University of California, Santa Barbara

Lexical flexibility in discourse:

A quantitative corpus-based approach

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of Philosophy in Linguistics

by

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2023	Word classes. In Carmen Jany, Marianne Mithun, & Keren Rice (eds.), *The languages and linguistics of indigenous North America: A comprehensive guide* (The World of Linguistics 13). Mouton de Gruyter.
2019	The Chitimacha language: A history. In Nathalie Dajko & Shana Walton (eds.), *Languages in Louisiana: Community & culture* (America's Third Coast Series). University Press of Mississippi.
2019	Semantic alignment in Chitimacha. *International Journal of American Linguistics* 85(3): 313–363. doi:10.1086/703239.

2018 Category genesis in Chitimacha: A constructional approach. In Kristel Van Goethem, Muriel Norde, Evie Coussé, & Gudrun Vanderbauwhede (eds.), *Category change from a constructional perspective* (Constructional Approaches to Language 20), 15–46. John Benjamins. doi:10.1075/cal.20.02hie.

2016 *The cohesive function of prosody in Ékegusií (Kisii) narratives: A functional-typological approach.* M.A. thesis, University of California, Santa Barbara.

2013 On linguistics, language, and our times: A linguist's narrative reviewed. *Linguistic Typology* 17(2): 291–321. Review article of *I am a linguist* by R. M. W. Dixon (Brill, 2010). doi:10.13140/RG.2.2.13238.96329.

2013 (with Sharon Hargus & Edward Vajda, eds.) *Working papers in Athabaskan (Dene) languages 2012.* Alaska Native Language Center Working Papers 11. ANLC.

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Abstract

Lexical flexibility in discourse:

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This dissertation is a qualitative corpus-based study of lexical flexibility in English (Indo-European) and Nuuchahnulth (Wakashan). *Lexical flexibility* is the capacity of lexical items to serve more than one discourse function—reference, predication, or modification (traditionally noun, verb, or adjective) with no overt derivational morphology.

Flexible words pose a problem for many theories of parts of speech because they cross-cut traditional part-of-speech boundaries, resisting clear classification. In response to this problem, many researchers have proposed new part-of-speech schemes with greater or lesser numbers of lexical categories. More recently, however, many researchers have come to treat lexical flexibility as an object of study in its own right. However, our understanding of how lexical flexibility operates, how it emerges diachronically, how prevalent it is, and how much it varies across the world's languages, is still nascent.

This study contributes new empirical data to the study of lexical flexibility. I analyze approximately 400,000 tokens of English and 9,000 tokens of Nuuchahnulth for their discourse function (reference, predication, or modification) in order to determine the overall prevalence of lexical flexibility in each language. I present a metric for quantitatively measuring lexical flexibility of each stem in a corpus that can be applied consistently across lexemes and languages for crosslinguistic comparison. I then apply this technique to English and Nuuchahnulth.

The data suggest that English and Nuuchahnulth differ significantly not just in their overall degree of flexibility, but also in the way that flexibility is realized. Most English stems exhibit lexical flexibility to a small degree, but otherwise center around a clear prototype. By

contrast, most Nuuchahnulth stems exhibit a high degree of lexical flexibility, but primarily between reference and predication. Nuuchahnulth stems show very few uses of modification in discourse. I also show that the degree of flexibility for each lexical item is synchronically fixed, suggesting that lexemes have a conventionalized set of discourse uses rather than productively appearing in whatever context is appropriate. I also investigate the relationship between lexical flexibility and either relative frequency or corpus dispersion, but find no clear correlations.

In both English and Nuuchahnulth, human animates are consistently low in flexibility, in line with the status of human animates as prototypical referents in discourse crosslinguistically. English and Nuuchahnulth display opposite tendencies for property words, however. In English, property words are among the low-flexibility items, whereas in Nuuchahnulth property words are consistently among the highest-flexibility items. I suggest that this difference is due to a lack of dedicated morphological modifying constructions in Nuuchahnulth.

The findings in this dissertation present a strong case for reversing the traditional perspective on lexical flexibility: rather than treating lexical flexibility as a relatively exceptional problem to be solved, I argue that lexical flexibility is a central and prevalent feature of the world's languages. Lexical flexibility exists anywhere a language has yet to develop dedicated morphosyntactic constructions for distinct discourse functions, or where those constructions have been diachronically leveled.

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List of Abbreviations

The following table provides the meaning of each abbreviation used in interlinear glossed examples throughout this dissertation.

1	first person
2	second person
3	third person
ACC	accusative
AGR	agreement
AGT	agent
CAUS	causative
COMPL	completive
COND	conditional
CONN	connective
DEF	definite
DUB	dubitive
DUP	reduplication
DUR	durative
EMPH	emphatic
EP	epenthetic
FIN	finite
FUT	future
HAB	habitual
HUM	human
IMP	imperative
INCEP	inceptive
IND	indicative
INDEF	indefinite
INSTR	instrumental
INTER	interrogative
IPFV	imperfective
LINK	linker
MOD	modifier
MOM	momentaneous
NAME	proper name
NEG	negative
NEUT	neutral position
NF	non-first person
PAST	past
PFV	perfective
PL	plural
PLACT	pluractional
POSS	possessive
PRED	predicate
PRES	present tense
PURP	purposive
QUOT	quotative
REF	referent
REFL	reflexive
REL	relative
SG	singular
SPEC	specific
SS	same subject
SUBJ	subject
SUBORD	subordinate
TR	transitive
VZR	verbalizer

List of Languages

The following table provides information about each language mentioned in this dissertation: the name of the language in English (following Haspelmath [2017]) with a link to that language's Glottolog page (Hammarström, Forkel & Haspelmath 2019), the International Standards Organization (ISO) 693-3 language code, and the Glottolog code. Genealogical information is taken from Glottolog.

Language Name (English)	ISO 639-3	Glottocode	Genetic Affiliation
Basque	eus	basq1248	isolate
Castilian Spanish	spa	cast1244	Indo-European > Italic
Cayuga	cay	cayu1261	Iroquoian > Northern Iroquoian
Chamorro	cha	cham1312	Austronesian > Chamorro
Cherokee	chr	cher1273	Iroquoian > Southern Iroquoian
Chitimacha	ctm	chit1248	isolate
Central Alaskan Yup'ik	esu	cent2127	Eskimo-Aleut > Yupik
Classical Greek	grc	anci1242	Indo-European > Hellenic
Classical Nahuatl	nci	clas1250	Uto-Aztecan > Nahuan
Dutch	nld	mode1257	Indo-European > Germanic
English	eng	stan1293	Indo-European > Germanic
French	fra	stan1290	Indo-European > Italic
German	deu	uppe1397	Indo-European > Germanic
Gooniyandi	gni	goon1238	Bunuban

Indonesian	ind	indo1316	Austronesian > Malayo-Sumbawan
Irish (Gaelic)	gle	iris1253	Indo-European > Celtic
Latin	lat	lati1261	Indo-European > Italic
Kuikuro	kui	kuik1245	Cariban > Kuikuroan
Kutenai	kut	kute1249	isolate
Mandarin Chinese	cmn	mand1415	Sino-Tibetan > Sinitic
Mandinka	mnk	mand1436	Mande > Western Mande
Middle English	enm	midd1317	Indo-European > Germanic
Mixtec	various	mixt1427	Oto-Manguean > Mixtecan
Mundari	unr	mund1320	Austroasiatic > Munda
Munya (Muya)	mvm	muya1239	Sino-Tibetan > Qiangic
Narragansett	xnt	narr1280	Algic > Eastern Algonquian
Navajo	nav	nava1243	Na-Dene > Athabaskan
North Efate (Nguna)	llp	nort2836	Austronesian > Oceanic
Nuuchahnulth (Nootka)	nuk	nuuc1236	Wakashan > Southern Wakashan
Occitan	oci	occi1239	Indo-European > Romance
Old English	ang	olde1238	Indo-European > Germanic
Old French	fro	oldf1239	Indo-European > Italic
Proto-Indo-European	ine	indo1319	Indo-European
Quechua	qwe	quec1387	Quechuan
Quiché Maya	quc	kich1262	Mayan > Quichean
Russian	rus	russ1263	Indo-European > Balto-Slavic
Soddo	gru	kist1241	Afroasiatic > Semitic
Spanish	spa	stan1288	Indo-European > Italic
Standard Arabic	ara	arab1395	Afroasiatic > Semitic
Sundanese	sun	sund1251	Austronesian > Malayo-Sumbawan
Swahili	swa	swah1254	Atlantic-Congo > Volta-Congo

