

# The Description, Measurement and Pedagogy of Words



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Edited by

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## INTRODUCTION

This book was inspired by the 40th Atlantic Provinces Linguistic Association (APLA) conference held at Mount Saint Vincent University in Halifax, Nova Scotia, Canada in October 2016. Lexicon was the main theme of the conference *Words: Description, Acquisition and Pedagogy*, where the Murray Kinloch Memorial Lecture entitled *Words as the Backbone of Language Ability* was delivered by keynote speaker Gary Libben, who specializes in the description of the mental lexicon. Authors who presented quality papers at the conference on various aspects of lexical description, vocabulary acquisition and instruction in monolingual, bilingual, and multilingual environments were invited to submit chapter proposals. Following a call for proposals to the broader research community, other researchers submitted their proposals, and after a double-blind peer review process, the chapters included in this volume were selected.

By studying languages, researchers are better understanding how the human brain works. The focus of this volume is on lexicon, or, simply put, words. Words are the building blocks of a language. To use the metaphor of Koenenman and Zeijlstra (2017, 8), words are like Lego blocks that one can combine in multiple ways to create an unlimited number of sentences, just as Legos can become a house or a car. Depending on their specialization and field of study, scientists are raising various questions about words. For instance, psycholinguists are studying the mental lexicon by describing how words are learned and stored in the mind, as well as how words are retrieved during language production and comprehension. Theoretical linguists create models of language production by describing the complex relationships existing between lexical units. Applied linguists and language educators enhance vocabulary teaching techniques based on the advances made in the theoretical fields. Across the different disciplines, we are seeking answers to the following core questions: What constitutes a word? What properties does a word have? Why is the term “word” ambiguous? How many words does a person know? What does it mean to know a word? How are words stored and accessed in our mind? How do monolinguals differ from bilinguals and multilinguals? How do children and adults learn new words? Why are some words more difficult to learn than others? What research methods are most appropriate for measuring lexical knowledge? What is it

we are measuring? What are the most effective techniques teaching and learning words?

Numerous studies have documented the strong relationship between vocabulary and academic success (e.g., Carlo et al. 2009; Townsend, Filippini, Collins, and Biancarosa 2012). Therefore, it is important for researchers and practitioners to better understand how words are acquired and represented in the mind, as well as learned in monolingual, bilingual, and multilingual environments. Combined with increased globalization, the need for better understanding how languages are learned is ever more pressing. This explains the emergence of vocabulary as a significant topic in various language-related fields of study such as linguistics, psycholinguistics, and applied linguistics. As noted by Webb (2016), who brought together an extensive collection of seminal pieces of work on the topic, the vast majority of studies on vocabulary appeared over the last 30 years. More recently, volumes and journal issues focused solely on vocabulary have been published: four volumes on vocabulary edited by Webb (2016), the 2017 special issue *TESOL International Journal: Teaching, Learning, and Assessing Vocabulary* (Dodigovic, Jeaco, and Wei 2017), and the edited volume *Lexical Issues in L2 Writing* (Pietilä, Doró, and Pípalová 2015), to name a few.

To further our understanding of what it really means to know a word, it is important to draw on multiple perspectives. This is why this edited book is bringing together multidisciplinary approaches to bridge the gap between theoretical frameworks, empirical studies, and practical applications. Linguists, neuroscientists, psycholinguists, speech-language pathologists, and language educators are examining vocabulary through the lenses of their respective disciplines. Transcending the disciplines, this book includes eleven chapters presenting theoretical approaches or empirical studies on the topic. Eight out of the eleven chapters describe studies recently conducted either with children or adult learners, using novel research methods and tools. The research studies were conducted in Canada with the focus of either English or French, the United States, and Japan. This book is divided into four main sections, each approaching the topic from a different angle.

**Part I**, entitled *Theoretical Description of the Mental Lexicon*, opens this volume with an introduction to the mental lexicon. It presents an overview of theoretical issues pertaining to the description of words' storage and retrieval.

**Gary Libben**, the invited author of this volume, largely contributes to the theoretical discussion on the mental lexicon. In his chapter entitled *Words as Action: Consequences for the Monolingual and Bilingual lexicon*,



Libben takes a new perspective in which words are considered as “activities” rather than “things,” and what is important for the development of the lexicon is what we *do* with words, including the building of links among them. From this angle, lexicon becomes a “dynamic knowledge store” rather than a static dictionary in the mind. In fact, Libben proposes to describe a multimorphemic word as being in a lexical superstate. The configuration of the superstate is based on patterns of language use. The chapter first gives a historical overview of the literature in formal linguistics and visual word recognition wherein the words are considered as linguistic representations, or “things” in the mind. This view is contrasted by Libben, who claims that the mental lexicon is “rather dynamic, ambiguously structured, and richly interconnected.” Activity-based perspective is illustrated by numerous examples taken from different languages. The chapter closes the discussion of how the “action / thing” duality impacts the nature of the models developed about lexical knowledge for bilinguals and multilinguals.

