (McClelland & Elman, 1986; Norris, 1994). For convenience, we adopt that localist terminology here, although we acknowledge that competition and feedback effects can arise within a variety of representational systems. Thus, here the terms *feedback* and *competition* are only meant to represent the general lexical properties of feedback and competition, and not specific mechanisms for implementing them. However they are implemented, the abilities to engage in such interactions are additional *properties* of a word, over and above the property of the knowledge of its phonological word form.

Given this framing, *learning* a word consists of not only acquiring information about its phonological word form (and in particular, encoding it in the bottom-up connections), but also the development of interactive properties, such as the capacity for feedback to sublexical

representations, and inhibition among fellow word forms. This raises a fundamental question: What must happen for a word to *acquire* these interactive properties?

In addressing this question, some terminology is in order. Leach and Samuel (2007) proposed a dichotomy between lexical *configuration* and *engagement*. They used the term *lexical configuration* to refer to knowledge about the word itself. In the present context, this could be viewed as the bare minimum informational content required to “know” a word form, which specifies the sound pattern of the word and allows listeners to recognize it (by the bottom up connections in Fig. 1). In contrast, the term *lexical engagement* refers to the manner in which a word affects the processing of other representations (e.g. other known words or phonemes), instantiated by the lateral and feedback connections in Fig. 1. What is not clear in Leach and Samuel’s formulation is whether the dichotomy between configuration and engagement applies only to the properties themselves, or also to the mechanisms by which these properties are formed.

This is a crucial distinction, because the existence of distinct properties does not necessarily imply the existence of different *learning mechanisms*. The *property* of lexical configuration for word forms is based on the feedforward connections between a representation of the sound input and some abstract representation of the word, whereas the *acquisition* of this property requires the formation of these connections. Similarly, the *property* of lexical engagement is based on inhibitory connections among words, and feedback connections to lower levels of processing, but the *acquisition* of this property again requires the formation of these connections. This formulation helps clarify the constructs of configuration and engagement by operationalizing the distinction between these properties: they depend on different sets of connections. It also speaks to the question of whether this distinction necessitates distinct mechanisms of acquisition. Specifically, it suggests that the dichotomy between properties of word forms may not necessitate distinct mechanisms for their acquisition; the different connections subserving the different properties might nevertheless all develop via similar experience-driven learning mechanisms, as commonly occurs in neural networks.

This frames our central question more precisely. When a new word is learned, what conditions are required for lexical engagement (the capacity for feedback and/or inhibition) to be acquired? Does this require learning

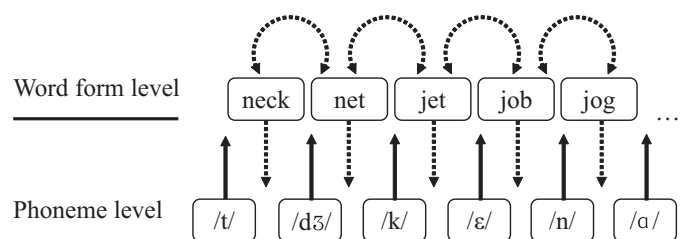


Fig. 1. Visualization of a multi-layer lexical network. Word form level representations are shown as localist for ease of depiction rather than a theoretical commitment to such representations.

Download English Version:

<https://daneshyari.com/en/article/7287553>

Download Persian Version:

<https://daneshyari.com/article/7287553>

[Daneshyari.com](https://daneshyari.com)