Tagalog	tgl	taga1280	Austronesian > Central Philippine
Tarascan (Purépecha)	tsz	tara1323	isolate
Timucua	tjm	timu1245	isolate
Tongan	ton	tong1325	Austronesian > Oceanic
Tuscan	ita	dalm1243	Indo-European > Italic
Tzeltal Maya	tzh	tzel1254	Mayan > Cholan-Tzeltalan
Ute	ute	utee1244	Uto-Aztecan > Numic
Wambon	wms	ketu1239	Trans-New Guinea > Awyu-Dumut
Welsh	cym	wels1247	Indo-European > Celtic
Wolof	wol	wolo1247	Atlantic-Congo > North Central Atlantic
Yucatec Maya	yua	yuca1254	Mayan > Yucatec
Zapotec	zap	zapo1437	Oto-Manguean > Zapotecan

Conventions

This note documents the conventions I have adopted regarding linguistic data, terminology, and presentation of data throughout this dissertation.

Interlinear Examples

It is well known that the world's languages realize widely different sets of morphosyntactic categories (Whaley 1997: 58; Haspelmath 2007). Moreover, even when these categories bear the same name, they may differ drastically in their behavior (Dixon 2010: 9). It is the subject of much debate whether these language-specific categories can be mapped onto each other or compared in any useful way (Croft 1995; Song 2001: 10–15; Croft 2003: 13–19; Haspelmath 2010a,c; Newmeyer 2010; Stassen 2011; Hieber 2013: 308–310; Croft 2014; Plank 2016; Song 2018: 44–58). Recognizing these difficulties, I have made no attempt to standardize the linguistic terminology used in examples from different languages. I have, however, standardized the abbreviations used to refer to those terms. For example, even though one researcher may abbreviate Subject as SUBJ and another researcher abbreviate it as SUB, I nonetheless gloss all Subject morphemes as SUBJ. See the List of Abbreviations for a complete list of glossing abbreviations.

I have not attempted to standardize the transcription systems and orthographies used in examples. All examples are given as transcribed in their original source. The reader should consult those original sources for further details regarding orthography.

In all interlinear glossed examples, I follow the formatting conventions (but not necessarily the recommended abbreviations) of the Leipzig Glossing Rules (Bickel, Comrie & Haspelmath 2015). The source of each example is always provided after the example itself.

Prose

It is increasingly common in typological studies to write language-particular terms and categories with an initial capital letter, and to write terms that refer to language-general or semantic/functional concepts (e.g. the crosslinguistic notion of subject) in lowercase (Comrie 1976: 10; Bybee 1985: 47 (fn. 3), 141; Croft 2000: 66; Haspelmath 2010a: 674; Croft 2014: 535). For example, the English Participle suffix *-ing* is, obviously, specific to English, and does not exist in any other language; therefore it is capitalized and written as *Participle*. If, however, a writer is discussing the category of participles generally and crosslinguistically, not specific to any particular language, the term is written in lowercase as *participle*. I follow these same capitalization conventions in this dissertation.

Quotations

Within quotations, *italics* indicate emphasis in the original, while **boldface** indicates my emphasis.

Chapter 1

Introduction

This chapter motivates the need for research on lexical flexibility by situating it within broader concerns regarding linguistic categories more generally, and categories in human cognition. The specific problem addressed is our lack of understanding regarding what lexical flexibility looks like, and how it varies across languages. This dissertation contributes to answering these questions via a quantitative corpus-based study of lexical flexibility in English (Indo-European > Germanic) and Nuuchahnulth (Wakashan > Southern Wakashan). I analyze approximately 400,000 tokens of English and 9,000 tokens of Nuuchahnulth for their discourse function to determine the overall prevalence of lexical flexibility in these languages. This is the first study to examine lexical flexibility using natural discourse data from corpora. This chapter provides an overview of the dissertation, including the specific research questions addressed, the data and methods used, a concise summary of the results, and a preview of the conclusions.

1.1 The "problem" of lexical flexibility

Word classes such as noun, verb, and adjective (traditionally called *parts of speech*) were once thought to be universal, easily identifiable, and easily understood. Today they are one of the most controversial and least understood aspects of language. While language scientists agree that word classes exist, there is much disagreement as to whether they are categories of individual languages, categories of language generally, categories of human cognition, categories of language science, or some combination of these possibilities (Mithun 2017: 166; Haspel-

math 2019; Hieber forthcoming). Lexical categorization—how languages assign lexical items[1] to categories—is of central importance to theories of language because it is tightly interconnected with linguistic categorization generally, which in turn informs (and is informed by) our understanding of cognition. Categorization is a fundamental feature of human cognition (Taylor 2003: xi; van Lier & Rijkhoff 2013: 2–3), and lexical categorization is perhaps the most foundational issue in linguistic theory (Croft 1991: 36; Vapnarsky & Veneziano 2017a: 1).

One challenge for traditional theories of word classes is the existence of *lexical flexibility*—the use of a lexical item in more than one discourse function with no overt derivational morphology, whether it is used to refer (like a noun), to predicate (like a verb), or to modify (like an adjective). In traditional terms, flexible words are those which may be used for more than one part of speech. (A more precise definition of lexical flexibility is given in §2.5.) Examples of flexible lexical items in several languages are shown below. In the examples, **Ref** stands for a lexical item being used for reference, **Pred** for a lexical item being used for predication, and **Mod** for a lexical item being used for modification. The flexible item in each set of examples is shown with **emphasis**. Here and throughout this dissertation, I use the terms *reference*, *predication*, and *modification* so as to focus on the functions of lexical items and avoid committing to any analysis regarding their part-of-speech classification.

(1) English (Indo-European > Germanic)

Ref: And the spots of **paint** would change every hundred degrees.
(Ide & Suderman 2005: FrancisClem)

Pred: One story does come to my mind though where you **painted** the foundation coating on the house and got tar all over you.
(Ide & Suderman 2005: BorelRaymondHydellII)

Mod: And it happened to be one of the rare **paint** jobs.
(Ide & Suderman 2005: sw2236)

[1] I use the term *lexical item* as a convenient cover term for root, stem, or fully inflected word. This term does not here refer to the phonological word, syntactic word, or any other concept of word. The reason for this vague usage is because languages vary as to which linguistic level bears category information. This issue is discussed more fully in Section 2.3.2.3. I use *lexical item* instead of *lexeme* because the concept of a lexeme implies lexical unity, that is, that we are discussing a single polysemous item rather than two homophonous ones. Use of the term *lexical item* is intended to bypass this distinction in favor of a focus on form. However, I also avoid the term *(lexical) form* because some lexical items have multiple forms (in the case of suppletion).

(2) Mandinka (Mande > Manding)

Ref: **Kuuráŋ**-o mâŋ díyaa.
sick-DEF PFV.NEG pleasant
'Sickness is not pleasant.' (Creissels 2017: 46)

Pred: Díndíŋ-o máŋ **kuraŋ**.
child-DEF PFV.NEG **sick**
'The child is not sick.' (Creissels 2017: 46)

(3) Mundari (Austroasiatic > Munda)

Ref: **buru**=ko bai-ke-d-a.
mountain=3PL.SUBJ make-COMPL-TR-IND
'They made the mountain.' (Evans & Osada 2005: 354)

Pred: saan=ko **buru**-ke-d-a.
firewood=3PL.SUBJ **mountain**-COMPL-TR-IND
'They heaped up the firewood.' (Evans & Osada 2005: 355)

(4) Nuuchahnulth (Wakashan > Southern Wakashan)

Ref: watqšiƛ ʔaƛimt …
watq-ši(ƛ) **ʔaƛa**-imt …
swallow-MOM **two**-PAST …
completely.swallowed two …
'He swallowed two of them […]' (Louie 2003: Qawiqaalth 57)

Pred: wiƙaƛ haʔukšiƛ ʔaƛiičiƛ
wik-'aƛ haʔuk-ši(ƛ) **ʔaƛa**-'i·čiƛ
not-FIN eat-MOM **two**-INCEP
didn't ate became.two
'He (Mink) didn't eat them and the crabs became two.' (Louie 2003: Mink 266)