In his chapter, **Jason Brown** provides relevant background information about the study of the mental lexicon. He raises important and interesting questions regarding the structure of the lexicon and its potential contents, which has implications for the learnability of words. The chapter presents a traditional approach to the concept of a lexical entry, contrasting the extreme positions of full listing and full decomposition of morphologically complex words. Presenting a background in the linguistics and psycholinguistics of lexical representation, this chapter includes matters related to first language acquisition and is beneficial to language teachers and educators. The chapter starts with a discussion of the essence of the lexical entry. First, it examines the arguments of the “Full Listing” hypothesis (Butterworth 1983), according to which each morphologically complex word is stored as a unit and constitutes a separate entry in the lexicon. This view is later contrasted with arguments in support of a model of morphological decomposition, or “parsing” model of language processing (Taft and Foster 1975; Taft 1993), where morphologically complex words are decomposed into roots and affixes. Alternative theories are also discussed in the light of empirical evidence. Further, recent studies on the storage of multiword expressions, such as idioms, are examined in the chapter. The author continues with debates about the size of the lexicon, concentrating on the English language, while comparing it to other languages. Finally, Brown discusses how derivation and inflection are developed by children and how they can be related to the pedagogy of language. He suggests that more research on children’s acquisition of words is needed to shed light on the theoretical

questions of storage and underlines that the acquisition of multiword expressions is a promising area for future research.

**Part II**, entitled *Research Methods and Tools in the Description of the Mental Lexicon*, comprises three chapters that take on the challenge of advancing the methodologies of investigating words.

**Antoine Tremblay** and colleagues propose a novel methodology bringing together the fields of linguistics and neuroscience with a new corpus, *NeuCorp*. This proposed neurolinguistics corpus will allow researchers to delve into the natural, language brain-based questions that were previously impossible to ask. In their chapter, Tremblay et al. outline the significant contributions that corpus and neuroscience database-based research have brought to their respective fields. The proposed *NeuCorp* is based on conversations, rather than experimental tasks, responding to the drawbacks of traditional corpus and neuroscience databases, and thus, allowing for a wider range of questions that can be answered by the proposed tool. To test the viability of *NeuCorp*, the chapter presents the results of using the neurolinguistics corpus to explore the relationship between lexical frequency and brain activity. The results correspond to previous research that lower frequency words stimulate increased cognitive demands. It is exciting to think of the possibilities that this new methodology has to offer by answering questions related to the mental lexicon and language acquisition. The authors propose a few areas of research that are possible. They hypothesize that the proposed tool could be used to delve into the questions surrounding the nature-versus-nurture debate of child language acquisition by providing non-invasive brain imaging data paired with natural conversations. Tremblay et al. suggest that research focused on interlocuter cognitive demands of conversation dynamics could greatly benefit from *NeuCorp*. This new type of technology has the potential to revolutionize the field of linguistics, just as large corpus data changed linguistics research 50 years ago.

**Maria Telegina** investigates the mental lexicon by taking a network analysis approach to analyze the spatial and temporal domains of the Japanese language. This approach by Telegina to study Japanese mental lexicon is novel. She not only used quantitative statistics to analyze the network dimensions, but also employed qualitative techniques to further characterize the semantic relationships of the spatial and temporal vocabulary studied. To build the network, the author collected data from Japanese undergraduate and graduate students who completed questionnaires to elicit free word associations to the chosen stimuli and filler words. The author observed that for the most strongly connected words, there were three predominant relations of synonymy, coordination, and subordination, and a

number of qualities (e.g., temperature, belonging, measure) distinguishing spatial and temporal vocabulary. Interestingly, it was noted that in the case of polysemous words, both temporal and spatial attributes of a measure can be used, depending on the context. Telegina, in her chapter, was able to apply both quantitative and qualitative analysis to hypothesize about the characteristics of vocabulary at the meso and macro levels, and to further the work of understanding Japanese language acquisition.

**Richard Drake** and **Nicole Conrad** consider the factors influencing our ability to activate representations of words stored in the mental lexicon. The authors examine the importance of semantic information in facilitating access to the mental lexicon. The chapter starts with an overview of theoretical debates about word representations' models, and later presents the variables affecting reading and spelling performance, such as frequency, regularity, and imageability. The latter is defined as "the strength of the association between a word's meaning and the senses" and is related to the degree of abstraction of a word. As mentioned by the authors, the reading and word-naming have been relatively well researched; individuals tend to read words with high imageability faster and more accurately than low-imageability words. The effect of imageability on spelling is not yet well documented. The experiment conducted by the authors with undergraduate students, native speakers of English, aimed to examine how spelling accuracy and speed was influenced by various word level properties. Adapting the methods used by Strain et al. (1995), the researchers administered a typing test to the participants. The results indicate that, overall, imageability affected spelling performance. Low imageability words were typed slower and with less accuracy, and this effect was especially noticeable for the spelling accuracy of infrequent words. The effects are discussed considering those observed in previous studies on word reading, and implications for various models of word access are debated. The contribution of this chapter is two-fold: it offers additional experimental data and provides food for thought to the current theoretical debate.

**Part III**, entitled *Lexical Knowledge: Measurement and Use*, includes three chapters and is dedicated to the measurement of vocabulary knowledge. Both breadth and depth of productive lexical knowledge are considered. All these chapters present recently conducted empirical studies where adult and children's language production is analyzed using contemporary methods of corpus studies.