Mod: hiiɬtqyaaƥup ʔaƛa qʷayaċiik
hiɬ-tqya·ƥi-up **ʔaƛa** qʷayaċi:k
there-back-MOM.CAUS **two** wolf
put.on.the.back two wolf
'Two wolves put (the dead wolf) on their back.' (Louie 2003: FoodThief 46)

(5) Quechua (Quechuan)

Ref: rikaška: **hatun**-(kuna)-ta
I.saw **big**-(PL)-ACC
'I saw the big one(s)' (Schachter & Shopen 2007: 17)

Pred: chay runa **hatun** (kaykan)
that man **big** is
'that man is big' (Schachter & Shopen 2007: 17)

Mod: chay **hatun** runa
that **big** man
'that big man' (Schachter & Shopen 2007: 17)

(6) Tongan (Austronesian > Polynesian)

Ref: na'e lele e kau **fefiné**
PAST run SPEC PL.HUM **woman**.DEF
'The women were running.' (Broschart 1997: 134)

Pred: na'e **fefine** kotoa e kau lelé
PAST **woman** all SPEC PL.HUM run.DEF
'The ones running were all female.' (Broschart 1997: 134)

(7) Central Alaskan Yup'ik (Eskimo-Aleut > Yup'ik)

a. *iqa-* 'dirt'; 'be dirty'
-ngtak 'very'
Ref: ***iqa-ngtak*** 'one that is very dirty'
Pred: ***iqa-ngtaq-*** 'be very dirty'
(Mithun 2017: 159)

b. *tangerr-* 'see'
-uaq 'imitation, inauthentic'; 'pretend to, without serious purpose'
Ref: ***tangerr-uaq*** 'movie, vision, hallucination'
Pred: ***tangerr-uar-*** 'hallucinate, watch a movie'
(Mithun 2017: 159)

c. *iqeq-* 'corner of mouth'
-mik 'thing held in one's mouth'; 'to put in one's'
Ref: ***iq-mik*** 'chewing tobacco'
Pred: ***iq-mig-*** 'put in one's mouth'
(Mithun 2017: 160)

In the English example in (1), the predicative use of *paint* takes the English Past Tense suffix *-ed* like any prototypical verb in English, but there is no morpheme present that explicitly converts the stem from noun to verb (or vice versa). The remaining examples illustrate the same situation for a variety of language families around the world. Even though in some cases there is inflectional morphology indicating the function of the word, none of these examples have explicit derivational morphology converting the target lexical items from one function to another.

Flexible items like those in the examples above create an analytical problem for traditional

theories of parts of speech. Traditional theories assume that lexical items can be partitioned into mutually exclusive categories based on a clear set of criteria, an approach that has its roots in the Aristotelian tradition of defining a category via its necessary and sufficient conditions. Flexible items would seem to violate this assumption because they appear to be members of more than one category at once, and the criteria for classifying them yield conflicting results.

Researchers have proposed numerous solutions to this problem. One response is to analyze different uses of a putatively flexible item as instances of *heterosemy*—a special case of homonymy in which two lexemes share the same form but belong to different word classes (Lichtenberk 1991). In this view, heterosemous items are related only historically, via a process of conversion or functional shift, in essence denying the existence of lexical flexibility (Evans & Osada 2005). However, this perspective fails to answer why functional shift is rampant in some languages but not others, or why it happens to some lexemes but not others, or what motivates this functional conversion. Morever, as will be discussed in Section 2.3.3.4, it is difficult to maintain a principled distinction between polysemy and heterosemy. Semantic, distributional, and formal similarity between words are continua, meaning that questions like "are uses X and Y of a form instances of the same or different lexemes?" cannot be answered categorically. Questions about multifunctional uses of the same form—call it lexical flexibility, conversion, or something else—merit empirical investigation irrespective of one's analytical position on the matter.

A more common approach to lexical flexibility is to adjust the selectional criteria so that only certain features are considered definitional of the class, allowing these researchers to dismiss other, potentially contradictory evidence as irrelevant (M. C. Baker [2003]; Dixon [2004]; Palmer [2017]; Floyd [2011] for Quechua; Chung [2012] for Chamorro). Another approach is to say that languages exhibiting flexibility have only some of the traditional categories. A notable example of this is Launey's (1994; 2004) analysis of Classical Nahuatl, which he calls an *omnipredicative* language. In this analysis, all lexical items are predicates, so there is just one giant class of verbs.

Some researchers enthusiastically embrace the existence of lexical flexibility and abandon a commitment to the traditional categories of noun, verb, and adjective. Instead they analyze flexible lexemes as belonging to a broader, flexible word class such as "flexibles", "contentives" or "non-verbs", etc. (Hengeveld & Rijkhoff 2005; Luuk 2010). Other researchers abandon the commitment to word classes entirely. Mandarin, Tagalog, Tongan, Riau Indonesian, and Proto-Indo-European have each been analyzed as lacking parts of speech by some researchers (see Simon [1937], McDonald [2013], and Sun [2020] for discussions of early analyses of Mandarin; Gil [1995] for Tagalog; Broschart [1997] for Tongan; Gil [1994] for Riau Indonesian; Kastovsky [1996] for Proto-Indo-European). Within generative linguistics, the Distributed Morphology framework takes it as an assumption that all roots are category-neutral (Siddiqi 2018). Farrell (2001) argues that *all* instances of flexible items (which he describes as cases of "functional shift") involve roots that are unspecified for category.

Note that these differences in perspective do not arise from disagreements about the empirical facts. Researchers mostly agree on the empirical data, but disagree on the relative importance of various pieces of evidence, and on which criteria should be taken as diagnostic of a category (Wetzer 1992: 235; Stassen 1997: 32; Croft & van Lier 2012: 58). Examples of contested languages include those of the Iroquoian family (Chafe 2012), Mundari (Evans & Osada 2005; Hengeveld & Rijkhoff 2005), Quechua (Schachter & Shopen 2007: 17; Floyd 2011), and Sundanese (Robins 1968: 352; Hardjadibrata 1985: 62–63), with many others that could be cited as well. It is rare that an argument for flexibility is refuted by linguistic facts alone (though see Mithun's [2000] response to H. J. Sasse [1988] regarding Cayuga).

Since analyses of lexical flexibility depend more on the theoretical commitments of the researchers involved rather than any crucial pieces of evidence, this leads to an intractable problem: researchers cannot agree on the criteria that should be considered diagnostic for a given category in a specific language, let alone crosslinguistically. Instead they partake in *methodological opportunism* (Croft 2001b: 30), choosing the evidence and criteria which best support their theoretical commitments. Discussions in the literature about the existence of

a particular category in a particular language are therefore often unproductive, and devolve into debates about theoretical assumptions or the relevance or importance of various pieces of evidence, which are ultimately unresolvable (Croft 2005: 435).

This is particularly unfortunate because lexical flexibility is by no means an isolated or minor phenomenon. Additional examples like those above could be provided for many or perhaps even all the world's languages. Lexical flexibility is not as rare or marginal as traditional approaches to word classes lead one to believe. In a survey of word classes in 48 indigenous North American languages (Hieber forthcoming), every language surveyed exhibits lexical flexibility in at least some area of the grammar (although not all authors analyzed these cases as such). In my own experience studying lexical flexibility over the last decade, I have yet to encounter a language that does not exhibit a degree of flexibility in at least some lexical items, however marginally. The prevalence with which different areas of the grammars of the world's languages lack sensitivity to the distinctions between reference, predication, and modification suggests that the existence of lexical categories in a language is not necessarily a given (Hieber forthcoming).