**Scott Roy Douglas** explores vocabulary knowledge as a crucial element of academic writing competence by analyzing language production of first-year students from linguistically diverse backgrounds enrolled in a non-credit general academic writing course. The aim of the course is to provide

support to students who desire to study at English-medium university, but do not possess sufficient level of language skills for a variety of reasons. Douglas creates lexical profiles by examining the breadth of vocabulary in participants' final in-class essays. He looks at the percentage of the running words covered by the General Service List (West 1953) and the Academic Word List (Coxhead 2000). Additionally, the author examines the existent correlations between high- and low-frequency lexical choices in students' essays with instructor's grades on the final essays. He demonstrates the relationship between the quality of academic writing and lexical breadth in student writing. Participants who relied less on higher-frequency word choices and made use of lower-frequency word choices generally received higher grades on final in-class essay. This study underscores the importance of explicit vocabulary instruction in the curriculum of general academic writing courses in English.

**Alla Zareva's** chapter echoes Douglas' conclusions about the need for explicit vocabulary instruction, even at an advanced level of language proficiency. As in the previous chapter, her study also examines productive lexical knowledge, but it is centered on a less researched topic—spoken rather than written academic discourse. The study concerns the depth of lexical knowledge as it tackles the question of how well students know the properties of multi-word verbs. The author explores the use of prepositional, phrasal, and phrasal prepositional verbs in oral production of advanced English L2 students from several USA universities. Students' oral presentations were analyzed to determine what categories of multi-word verbs are most often used by L2 learners. The results of this study indicate that even at a high level of language proficiency, students use incorrectly formed prepositional and phrasal verbs. Moreover, compared to L1 presenters, who used about as many multi-word verbs as free combinations (Zareva 2016), these L2 learners seemed to “shy away” from these structures. They showed almost half the variety than native speakers. Considering this evidence, it is not surprising that L2 students tended to repeat the same multi-word verbs across all subcategories studied. As Zareva states, the fact that these structures are challenging for students calls for additional explicit vocabulary instruction. The author describes the preferred hierarchy of usage across different subcategories of verbs, shedding light on the specific needs of this type of learner.

**Bonita Squires** and colleagues are looking at an under-represented area of research in child language production. This study focuses on derivational morphology and compound's use in child language, which was less described than the development of inflectional morphology in the literature. The study provides novel insights into the development of the derivation

and compounding in children by collecting language samples of conversational, narrative, and expository discourse types. First, the chapter gives an overview of the development of multimorphemic words in children's language production. It then proposes a set of rules that allow researchers to identify derived and compound forms in language samples, based on theoretical constructs. Each rule is illustrated by multiple examples from the corpus collected by researchers. These rules were tested on six language samples of 7-to 8-year-old and 11-to 12-year-old children. The use of multi-morphemic forms was more pronounced for the older children. The reliability of the proposed rules is discussed at the end of the chapter, and practical advice is provided to inform further developmental research. This chapter contributes to the development of novel research methods in the investigation of vocabulary acquisition by English-speaking children, and is of interest to clinical research specialists, speech-language pathologists, and language educators in general.

**Part IV**, entitled *Pedagogical Implications*, concentrates on better vocabulary teaching techniques. To really know a word, one must be familiar with its form, meaning, and combinatorial properties. In other words, knowing a word implies knowing its spoken and written form, knowing its meaning, and being aware of its associations with other words, such as its synonyms and antonyms, as well as being able to use it appropriately in collocations and other contexts (e.g., Nation 2013). All three chapters in this section of the book concern the methods and approaches for a better vocabulary teaching in an additional language at an advanced level of proficiency. Both breadth and depth of word knowledge are considered, and the importance of explicit teaching to adults is underscored.

Studying productive vocabulary use by L2 learners has important implications for needs analysis for pedagogical purposes. **Léonard P. Rivard** and **Martine Canavagh** consider the use of discourse markers in summary writing by advanced L2 learners. It is known that the discourse competence needed to write a "coherent, accurate, and succinct representation of a source text" is acquired at later stages of language acquisition and poses a difficulty even to advanced learners. This competence is essential for effective academic writing. To propose efficient strategies for connectors' and discourse markers' use, it is necessary to first assess students' difficulties in this area. The authors first present an overview of the order of acquisition of connector words in L1 and L2. Later, they present an empirical study that examines how connector words are employed in summary writing by French immersion students (from grade nine to university students), compared to native speakers of French. Based

on to the type of semantic relationships expressed, connector words were divided in various categories. This study reveals that temporal and adversative connectors are used in a different way by L1 and L2 speakers. L1 students demonstrated a richer repertoire of words in both instances. The authors argue that the successful strategies for summary writing are generic and could be applied to many languages. Therefore, they propose sample classroom activities in English illustrating these strategies and concentrating on argumentative and persuasive texts. These strategies include finding discourse markers from context, reconstructing text puzzles, and writing-planning activity with graphic organizers. This chapter contributes to better understanding students' needs in academic writing and proposes novel techniques for better instruction of discourse markers' use.

**Alexandra Tsedryk** examines the relationship between the lexical knowledge of advanced learners of French and their ability to paraphrase. Paraphrasing is a crucial tool in language performance, since it allows the flexibility of expressing the same meaning using various linguistic means. Paraphrasing competence is related to the depth of lexical knowledge, since it heavily depends on relations between lexical units. It also implies a very good understanding of a source text and correct use of grammar rules. Students working on academic writing tasks, such as essay writing, text editing, or summarizing are expected to possess solid paraphrasing skills. However, even at an advanced level, L2 learners have difficulties in reformulating sentences (Tsedryk 2016). The study described in this chapter aims to improve lexical and paraphrasing competences based on a novel didactical approach. It is based on structured explicit teaching of linguistic concepts pertaining to paraphrasing, and various reformulation exercises. The goal of the didactic module was to raise students' awareness of different paraphrasing rules. The approach was tested online and in class with advanced French L2 university students. The author examined semantic equivalence, repetition of tokens, and use of paraphrasing means. The results indicate that the notion of paraphrase is acquired after explicit training, and that instruction in the classroom proved to be a more effective mechanism than online teaching. L2 students with classroom instruction used more diverse lexical and lexical-syntactic means of paraphrasing in the post-test. Additionally, students appreciated the proposed didactical approach and strongly agreed that teaching paraphrasing techniques would be beneficial in L2 language instruction. Despite these positive trends, the task of paraphrasing remains complicated for a L2 learner. The implications for vocabulary instruction are discussed considering problems identified during the task. This chapter highlights the role of paraphrasing in the

development of lexical competence and advocates for explicit methods of teaching at an advanced level.

**Déogratias Nizonkiza's** chapter considers the use of corpora and online tools for pedagogical purposes to help improve students' academic vocabulary. This awareness-raising approach to teaching collocations focuses on student perceptions of the usefulness of including such tools in a credit university course. The aim of the course was to help students identify collocations, use corpora, and improve their self-editing skills. The students enrolled in the course were in their post-graduate studies and interested in improving their academic writing skills. Nizonkiza administered a survey to students that asked questions about familiarity with the tools and whether the students used the tools to self-edit or improve their academic vocabulary or writing. The majority of the participants responded positively and reported that they were more aware of the tools and used them to support their academic writing. The results also highlighted the participants' positive response towards the use of the tools as an aid to help improve academic vocabulary. Some of the participants reported time as a constraint when trying to use the corpora and online tools as supports for writing academic papers. The author discusses implications for future research and instruction on collocations in courses at a lower proficiency level. The findings of Nizonkiza's study are promising for second language students studying at a post-graduate level and writing academic papers.

With this collection of chapters, we aim to appeal to a wide variety of readers, including individuals from academic, professional, governmental, non-for-profit, and private sectors. This book will be useful to graduate students and senior scholars in the various fields of theoretical linguistics, psycholinguistics, applied linguistics, adult and child language acquisition, and modern languages. In addition, it should appeal to language educators at various institutions, immigrant service specialists, school board officials, and study abroad consultants.

We are grateful to our numerous colleagues, advisors, reviewers, and proofreaders without whom this volume would be impossible to prepare. We thank Mount Saint Vincent University's Research Office for their financial support of this project. We are particularly grateful to Mark Vickers and to Rebecca Babcock for their help in editing the manuscript. We hope we have engaged the readership with pressing issues about vocabulary and provided food for thought for future studies.

Halifax, Canada, August 2019

*Alexandra Tsedryk and Christine Doe*

## References

- Butterworth, Brian. 1983. "Lexical representation." In *Language Production, vol. 2: Development, Writing and Other Language Processes*, edited by Brian Butterworth, 257-294. London: Academic Press.
- Carlo, Maria S., Diane August, Barry McLaughlin, Catherine Snow, Cheryl Dressler, David Lippman, Teresa J. Lively, and Claire E. White. 2009. "Closing the gap: Addressing the vocabulary needs of English-language learners in bilingual and mainstream classrooms." *Journal of Education* 189(1-2): 57-76.
- Coxhead, Averil. 2000. "A New Academic Word List." *TESOL Quarterly* 34(2): 213-238. <http://www.jstor.org/stable/3587951>.
- Dodigovic Marina, Stephen Jeaco, and Rining Wei., eds. 2017. TESOL International Journal. Special Issue. *Teaching, Learning, and Assessing Vocabulary*, 12 (1).
- Koenenman, Olaf, and Hedde Zeijlstra. 2017. *Introducing Syntax*. Cambridge: Cambridge University Press.
- Nation, Paul. 2013. *Learning Vocabulary in Another Language*. Cambridge: Cambridge University Press (2<sup>nd</sup> ed.).
- Pietilä, Paivi, Katalin Doró, and Renata Pípalová, eds. 2015. *Lexical Issues in L2 Writing*. New Castle upon Tyne: Cambridge Scholars Publishing.
- Strain, Eamon, Karalyn Patterson, and Mark S. Seidenberg. 1995. "Semantic Effects in Single-Word Naming." *Journal of Experimental Psychology: Learning, Memory, and Cognition* 21 (5): 1140-54. doi:10.1037/0278-7393.21.5.1140.
- Taft, Marcus. 1993. "Interactive-activation as a framework for understanding morphological processing." *Language and Cognitive Processes*, 271-294.
- Taft, Marcus, and Kenneth I. Forster. 1975. "Lexical storage and retrieval of prefixed words." *Journal of Verbal Learning and Verbal Behavior* 14: 638-647.
- Townsend, Dianna, Alexis Filippini, Penelope Collins, and Gina Biancarosa. 2012 "Evidence for the importance of academic word knowledge for the academic achievement of diverse middle school students." *The Elementary School Journal* 112 (3): 497-518.
- Tsedryk, Alexandra. 2016. *La compétence paraphrastique en français langue seconde*. Bern: Peter Lang.
- Webb, Stuart, ed. 2016. *Vocabulary: Critical Concepts in Linguistics*. IV Volumes. Routledge: New York.
- West, Michael. 1953. *A General Service List of English Words*. London, UK: Longman.



Zareva, Alla. 2016. "Multi-word Verbs in Students' Academic Presentations."  
*Journal of English for Academic Purposes* 23: 83–98.