Given what we know from both cognitive science and diachronic linguistics, it would be surprising if clear-cut categories *did* exist. Cognitive science tells us that mental categories, word meanings, and lexical categories are all prototypal[2] (Taylor 2003). What it means for a category to be *prototypal* is that category membership is graded so that some members of the category are perceived as better representatives of that category than others. The prototypical meaning or concept within a category is the one that speakers conceive of as the most basic. The fact that mental categories are prototypal leads to various *prototype effects* in both everyday life and language. More prototypical members of a category are learned earlier in development and acquisition, are used more frequently, can be recalled more quickly,

[2]In this dissertation, I use the term *prototypical* to mean 'having the properties of the prototype, exemplar, or central member of a category' and the term *prototypal* to mean 'having a prototype structure, with central and less central members'. The term *prototypal* is borrowed from the programming community, where it is used to describe programming languages (such as JavaScript) in which objects inherit properties from shared prototypes. Word classes may be described as prototypal, and their members as prototypical or non-prototypical.

are more likely to be represented using a simple lexical item rather than a complex word or compound, and are more strongly primed by the name of the category itself (Croft & Cruse 2004: 78–79). Exactly which of these observed effects best picks out the most prototypical meaning of a category is an open question and an area of active research (Gries 2006: 75; Gries & Divjak 2009: 58–59). Regardless, given the prototypal nature of mental categories, it would be quite surprising if lexical categories did not also exhibit prototype effects.

We also know from diachronic linguistics that language change is both gradual and gradient (Hopper & Traugott 2003; Traugott & Trousdale 2010). At any given point in time a lexical item might be in a stage of transition or expansion from one category into another, meaning that it will show attributes of both. Likewise, languages develop constructions dedicated to signaling the discourse functions of reference, predication, and modification over time, but at any given point in time, a language may have few or many of these constructions, and they may be at various stages of development (Vogel 2000). Given these facts, the real curiosity is how discourse functions come to be grammaticalized in language over time, not why it is that some languages lack such distinctions in certain areas of their grammars. Lexical flexibility is not so much a problem as it is a design feature of language. It is precisely the liminal categorial[3] status of flexible items that makes them interesting:

> In the functionalist view, linguists should recognize the boundary status of the cases in question and try to understand why they are boundary cases. The major empirical fact that has led to concrete results for typology is the discovery that the cross-linguistic variation in such things as the basic grammatical distinctions is patterned. (Croft 1991: 23)

It is only recently that lexical flexibility has become an object of study in itself, rather than a problem to be solved. As explained above, most prior studies aim to advance a particular analysis rather than to expand empirical coverage of the phenomenon. While they often provide numerous examples, they are neither quantitative nor comprehensive. As yet, there are only a small number of empirical investigations into the extent and nature of lexical flexibility

[3] In this dissertation, I use the term *categorical* to mean 'without exception; unconditional' and the term *categorial* to mean 'having to do with categories'.

in individual languages (let alone crosslinguistically). What follows is a brief synopsis of the existing studies of this latter type.

1.2 Previous research

The existing studies on the empirical extent of lexical flexibility are of two types: lexicon-based studies which examine dictionaries to determine whether lexical items may be used for multiple functions, and corpus-based studies which examine whether and how often lexical items are used for multiple functions in discourse.

Cannon (1985) is an early lexicon-based study of functional shift in the history of English. Functional shift became an especially common pattern of word formation in early Middle English as inflectional paradigms were leveled (Cannon 1985: 414). Cannon examines 13,805 lexical items from three English dictionaries with etymological information, and finds that just 541 entries (3.92%) were created via conversion. Conversion from noun > verb is the most common, adjective > noun conversion the second most common, and verb > noun conversion the third most common. The full results from the study are shown in Table 1.1.

Table 1.1: Types of conversion in English (Indo-European > Germanic) (Cannon 1985: 416)

from	to	count
noun	verb	189
adjective	noun	121
verb	noun	114
noun	adjective	77
verb	adjective	19
adjective	verb	11
adverb	adjective	10
	Total	541

Another lexicon-based study, though not explicitly focused on lexical flexibility, is Croft's (1984) study of categories of Russian roots (summarized in Croft [1991: 66]). Croft finds that Russian roots are unmarked, or among the least marked forms, when their semantic category

(object, action, or property) aligns with their discourse function (reference, predication, or modification respectively). When roots are used for discourse functions that are atypical for their meaning—in other words, when they are used flexibly—they are marked in some way (or at least as marked as their prototypical uses). These data suggest that lexical flexibility is constrained in a principled way, by what Croft calls the *typological markedness of parts of speech* (explained in detail in §2.4).

In a study of Mundari, Evans & Osada (2005) conduct a dictionary analysis using a focused 105-entry sample as well as a larger 5,000-entry-sample. In the 105-entry sample, 74 stems (72%) could be used as either noun or verb. In the larger sample, 1,953 stems (52%) could be used as both noun and verb. The complete figures for the large sample are shown in Table 1.2. Evans & Osada argue on the basis of these data that, because not all the items in the Mundari lexicon are flexible, Mundari is *not* a flexible language. As with any whole-language typology, however, this is an oversimplification. To overlook the flexibility of these items ignores the behavior of a vast portion of the lexicon. It is exactly this flexible behavior which is of interest in this dissertation. Evans & Osada's study nonetheless constitutes an important contribution to our knowledge of the empirical extent of lexical flexibility across languages.

Table 1.2: Percentage of lexical items used as nouns, verbs, or both in Mundari (Austroasiatic > Munda) (Evans & Osada 2005: 383)

noun only	772	20%
verb only	1,099	28%
noun and verb	1,953	52%
Total	3,824	100%

Mithun (2017: 163) also conducts a lexicon-based analysis of roots in Central Alaskan Yup'ik using Jacobson's (2012) exhaustive dictionary, and shows that only a small minority of roots (12%) are flexible, and can be used as both nouns and verbs. The results of this study are shown in Table 1.3. Mithun reports that the words in these groups cannot be characterized in any general or semantic way. Mithun's finding that flexibility in Yup'ik is rather marginal is surprising given that Yup'ik was the focus of an extensive debate about whether the lan-

guage distinguished nouns and verbs (Sadock 1999). The fixation with these marginal cases in the literature seems disproportionate to their actual type frequency of occurrence, again illustrating the disconnect between research advancing a particular analysis and research aiming to improve empirical coverage of the phenomenon. Just as with Mundari, however, it would be an oversight to simply ignore these flexible cases. Instead we should ask what accounts for the large difference in the extent of flexibility in the lexicons of Mundari versus Yup'ik.

Table 1.3: Percentage of roots used as nouns, verbs, or both in Central Alaskan Yup'ik (Eskimo-Aleut > Yupik) (Mithun 2017: 163)

noun only	35%
verb only	53%
noun and verb	12%
Total	100%

In summary, existing lexicon-based studies have yielded differing results, each contributing to our understanding of lexical flexibility, but there are still too few such studies to draw any general conclusions. Since lexicon-based studies report only type frequencies, we do not know whether the flexible lexemes in these studies account for a greater or lesser portion of tokens in a corpus.

Corpus-based studies of lexical flexibility are also scarce. In a study of the discourse functions of property words in English and Mandarin, Thompson (1989) reports that predicative uses of adjectives are in fact more common than attributive (modifying) uses of adjectives in conversation. The resulting figures from this study are shown in Table 1.4. Some of the attributive adjectives reported in Table 1.4 have "anaphoric head nouns" (Thompson 1989: 258), meaning that they are adjectives functioning to refer, so the figures presented are not entirely representative of the pragmatic functions of these items. The study also does not discuss the extent to which *individual* lexical items exhibit this predicate-modifier flexibility—we only have the data in aggregate—and it also excludes any prototypical nouns being used to modify. These methodological choices are appropriate for a study of the discourse uses of prototypical adjectives, but the result is that we cannot infer much about the extent of lexical

flexibility in English or Mandarin from this study.

Table 1.4: Distribution of functions of property words in English (Indo-European > Germanic) and Mandarin (Sino-Tibetan > Sinitic) (Thompson 1989: 253, 257)

	English		Mandarin	
predicative adjectives	209	86%	243	71%
attributive adjectives	34	14%	97	29%

Nonetheless, Thompson's study suggests a functional underpinning to the observed flexibility in prototypical property words. She finds that property words have primarily two functions in discourse: 1) to introduce new referents; and 2) to predicate an attribute about a referent. It is therefore no surprise that property words in some languages have their own specialized constructions since they represent a unique mix of referring and predicating functions. However it is equally unsurprising that some languages encode property concepts using either referring or predicating constructions, since prototypical adjectives exhibit behavior related to both functions.