**PART I**

**THEORETICAL DESCRIPTION  
OF THE MENTAL LEXICON**

CHAPTER ONE

WORDS AS ACTION:  
CONSEQUENCES FOR THE MONOLINGUAL  
AND BILINGUAL LEXICON

GARY LIBBEN

**Abstract**

Words can be considered to be the building blocks of language. But the term *building block* evokes a sense of words as things. I present a perspective on word structure and the mental lexicon that moves away from thing-like representations and toward a view in which words are seen as activities, and the lexicon as a whole is considered to be a dynamic knowledge store. Within that store of knowledge, words may be described as being in a lexical superstate. Lexical superstates capture the morphological configurations that a word can have, based on patterns of language use. This perspective leads to a more dynamic view of lexical knowledge and has substantial consequences for models of lexical knowledge among bilinguals and multilinguals.

**Introduction and overview**

In a very important way, words are the building blocks of language. They constitute the fundamental and all-important associations between form and meaning upon which our overall language ability depends. Our capacity to acquire words in childhood and to expand, modify, and re-organize our lexical knowledge throughout the lifespan is a key component of language change and language growth. It is also a key component of an individual's ability to participate in language communities and cultural communities.

The notion of words as building blocks and the notion of word knowledge as being dynamic and self-organizing carries with it a particular kind of tension. This is the tension between words as things and words as actions. In this chapter, I discuss the historical roots of this tension and the

ways in which seeing words as actions opens up new ways to think about lexical knowledge. Thinking about words as actions may also lead us to new ways of seeing and understanding the morphology of words. If, for example, lexical knowledge within an individual is the result of his or her lexical action over time, then it may turn out to be the case that what we used to think of as morphological structures or morphological boundaries simply reflects how people make use of the potential sub-elements of words in reading, writing, listening, or speaking. Additionally, it is very likely that people would use these potential sub-elements in different ways at different times.

A perspective such as this would bring us to a much more dynamic view of the mental lexicon and of lexical knowledge. It would be a view in which words are just as much mental actions as they are mental representations. It would be a view in which words would not have a fixed structure in the mind and might indeed be in a continual state of flux as a result of new patterns of lexical action. The lexical system would thus have duality and indeterminacy at its core.

In the sections below, I discuss the historical roots of the words-as-things perspective, as well as the characteristics of a words-as-action perspective. I propose ways in which some of the metaphors of early quantum physics could be useful in enabling us to build models of the lexicon that incorporate the duality of representation and action and the ways in which we can build these properties into psycholinguistic models of morphological structure and morphological processing. Finally, I explore the consequences of this perspective for the modeling of the bilingual lexicon.

## 1. Where we are coming from: words as things

There is an immediately intuitive sense in which words appear to be real “things.” This places words in rather sharp contrast to other sorts of linguistic constructs. Indeed, almost all putative constructions in linguistics seem subject to debate both within the discipline and among persons with no formal training in linguistics. For example, we might feel a need for evidence to support the claim that *syllables* are real things, that *rimes* and *codas* are real, that *morphemes* are real, or that *phrases* are real. However, *words* seem real to most everyone.

This sense of words as things is evident throughout modern culture in which words are everywhere. In the Roman alphabet that is used for most European languages, words are marked off in a manner that makes “wordhood” visually salient from the very onset of reading. Parents seem to naturally adopt the word as the measure of language development, so that

they will be much more likely to estimate the number of words their children know, and quite unlikely to estimate the number of phonemes or the number of phrases. Indeed, from almost every perspective, there is considerable cultural pressure to conceive of words as things.

In the formal study of linguistics, there has also been considerable pressure to see words as things—and with that, to see the mental lexicon as a storehouse for things (in this case, the things that we call lexical representations). The notion of a lexicon as a list of exceptions emerged very early on in the history of generative linguistics. Bloomfield (1933) characterized the lexicon as an appendix to the grammar, a list of basic irregularities (274). In Chomsky (1957), the lexicon was also seen as a list of irregularities, containing only simple (i.e., non-derived and uninflected) forms. Beginning with Chomsky (1970) and Halle (1973), there was a shift toward developing a notion of a distinct lexical component of the grammar that would also contain lexical rules. In this tradition, a number of proposals emerged regarding what is actually listed in the lexicon and what is derived by lexical or syntactic rules (e.g., Aronoff 1976; Selkirk 1982; Di Sciullo and Williams 1987). In all these approaches, however, there is a clear sense that words are linguistic representations—*things in the mind*.

This notion of words as things was not only evident in early linguistic approaches to the lexicon. It was also evident in early psycholinguistic approaches, particularly those associated with models of reading and the characterization of acquired dyslexia (e.g., Morton 1969; Coltheart Davelaar, Jonasson, and Besner 1977; Coltheart 1987). In order to capture patterns of reading words aloud among unimpaired readers of English and persons with acquired dyslexia, these approaches typically contained more than one store of words, including an orthographic input lexicon, a phonological output lexicon and a somewhat less well defined “semantic system.” This basic configuration continued to be evident in subsequent computationally implemented models such as the DRC model (Coltheart, Rastle, Perry, Langdon, and Ziegler 2001).

In the field of visual word recognition, the early contribution of Forster (1976) and the view that the mental lexicon could be conceived of as a frequency-ordered list of lexical entries (i.e., mental things) had enormous influence on the field. In this seminal work, Forster (1976) opened the door to a generation of work on functional properties of the mental lexicon, the processing of multimorphemic words (Taft and Forster 1975; 1976), and the core characteristics of lexical access (Forster 2007). Researchers currently working in the field of lexical processing no longer typically use the metaphor of a “list” to characterize the organization of words in the mind. However, they very much continue to use the notion of a word as a mental

representation with which to characterize lexical access. Furthermore, the construct of lexical access itself assumes that words are static representations in the mind.

Thus, the tradition that has its roots in the studies above has offered a sense of “obviousness” to the notion that words are things and that the mental lexicon is a storehouse of those things in the mind (see Aitchison 2012). This sense of the mental lexicon draws on the metaphor of a dictionary in the mind (Libben, Westbury, and Jarena 2012). However, from the outset, it has been clear that this must be a metaphor of convenience, not a substantive claim about cognitive architecture.

The most important reason that the dictionary in the mind must remain a rough metaphor concerns the homunculus problem (Dennett 1978; Westbury 2016). This problem is perhaps easiest to assess in the domain of visual processing. Indeed, the manner in which I was taught, in elementary school, about how human vision works provides a convenient illustration of the problem. I was taught that light came in through my eye and an image was shown upside-down on my retina, and so my brain had to turn it right-side-up in order to see it. At the age of seven or eight, this struck me as a rather complete explanation. The problem is, of course, that it is not a complete explanation at all. What does my brain use to see the upside-down picture? Might it be another eye?

In developing domains of research on cognition such as the study of lexical processing, the homunculus problem can present a formidable challenge to the articulation of deep levels of explanation. It is exceedingly unlikely that the mental lexicon can be a knowledge source that is consulted in the mind in the way that is similar to how a scholar might consult a physical dictionary. The reason for this is that such a view would require that, in addition to the mental lexicon, we would have to posit the little scholar in the mind who would consult it.

It seems, therefore, that when the cognitive details and their implications are considered, the mental lexicon could not really have the overall form that would make it similar to dictionaries in the outside world. Neither could it have the internal properties of dictionaries. A physical dictionary is typically composed of entries. Those entries have a fixed internal structure and fixed properties. The reason for this is that the content of a dictionary reflects the efforts of a lexicography team that has worked to make the dictionary as clear, as unambiguous, and therefore as useful as possible. One important difference in considering the mental lexicon is that if there is no scholar homunculus in people’s heads, there certainly will not be any little lexicography team either. As a result, as I will discuss below, the mental

lexicon is likely not well ordered and not static. Rather, it is dynamic, ambiguously structured, and richly interconnected.

## 2. Where we are going: words as activities

An activity-based perspective on words requires that we think of words as something that people do, rather than something that people have. In this way, we are thinking about words as psycholinguists think about language as a whole. Fundamentally, psycholinguistics is the study of how people *do* language: how they learn and unlearn, how they understand and misunderstand, how they communicate and miscommunicate. These activities that characterize language as a whole also characterize words. They are fundamentally things that we do.

As an example of this reasoning, we might consider other types of activities to which we give labels and which, as a result, appear to us to have the properties of things, when, in fact, they are activities. It seems to me that many of the words that we use in sports have such qualities. In tennis, for example, we use the term “backhand” as a noun. Thus, we consider sentences such as “I practiced my backhand” or “My backhand is weak” to be completely unproblematic. We know that a *backhand* is actually an activity, but we treat it as a thing. That thing is actually a coordinated network of activities (e.g., foot movements, weight transfer, follow-through, etc.). But it serves us well to be able to capture that coordinated hierarchy of activities as a single construct. It has substantial advantages in enabling the tennis player to conceptualize and improve his or her performance.

I would like to suggest that this is exactly the manner in which we might want to think about the word *backhand* as a purely lexical phenomenon when we perform activities such as writing, reading, speaking, and listening.

This may be easy to see if we were to now bring together the construct *backhand* as a coordinated network of activities both physically on the tennis court and lexically in the mind. It seems to me that considering these together highlights the way in which it is sometimes very difficult to create sharp boundaries between the lexical activities in the mind and physical activities in the world.

In terms of physical activity in the tennis court, the construct *backhand* allows the player to conceptualize (and presumably more easily acquire and execute) movement alternatives such as *forehand* or variations such as *backhand slice* and *backhand drive*. It is noteworthy that in terms of lexical functioning in the mind, the morphological characteristics of the English words associated with these movements also facilitate the acquisition and execution of related lexical events (or words). The fact that the word



*backhand* is a compound in English makes it easier to relate it to the word *forehand* because the two words share a morphological head as their final element. What follows from this is that the two words *backhand* and *forehand* will be involved in the same actions. In speaking, they will be involved in the same actions to produce the final constituent *-hand* with the same compound stress patters. The words will also share activity in writing, and we would expect that that there would be considerable overlap in the lexical recognition activities for the two words during word comprehension.

For the linguistic constructions *backhand slice* and *backhand drive*, the parallelism in morphological structure seems to facilitate cognitive linking related, again, to the overlap in lexical cognitive activities associated with both producing and comprehending these triconstituent compounds.