A similar study to Thompson's is Croft's (1991: §2.5) investigation of the frequencies with which different semantic classes of lexical items (object words, action words, and property words)[4] are used for different discourse functions (reference, predication, and modification) in four languages: Quiché Maya (Mayan), North Efate (Austronesian), Soddo (Austroasiatic), and Ute (Uto-Aztecan). In all four languages, the most frequent use of lexical items is when their discourse function aligns with their semantic class. Object words are most frequently used to refer, action words are most frequently used to predicate, and property words are most frequently used to modify. Together with data from morphological markedness, semantic shifts, and combinatorial possibilities, Croft takes this as evidence that these are the most prototypical discourse functions for those semantic classes. As with other prototype categories, then, lexical categories display prototype effects in grammar. This fact is a key

[4]I use the terms *object word*, *action word*, and *property word* when referring to the semantic class of a word rather than its discourse function. Object words are object-denoting, action-words are action-denoting, and property words are property-denoting.

component of Croft's typological-markedness theory of lexical categories, to be explained fully in Section 2.4.2. Like Thompson's (1989) study, however, Croft's study does not tell us the distributions for individual lexemes. Additionally, Croft's data include cases of overtly marked uses of lexical items in non-prototypical functions, which would not be considered instances of lexical flexibility.

In sum, no existing studies examine the distribution of pragmatic functions for individual items while limiting themselves to only flexible (morphologically unmarked) cases. To my knowledge, the studies just reviewed exhaust those that take an empirical approach to determining the extent of lexical flexibility in or across languages. There are numerous additional studies of lexical flexibility, but these either a) focus on particular analyses or theories of flexible items rather than attempt to expand the empirical coverage of lexical flexibility, as mentioned earlier; or b) focus on various dimensions of the *behavior* of flexible items rather than studying the overall *prevalence* of flexibility. This point is not a criticism, but simply a recognition of a lacuna in existing research. The emergent literature which treats lexical flexibility as a phenomenon of interest in its own right and applies empirical data to the task of understanding its behavior has advanced our knowledge of the various ways lexical flexibility can be realized, and what the constraints on that variation are. Existing research shows, for example, that lexical flexibility is constrained and shaped by the very principles that give rise to the crosslinguistic categories of noun, verb, and adjective in the first place (Croft 2000; 2005; Croft & van Lier 2012). This literature and its many findings are reviewed in Section 2.3.

There is however still much to discover about lexical flexibility. Most significantly, we do not yet know the overall prevalence of the phenomenon. Most grammatical descriptions of flexibility present a relatively small set of handpicked examples, so that we do not know how representative these examples are. Croft (2001b: 70) makes this point nicely:

> Does English have too few N/V lexemes to qualify as a flexible N/V language? If not, then how many is enough? [...] How do we know that when we read a grammar of an obscure "flexible" language X that the author of the grammar has systematically surveyed the vocabulary in order to identify what proportion is flexible? If English were spoken

> by a small tribe in the Kordofan hills, and all we had was a 150 page grammar written fifty years ago, might it look like a highly flexible language? (Croft 2001b: 70)

Equally significant (and equally unknown) is whether there are any commonalities among lexical items or languages which exhibit greater flexibility than others. These questions are relevant even if one adopts the position that flexible uses of lexical items are truly heterosemous, related only historically. There remains the question of how such rampant heterosemy arises in the first place. Are there patterns or principles that guide the emergence of heterosemous forms? Whether one prefers to analyze this phenomenon as conversion, zero derivation, functional shift, polycategoriality, heterosemy, acategoriality, or something else, the fact is we do not yet have a strong empirical grasp of just how this phenomenon is realized in the world's languages. This dissertation is a first foray into filling that empirical gap. The following section describes the contribution made by this dissertation to addressing this gap and gives an overview of the present study.

1.3 Overview of this study

This dissertation is a quantitative corpus-based study of lexical flexibility in English (Indo-European > Germanic) and Nuuchahnulth (Wakashan > Southern Wakashan). It is exploratory and descriptive, with the primary goal of describing the prevalence of lexical flexibility within and across languages. The specific research questions investigated are as follows:

R1: How flexible are lexical items in English and Nuuchahnulth?

R2: Is there a correlation between degree of lexical flexibility and size of the corpus?

R3: Is there a correlation between degree of lexical flexibility for a lexical item and frequency (or corpus dispersion)?

R4: How do the semantic properties of lexical items pattern with respect to their flexibility?

I explore each of these questions from several angles. R1, "How flexible are lexical items in English and Nuuchahnulth?" is the core empirical focus of this dissertation. To answer it, I count the frequency with which stems are used for each of the three functions of reference, predication, and modification in a corpus of spoken texts for each language. I annotated nearly 400,000 tokens of English and 9,000 tokens of Nuuchahnulth for their discourse function. Based on these data, each stem is then given a flexibility rating from 0 to 1 based on how evenly its uses are distributed across the three function, computed using a normalized Shannon diversity/entropy index (Shannon 1948). A rating of 0 indicates that the stem is highly inflexible, with all its occurrences being used for a single function; a rating of 1 indicates that the stem is maximally flexible, with its occurrences evenly distributed across the three functions. By quantifying the flexibility of each stem in this way, it then becomes possible to look for statistical correlations between the flexibility of a stem and other factors, such as those addressed by the other two research questions. It also enables us to answer the question of just how pervasive flexibility is in the two languages.

R2, "Is there a correlation between degree of lexical flexibility and size of the corpus?", is motivated by claims made by some researchers that all items exhibit flexibility if you examine enough of their tokens (Mosel & Hovdhaugen 1992: 77). If true, this would lend some empirical support to the claim that all items are (or least can be) to some degree flexible, or perhaps even acategorial.

R3, "Is there a correlation between degree of lexical flexibility for a lexical item and frequency (or corpus dispersion)?", uses the flexibility ratings calculated in R1 to consider whether the flexibility of a stem correlates with either its overall frequency or with its corpus dispersion. *Corpus dispersion* refers to how evenly/regularly the item appears in a corpus, a measure which is thought to more accurately capture the notion of frequency of exposure (Gries 2008; forthcoming). This question has two motivations: First, higher-frequency items often preserve irregular or atypical forms or functions (Bybee 2007: Ch. 13), such that items with higher frequencies might be more likely to retain their non-prototypical, flexible uses.

Second, the fact that a lexical item is flexible means that there is a wider range of constructions it can appear in. This could reasonably result in a higher overall frequency for flexible items. Both of these potential factors invite inquiry into the relationship between frequency and flexibility.

R4, "How do the semantic properties of lexical items pattern with respect to their flexibility?", is investigated using a mix of quantitative and qualitative methods. Unlike the other two research questions, which are intended to capture the extent of flexibility in and across languages, R4 is an inquiry into the semantic *behavior* of flexible (and inflexible) lexical items. This research question is directly motivated by Croft's (1991; 2000; 2001b; forthcoming) typological markedness theory of lexical categories, which claims among other things that lexical items used in non-prototypical functions (for example, a property word being used to refer, as a noun) will always show a semantic shift in the direction of the meaning typically associated with that function. So, if a property word is used to refer, its meaning should be more object-like than property-like; that is, it should mean something like 'an entity with the property X' rather than 'the abstract property X'. Croft's (1991) seminal work in this area provides strong empirical evidence for this semantic markedness principle, but is nonetheless somewhat preliminary. Croft himself has in various places implored linguists to investigate the lexical semantics of these functional shifts further (Croft 2005: 440; Croft & van Lier 2012: 70), but as yet little research has responded to this call (though see Rogers [2016] and Mithun [2017]). Investigating the semantic patterns that appear in cases of lexical flexibility is therefore another contribution of this dissertation, addressed by question R4.

The preceding notes are a high-level summary of the principal research questions investigated in this dissertation. A complete description of the methods used in answering each question is given in Chapter 3.

This study aims to be framework neutral in the sense of Haspelmath (2010b). Its findings should be interpretable and of interest to researchers working in a range of linguistic theories and with different approaches to lexical categories. As mentioned in §1.2, the results of this

study do not depend on whether one analyzes lexical flexibility as polycategoriality, conversion, or something else. While my own perspective on language is decidedly functional, this is of little relevance to how I coded the data, the procedures for which are described in detail in Chapter 3. The relevant factors in this study are operationalized in a theory-neutral way (to the extent such a thing is possible), and I expect that my coding decisions for individual data points will be found largely unobjectionable. Thus some researchers may choose to view this study as an empirical investigation into the frequency of conversion in languages rather then frequency or degree of lexical flexibility.

While the methods used in this study are compatible with a variety of theories of lexical flexibility, I nonetheless argue in Chapter 2 for a cognitively informed, typological-constructional theory of word classes and flexible items. It is cognitively informed in that it treats mental categories as *prototypal* and recognizes the existence of various prototype effects in language. I also adopt a Radical Construction Grammar approach (Croft 2001b) in which the basic categories in language are *constructions* rather than *parts of speech* (see also [Langacker 1987; Fillmore, Kay & O'Connor 1988; Goldberg 1995; 2006]). In construction grammar, language is viewed as a structured taxonomic network of constructions, whether those constructions are *substantive* (like words and morphemes) or *schematic* (like grammatical relations).

Several principles guided the choice of data used for this study. First, a self-imposed requirement for this project is that of empirical accountability and replicability. It should be possible for other researchers to apply the measure of lexical flexibility defined in Chapter 3 to new corpora, or to replicate the results of the present study on the existing dataset. As such, I only used data that were publicly available and, if possible, open access. Second, since the aim of this study is to investigate lexical flexibility in actual language *use*, I rely solely on naturalistic data from spoken texts. This has the additional advantage of abetting comparison between other, less well documented languages since most corpora of minority languages consist mainly of spoken texts. Third, I sought to examine data from languages that have featured prominently in discussions of lexical flexibility in the literature, with the intention of

offering a more expansive empirical foundation for future discussions. With these principles in mind, I chose to focus this study on English and Nuuchahnulth.

English has at various times been described as both a highly flexible language with fluid category membership (Crystal 1967: 47–48; Vonen 1994; Croft 2000: 75–76; 2001b: 69; Farrell 2001; Cannon 1985) and a fairly rigid language with clearly-delineated categories (Rijkhoff 2007: 710; Schachter & Shopen 2007: 4, 11, 12; Velupillai 2012: 122, 126). It is used as a point of comparison for nearly every discussion of lexical flexibility, but we do not have a clear idea of just how flexible items in English are. Its inclusion in this study is therefore well justified. The data for English are from the Open American National Corpus (OANC), a 15-million-token corpus of American English comprising numerous genres of both spoken and written data, all of which is open access (Ide & Suderman 2005). This study uses just the spoken portion of the corpus, consisting of approximately 3.2 million tokens, which is itself composed of two distinct subcorpora—the Charlotte Narrative & Conversation Collection (or simply "the Charlotte corpus") and the Switchboard Corpus.

Nuuchahnulth (formerly referred to in the literature as Nootka) is a Wakashan language presently spoken by a hundred or so people on and around Vancouver Island, British Columbia, in the Pacific Northwest. Nuuchahnulth, together with the other members of the Wakashan family (especially Makah and Kwak'wala / Kwakiutl), is one of the widely discussed languages in the literature on lexical flexibility (Swadesh 1939b; Jacobsen 1979; Braithwaite 2015). This is due largely to the following examples of flexible items from Swadesh (1939b).

Nuuchahnulth (Wakashan > Southern Wakashan)

(8) a. qo·ʔas-ma ʔi·ḥ-ʔi
man-3SG.IND large-DEF
'The large one is a man.' (Swadesh 1939b: 78)

b. ʔi·ḥ-ma ʔo·ʔas-ʔi
large-3SG.IND man-DEF
'The man is large.' (Swadesh 1939b: 78)

(9) a. mamo·k-ma ʔo·ʔas-ʔi
work-3SG.IND man-DEF

'The man is working.' (Swadesh 1939b: 78)

b. ʔo·ʔas-ma mamo·k-ʔi
man-3SG.IND work-DEF
'The working one is a man.' (Swadesh 1939b: 78)

Hardly a single typological survey of lexical categories or study of lexical flexibility has failed to include these examples since (see especially the much-cited chapter by Schachter & Shopen [[1985] 2007: 12]). Yet we still do not know how representative these examples are of Nuuchahnulth in general. What is more, lexical flexibility is an areal feature of the entire Pacific Northwest. The nearby Chimakuan, Chinookan, Coosan, Sahaptian, Salishan, and Tsimshianic families as well as the isolate Kutenai each exhibit lexical flexibility to a presumably strong degree, since they have caught the attention of so many researchers in this regard (Chimakuan: Andrade [1933: 179]; Chinookan: Duncan, Switzler & Zenk [forthcoming]; Coosan: Frachtenberg [1922: 318]; Sahaptian: Wetzer [1996: 142]; Salishan: Kuipers [1968], Hébert [1983], Kinkade [1983], van Eijk & Hess [1986], Jelinek & Demers [1994], Mattina [1996], Beck [2002: §4.1.1], Montler [2003], Beck [2013], Davis, Gillon & Matthewson [2014]; Tsimshianic: Davis, Gillon & Matthewson [2014]; Kutenai: Morgan [1991]). Again, we do not actually know whether this literature is truly representative of the pervasiveness of the phenomenon, or whether its "exotic" nature as compared to Indo-European languages has simply garnered undue attention to the topic in this geographic region. Nuuchahnulth, being the most discussed of these languages, is therefore nearly obligatory to be included in a study such as this one.

The data used for the investigation of Nuuchahnulth come from a corpus of texts collected and edited by Toshihide Nakayama and published in Little (2003) and Louie (2003). The corpus consists of 24 texts dictated by speakers Caroline Little and George Louie, containing 2,081 utterances and 8,366 tokens (comprising 4,216 distinct wordforms). The texts cover a variety of genres, including procedural texts, personal narratives, and traditional stories. I manually retyped these texts as scription files for analysis. Scription is a simple text format for representing interlinear glosses in a way that is both familiar to linguists and computationally

parseable (Hieber 2021a). The resulting digitally searchable corpus is available on GitHub at https://github.com/dwhieb/Nuuchahnulth.

Other languages that would have been obvious choices for inclusion in this study are Riau Indonesian (Austronesian > Malayo-Polynesian) (Gil 1994), Mundari (Evans & Osada 2005; Hengeveld & Rijkhoff 2005), Classical Nahuatl (Uto-Aztecan) (Launey 1994; 2004), and Central Alaskan Yup'ik (Eskimo-Aleut > Yupik) (Thalbitzer 1922; Sadock 1999; Mithun 2017). Each of these has generated contested claims about their flexibility and the existence of flexibility more generally. However, practicalities have limited me to examining just English and Nuuchahnulth for the time being. I leave investigations of other languages to future research and researchers.

Both the English and Nuuchahnulth corpora were converted to the Data Format for Digital Linguistics (DaFoDiL) (a JSON format for representing linguistic data; Hieber [2021b]) for tagging and scripting purposes. This made it possible to use the Digital Linguistics (DLx) ecosystem of tools and software to more quickly tag and analyze the data. More information about Digital Linguistics may be found at https://digitallinguistics.io.

The datasets, scripts, and source files for this dissertation are publicly available on GitHub at https://github.com/dwhieb/dissertation.

Turning now to results:

Regarding R1, "How flexible are lexical items in English and Nuuchahnulth?", I find that English and Nuuchahnulth differ significantly not only in their overall degree of flexibility, but also in how that flexibility is realized. In English, the majority of items surveyed are flexible, but only to a small degree. Most lexical items of English can be used for multiple discourse functions, but there is a strong tendency for each item to be used for primarily one function. English thus shows a consistent but somewhat marginal degree of flexibility. In contrast, most lexical items in Nuuchahnulth are highly flexible, but primarily along the reference-predication axis; Nuuchahnulth lexical items are very freely used for both reference and predication, but only infrequently used as modifiers. Property-denoting words appear

much more frequently as referents and predicates than they do in modifying constructions. Nuuchahnulth thus shows a consistently high degree of flexibility, but primarily in just one dimension.

In relation to R2, "Is there a correlation between degree of lexical flexibility and size of the corpus?", I find that once a sufficient number of tokens are encountered to establish a reliable flexibility rating, that rating does not change noticeably as the size of the corpus continues to grow. The exact number of tokens it takes to determine a reliable flexibility rating varies from word to word, likely due to the fact that some words appear in a wider variety of discourse contexts than others. While larger corpora do make it more likely to encounter *some* flexibility, the overall flexibility rating of each word is synchronically fixed, suggesting that speakers know the specific functions that a word may be used for. The data for Nuuchahnulth are consistent with the findings for English, but the overall corpus size for Nuuchahnulth is too small to say with confidence that the same findings hold. The point of diminishing returns on flexibility for Nuuchahnulth could be quite different from that of English.