## 2.1 The status of lexical representations

In the discussion of the compound word above, I have sought to highlight the manner in which words can be discussed psycholinguistically in terms of lexical action. This accords with a good deal of experimental research that has revealed that compound word processing involves both activation of constituent morphemes and the activation of related words that share constituent forms and constituent meanings (Fiorentino, Naito-Billen, Bost, and Fund-Reznicek 2014; Libben 2014; Libben, Gibson, Yoon and Sandra 2003; Schmidtke, Van Dyke, and Kuperman 2018). It also accords with research that has found that the processing of compounds is affected by the semantic relations among compound elements (Gagné and Spalding 2009; Marelli, Gagné, and Spalding 2017).

This psycholinguistic evidence suggests, for example, that processing the word *backhand* initiates coordinated activity that results in a spread of activation from words such as *tennis* (which is semantically related), compounds such as *background* (which shares the initial compound element *back-*), and compounds such as *freehand* and *shorthand* (which share the final compound element *-hand*). Such activity speaks to the dynamicity of the lexical system as a whole. However, in our current state of knowledge, it is extremely difficult to discuss lexical activity without referring to lexical representations as things (even though we might believe that they will actually be shown to be hierarchies of action). For example, when we speak about the activation of morphemes within a compound word, those morphemes are treated as representations. When we talk about the spread of activation to other words in the mental lexicon, those other words are treated as lexical representations. It seems to me that this is a situation that is very difficult to avoid. It, in fact, is a manifestation of the phenomenon that I

discussed above. Although most everybody will agree that a *backhand swing* is an action, it is just more convenient to refer to it with a compound noun. Moreover, moving to lower component levels of the activity does not solve the problem, for here we simply find another set of hierarchies (e.g., *wind-up*, *follow-through*, etc.). The same seems to be the case for our description of lexical representations in the mental lexicon. Even though morphemes, letters, and even strokes within those letters are activities, by necessity, we use the language of representations to talk about them.

What, then, might be the best way to capture the nature of words in the mind? I think the first step would be to allow for the possibility that words (and perhaps many other types of cognitive representations) do not have a single unambiguous nature. As I have discussed above, there is a way in which words are fundamentally actions, but we need to refer to them as representations in order to capture those actions. Thus, words can be said to have a dual nature: They are actions and they are representations. We are best off considering them to be actions when we think about their status in the activities of language production and comprehension. We are also best off considering them to be actions when we think about their acquisition and perhaps their attrition. On the other hand, as I have noted above, there are clearly times in which it is necessary to see words as representations.

I would like to suggest that this issue of duality has some similarities to the issues of duality discussed in the relatively early days of quantum physics. These early quantum physicists tried to account for the observations that electrons behave in a manner that is consistent with them being waves and also consistent with them being particles (Einstein 1905; Bohr 1934; Heisenberg 1958). The issue of wave/particle duality became a central conceptual issue in the development of quantum physics and, perhaps surprisingly, drew from the metaphors and perspectives of the American psychologist William James who, in his studies of consciousness, was also dealing with the dual nature of mental representations (Hunt 2001; Smith 2006). William James (1890) understood the danger of trying to capture mental activities as objects. In one of his many poignant similes, James described efforts to capture mental representations in consciousness as similar to trying to see how darkness looks by turning on a light very quickly (Hunt 2001).

It seems to me that the perspectives of William James on the nature of mental representations has important lessons for our treatment of lexical representations more than 125 years later. It also seems to me that the approach that early quantum physicists took to the interpretation of wave/particle duality offers a useful lesson for the understanding of words in the mind and brain. That lesson is that it might be most appropriate to

consider many lexical properties to not have a fixed state or representation in the mind, but rather have the potential to manifest in a number of different ways. Thus, words can behave as actions under certain circumstances and as representations under other circumstances. Moreover, even when words are manifested as representations, their structure will not be in a fixed state, but rather will have the capacity to manifest in different configurations, depending on the circumstances.

In the section below, I discuss the consequences of this view for the representation of morphological structure in the mind.

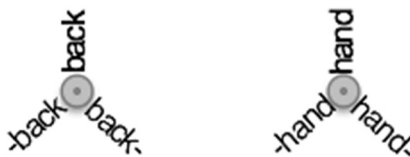
## 2.2 Word structure as lexical superstates

The metaphor of a lexical superstate builds directly on the notion of superposition in quantum physics in which it is understood that characteristics of elements can remain indeterminate until they are observed. Applying this as a metaphor in the psycholinguistics of lexical processing, I suggest that seeing words in the mind as being in an indeterminate superstate until they are used in a language activity (i.e., speaking, listening, reading, or writing) can have substantial advantages in the interpretation of the results of psycholinguistic experiments and in the modeling of words in the mind (Libben 2017).

Let me illustrate by returning once again to the example compound word *backhand*. In terms of its lexical sub-organization, the word *backhand* is a noun composed of the elements *back* and *hand*. But what is the nature of those elements? Are they actually the words *back* and *hand*, the same words that appear in a sentence such as “The boy in the *back* of the class raised his *hand*?” Are the morphemes *back* and *hand* in the compound *backhand* the same as the morphemes in the compounds *payback* and *handstand*?

I think that the answer to these questions is truly both “yes” and “no.” The reason for this is that the elements *back* and *hand* can be all those things. They can be free-standing words, compound modifiers and compound heads. But, seen from another perspective, they are none of these things, until actually used in a language event. Until that time, they are best described as being in a lexical superstate.

In Figure 1.1, a superstate configuration for the lexical elements *back* and *hand* is shown. As can be seen in this Figure, the free-standing word is *back*, the compound modifier is *back-* and the compound head is *-back*. By representing these as a lexical superstate, I am claiming that they are represented in the mind as having the potential for any one (and perhaps all) of these manifestations in lexical activity.