For R3, "Is there a correlation between degree of lexical flexibility for an item and frequency (or corpus dispersion)?", I find no significant correlations for English, but highly significant correlations for Nuuchahnulth. In Nuuchahnulth, high-frequency words show a greater degree of flexibility than low-frequency words, and the combined effects of frequency and dispersion account for 18.2% of the deviance in the flexibility ratings. However, given the small size of the Nuuchahnulth corpus, these findings should be taken as tentative.

Lastly, R4 asks "How do the semantic properties of lexical items pattern with respect to their flexibility?". With respect to Nuuchahnulth, I find that property words, especially numerals and quantifiers, are the most flexible semantic class of items. Nearly all of the most flexible items denote property concepts. Deictic expressions such as *this*, *that*, *here*, *there* also rank very highly in their flexibility. I also find that there are strong correlations between morphologically marked aspect (durative, continuative, inceptive, etc.) and discourse function.

In Nuuchahnulth, aspect markers may be used with either predicates or referents; they are not an exclusively verbal category. However, I find that the presence of any aspect marker does correlate strongly with predication, lending additional empirical evidence to Hopper & Thompson's (1984) claim that items used in their prototypical function will show the inflectional behaviors typical of that function, and Croft's (1991) behavioral potential hypothesis. The momentaneous and telic aspect markers are the only ones in Nuuchahnulth which show any sort of tendency towards use with referents, while the durative was the only aspect marker to show any sort of tendency towards use with modifiers. Since aspect is a grammatical category that expresses how speakers construe the temporal structure of an event, these data suggest that flexibility has a great deal to do with how speakers conceptualize or construe concepts—as an action, object, or property—as has been suggested by Croft (1991: 99; 2001b: 104).

Nuuchahnulth also has a definite suffix *-ʔiː* used with referents. Nakayama (2001: 48) states that this suffix is used with action words being construed as objects. This observation suggests that the definite suffix may have a clarifying function, appearing whenever an action word is used for the atypical role of reference (as predicted by Croft's structural coding hypothesis; see §2.4 for more details). One hypothesis that arises from applying typological markedness theory to Nuuchahnulth is that aspect markers which correspond to more object-like construals of an item (durative, telic, momentaneous) are more likely to be marked with the definite suffix. This turns out to be true, but only trivially so—only a tiny percentage (7.98%) of tokens with definite markers also had aspect markers. However, this leads to the far more interesting observation that the definite marker and the aspect markers in Nuuchahnulth are *almost* entirely mutually exclusive. They only rarely co-occur. These facts demonstrate that even in a language with rampant flexibility, as this study shows Nuuchahnulth to be, flexibility is nonetheless bound by universal typological constraints.

To summarize, this dissertation makes contributions in several areas. The first is methodological: this dissertation lays out a procedure for quantifying lexical flexibility for individual

lexical items in a corpus that can be replicated for other languages and corpora (Chapter 3). The second is empirical and descriptive: I describe the extent of lexical flexibility and the way it operates in English and Nuuchahnulth (Chapter 4). The final contribution is analytical and theoretical: I argue that the data and statistical analysis presented in this dissertation support Croft's typological markedness theory of word classes, in which lexical categories such as noun, verb, and adjective are not in fact categories of particular languages as has been historically assumed, but instead are emergent patterns that arise from how speakers use object, action, and property words for different functions in discourse (reference, predication, and modification). Lexical items used for functions that are not prototypical of their meaning *tend* to be more marked (morphologically, behaviorally, semantically, and/or frequentially) than prototypical uses, but this is not an absolute universal. Lexical flexibility is the natural and expected result of the fact that these non-prototypical uses are *not* always morphologically marked, even when they are marked in other ways (Chapter 5).

The remainder of this dissertation is organized as follows: Chapter 2: Background summarizes previous definitions of lexical flexibility and discusses their shortcomings. I propose an alternative, functionally oriented definition that is consistent with cognitive and typological approaches to word classes instead. Chapter 3: Data & Methods describes in detail how the data were coded and analyzed for each of the major research questions (and contributing subquestions) in this study. I discuss factors that influenced how the data were coded and outline the various coding decisions that were made. I present and explain a measure of corpus dispersion that is used partly in place of, and partly as a complement to, raw frequencies of items. Lastly, I set forth a procedure for operationalizing and quantifying lexical flexibility in a crosslinguistically comparable way. Chapter 4: Results presents the empirical findings from this study. I demonstrate how the methodological techniques from Chapter 3 are applied to individual lexical items, and then present aggregated views of the data for English and Nuuchahnulth respectively. Chapter 5: Discussion & Conclusion considers the implications of the results in Chapter 4 for theories of lexical categories. I argue that the data support a

typological-universal theory of word classes, and that lexical flexibility should be viewed as a natural result of the cognitive and diachronic processes at work in language, rather than as an exceptional phenomenon. I conclude by discussing some limitations of the present study and avenues for future research, followed by closing remarks.

Chapter 2

Background

The focus of this chapter is to explain the concept of lexical flexibility, consider its criticisms, and offer a more robust, functionally grounded definition instead. I first briefly describe how flexible approaches to lexical categories developed as a response to weaknesses in traditional theories of parts of speech. I then survey the landmark studies and important findings on lexical flexibility, along with criticisms of this research. Following that, I present the typological markedness theory of lexical categories, which states that lexical categories are epiphenomenal markedness patterns regarding how different semantic classes of words are used for different discourse functions. I conclude by offering a revised formulation of lexical flexibility which is in line with typological markedness theory.

2.1 Introduction: Approaches to lexical flexibility

The field of linguistics as a whole and the subfield of typology in particular is undergoing a radical shift in how we understand lexical categories, along primarily two dimensions. The first dimension is our understanding of what lexical categories are a property *of*. Early researchers viewed categories as universal properties of both language generally and specific languages. I call this the *universalist* position. After Boas, many researchers then came to view categories as language-specific, with patterned similarities across languages. I call this the *relativist* approach. Most recently, some researchers view categories as typological patterns rather than properties of any particular language. This is the *typological* position, and

the one I adopt here.

The second dimension of historical change in linguistic theories of categories is in the *nature* of the categories themselves. In the Classical tradition, categories were thought to be categorical and well-defined by a set of necessary and sufficient conditions in the tradition of Aristotle. After the cognitive turn in the 1960s and 1970s, many linguists came to view categories as prototypal, with some members of a category being more central, or better exemplars, than others. Cognitive research into the nature of idioms then led to the development of construction grammar, which sees language as consisting of a network of constructions rather than monolithic categories. I adopt a constructional approach to categories in this dissertation.

These theoretical paradigm shifts are summarized in (10). At each stage of development, there has not been a wholesale displacement of previous theories. There are still many who regard word classes as universal and categorical, and the typological-constructional approach is still nascent.

(10) a. universal > language-specific > typological

b. categorical > prototypal > constructional

Section 2.2 gives a synopsis of these theoretical positions and shows how research on lexical flexibility developed in recognition of the shortcomings of traditional approaches. Section 2.3 summarizes the key concepts and findings that have arisen from the research on lexical flexibility. Such research, however, is not without its own shortcomings. Section 2.3 also presents the main criticisms that have been leveled against flexible analyses of word classes. Section 2.4 then presents an alternate, functionally-oriented approach—the typological-constructional perspective. The final section of this chapter (§2.5) then applies this functional perspective to formulate an improved definition of lexical flexibility.

2.2 Traditional approaches

This section is a necessarily brief history of approaches to lexical categories up until the cognitive turn of the 1960s. It covers the universalist position that developed in the Classical tradition, the relativist position that developed as a result of Boas' cultural relativism, and the structuralist (or "distributionalist") position that developed in the tradition of Saussure. Depending on how one understands and applies these different perspectives, none of them are mutually exclusive. It is especially common for linguists to simultaneously hold that lexical categories must be identified on the basis of language-internal evidence alone (the relativist position) and that lexical categories are universal in some sense or another (the universalist position).