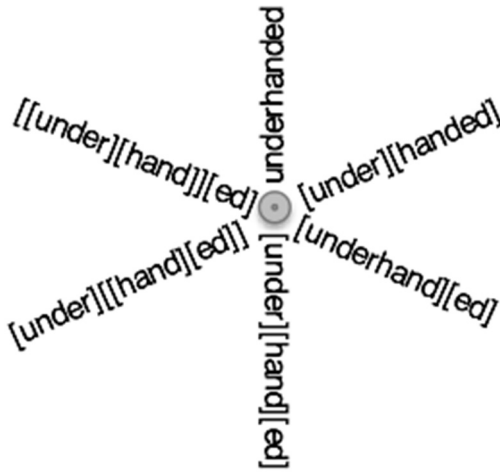
**Figure 1.1.** Lexical superstate representations for the elements *back* and *hand*. A hyphen to the right indicates modifier function. A hyphen to the left indicates head function. No modifier indicates a free-standing word.

The notion of a lexical superstate can be applied to many aspects of lexical structure and, in particular, to many morphological phenomena. Consider the word *underhanded* shown in Figure 1.2.

The word in Figure 1.2 may be structured in the mind of an individual in very different ways. It is conceivable that the word *underhanded* is processed as an unanalyzed whole for some individuals. One might imagine that it would thus be interpreted as a word that means “mean and sneaky,” as in sentence (1a). There is, of course, another meaning for the word *underhanded*. This one refers to the throwing of a ball or similar object with the hand below the elbow, as in sentence (1b).

- (1) a. That was an underhanded thing to do.  
 b. That was a fast underhanded throw.

One would expect, however, that the meaning in (1b), which is so strongly linked to the word *underhand*, would be unlikely to be fully morphologically unstructured, but, rather, would have one of the structures [underhand][ed] or [[under][hand]][ed] in Figure 1.2. In both these structures, the internal substring *underhand* is isolated as a constituent. The difference is that in one case, *underhand* is an unanalyzed whole, whereas in the other case, the substring *underhand* is internally structured as a compound.



**Figure 1.2.** Lexical superstate representations for the word *underhanded*. The representation at the top center shows the word as undecomposed and ungrouped. The representation at the bottom center shows it as fully decomposed, but ungrouped. On the right, the string is shown with two constituents (with two grouping alternatives). On the left, the string is shown with three constituents (with two grouping alternatives).

It may be very difficult, if not impossible, to determine which is the correct morphological structure for the word *underhanded*. Even if only one of the meanings is used, say the throwing meaning, then one could easily imagine conditions under which a language user might ascribe a different structure to the word at different times and under different conditions of use. The key point is this: It may be the case that the way that a word is structured in the mind and the way in which a person uses a word are one and the same.

The claim above that morphological structure can correspond exactly to lexical use may have extensive consequences for the ways in which we view morphological structure. One reason for this is that morphological structure that is driven by patterns of use may diverge from those that are driven by purely formal considerations.

Libben et al. (2016) investigated such a possibility in a series of word recognition and production experiments. Their core stimuli were English words such as *formality*. The word *formality* can potentially be structured in a variety of ways, containing various configurations of the putative morphemes *form*, *-al*, and *-ity*. Libben et al. (2016) reasoned that if morphology is indeed related to patterns of use, the organization of a word such as *formality* in the mind could, in principle, include the suffix string -

*ality*. Such an internal substring would not conform to a morphological unit in any existing theory of morphology, but it could indeed conform to a patterning in the mind based on language use (Derwing 2014).

Libben et al. (2016) used a progressive demasking technique to measure word recognition. This is a technique in which words are presented in a manner in which they seem to be emerging from a fog (Grainger and Segui 1990). Participants are asked to say the word aloud as soon as they can recognize it. The resulting naming latencies serve as the dependent variable in the experiment. Word production was measured in a typing task in which morphological structuring effects were detected by comparing letter typing at putative morphological boundaries to letter typing times within putative constituents.

The results of both the recognition and production components of the experiment were linked statistically to possible morphological structures. Using linear mixed effects modeling, the authors investigated whether recognition and production latencies are linked independently to whole word frequency (e.g., the frequency of *formality*), the frequencies of constituent words (e.g., the frequencies of *form* and *formal*), the frequency and productivity of possible affixal elements (e.g., *-al*, *-ity*, and *-ality*). The results of the study showed that effects for all the possible elements were found to affect both recognition and production of words such as *formality*.

How is this possible? How could word processing be affected by all possible morphological structures? It seems to me that the answer to this question is that, as a result of lexical action, the best mental representation in the mind for words such as *formality* is that representation which enables all possible lexical actions. Thus, the optimal representation of a multimorphemic word in the mind is a superstate representation. Such a superstate representation for the word *formality* is shown in Figure 1.3.

As a final example of the role of superstates and their relation to an action-based perspective on words, I turn to so-called ambiguous morphological structures. The word *unpackable* can be considered to be morphologically ambiguous. It can have two meanings based on the morphological configuration of its elements, as shown in examples (2a) and (2b).

- (2) a. Unpackable: ‘able to be unpacked’  
The trunk was *unpackable* in minutes.
- b. Unpackable: ‘not able to be packed’  
The trunk was broken and therefore *unpackable*.