2.2.1 Universalism

Historically and still presently, many researchers assumed that a small set of lexical categories are basic and universal to all languages (Bolinger & Sears 1981: 81; Croft 1991: 2; Payne 1997: 32; Stassen 2011: 95). The set typically consists of some variation of the following: Noun, Verb, Adjective, Adverb, Pronoun, Adposition, Conjunction, Numeral, and Interjection (Haspelmath 2001: 16538). This list has its origins in the *Τέχνη Γραμματική* / *Tékhnē Grammatikḗ* ('The art of grammar') of the 2nd century B.C.E. grammarian Dionysius Thrax. The *Tékhnē* synthesizes the work of Dionysius' predecessors, describing eight parts of speech for Classical Greek. These parts of speech were based largely on morphological (especially inflectional) criteria (Rauh 2010: 17–20). The *Tékhnē* was then translated and its model applied to Latin in the *Ars Grammatica* of Remnius Palaemon. The *Ars Grammatica* initiated a tradition wherein the languages of Europe and eventually the world (e.g. Mandarin [McDonald 2013]) were described using both Dionysius' categories (with occasionally additions / subtractions) as well as his method of identifying those categories on the basis of morphological criteria (Rauh 2010: 20). Because of the strong association of the term *parts of*

speech with this Classical perspective, I prefer the term *lexical categories* in this dissertation.

Implicit in the Classical method is the assumption that lexical categories are universal in the sense of being instantiated in all languages. However, as European scholars began to encounter non-Indo-European languages (or even non-Romance languages) in both Europe and abroad, this assumption was challenged, as early as the first grammatical descriptions of Irish in the 7th century. At first, these languages either had Classical grammar imposed upon them or were deemed grammatically deficient (Suárez 1983: 3). Nonetheless, missionary linguists in the early colonial era were aware of the significant grammatical differences between these languages and Latin and made their best attempts at describing them (Suárez 1983: 3–4). It is also important to realize that the project of describing the languages in the Americas and other zones of colonial influence was partially contemporaneous with the publication of the first grammars of the vernacular languages of Europe, as illustrated in Figure 2.1 (the data for which are given in Appendix A). Between 1524 and 1572, over 100 catechisms, manuals for confession, collections of sermons, grammars, and vocabularies were written in or about ten languages within the Viceroyalty of New Spain alone (an area smaller than present-day Mexico), mostly by Spanish Franciscan and Jesuit missionaries (Suárez 1983: 2). The task of converting the indigenous peoples to Christianity via the medium of their own languages was so important to the Spanish crown that the first bishop of Mexico, Francisco de Zumárraga, brought a printing press to Mexico in 1534 (just 15 years after the arrival of the first Spaniards in Mexico in 1519). The first book printed in Mexico was a Spanish-Nahuatl catechism by Alonso de Molina (Suárez 1983: 2). All this is merely to illustrate that language scholars in the colonial era were still in the early stages of discovering the complexities of the world's languages and how much they differed from Latin and Greek. Nonetheless, they were aware of the challenges that non-Indo-European languages posed to Classical theories at an early stage.

As documentary linguistics turned its attention to North American (as opposed to Mesoamerican) languages, lexical flexibility in particular became a more prominent issue. In fact, even

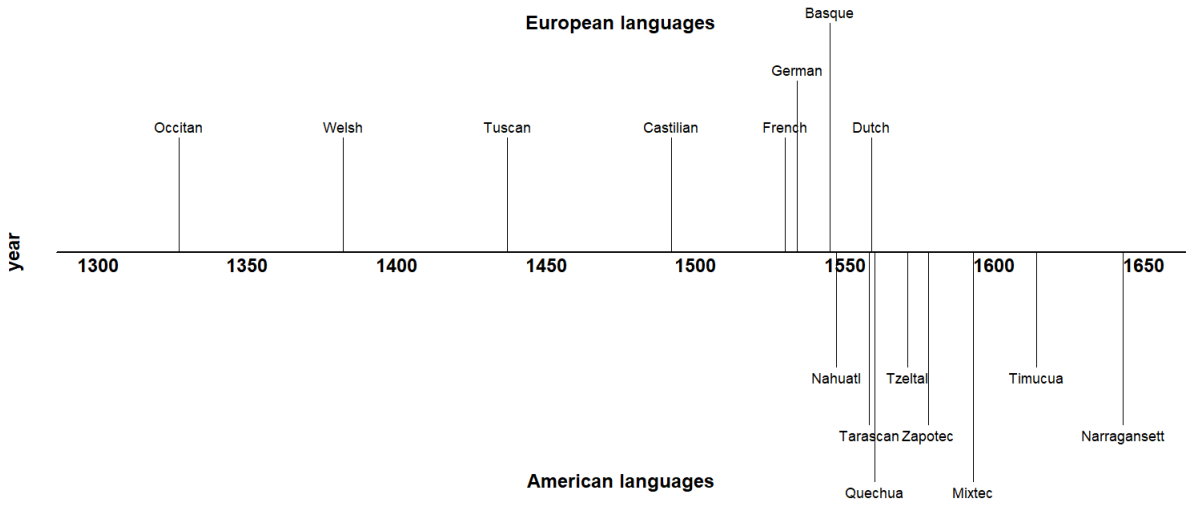


Figure 2.1: Timeline of early grammatical descriptions of European vs. American languages

the first comprehensive survey of North American languages contains an entire section on "Conversion of nouns into verbs" (Gallatin 1836: 174–177), in which Gallatin depicts lexical flexibility as a rampant feature of all languages on the continent:

> It is the substantive [i.e. copula / auxiliary] verb which we [speakers of Indo-European languages] conjugate; whilst the [Native American] conjugates what we call the adjective and even the noun itself, in the same manner as [s/he] does other intransitive verbs. […] I believe it must appear sufficiently obvious, that this general if not universal character of the [Native American] languages, the conversion into verbs and the conjugation, through all the persons, tense, and moods, of almost all the adjectives and of every noun which, without a palpable absurdity, is susceptible of it, is entirely due to the absence of the substantive verb. (Gallatin 1836: 175–176)

As evidenced by the above passage, increasing familiarity with non-Indo-European languages prompted some writers to abandon the universalist commitment. However, categorial universalism is still a widely-held position today, either in the sense of a) categories being universally instantiated in all languages (commonly assumed by most generative frameworks; although see Culicover [1999]), or b) categories being available to all languages, but only instantiated in some (sometimes called the "smörgåsbord" or "grab bag" approach, as exemplified by Dixon's Basic Linguistic Theory framework [2010: 9, 11, 14, 27, 50; 2011: 26]; see

Hieber [2013: 298] and Croft [2001b: 10] for discussion).

2.2.2 Relativism

American ethnographers in the tradition of Franz Boas questioned the universalist assumption in a programmatic and comprehensive way. Writing on grammatical categories, Boas states, "Grammarians who have studied the languages of Europe and western Asia have developed a system of categories which we are inclined to look for in every language" (Boas 1911: 35). He concludes that this endeavor is a folly, and that "in a discussion of the characteristics of various languages **different fundamental categories** will be found" (Boas 1911: 35). Boas' students all adopted his grammatical relativism, and it became a foundational principle of the American linguistics tradition. His student Edward Sapir, writing on lexical categories specifically, makes one of the best-known and strongest statements of this position in his influential textbook *Language*: "[N]o logical scheme of the parts of speech—their number, nature, and necessary confines—is of the slightest interest to the linguist. Each language has its own scheme. Everything depends on the formal demarcations which it recognizes." (Sapir 1921: 125).

Many linguists today hold to Boas' grammatical relativism in some fashion or another. Textbooks and typological surveys commonly state that languages have varying numbers of lexical categories, though usually with the caveat that all languages seem to differentiate at least noun and verb (e.g. Velupillai 2012: §6.2). Some researchers, especially those working in typology, argue that linguists are still not rigorous *enough* in their application of grammatical relativism; they criticize certain kinds of crosslinguistic comparisons for imposing the categories of one language onto another (Croft 2001b; Gil 2001; Haspelmath 2010a; 2012; LaPolla 2016). This position is discussed further in §2.4.

2.2.3 Structuralism

Developing alongside the early anthropological linguistics of Boas was the linguistic structuralism of Ferdinand de Saussure. His work informed both the Prague school under Nikolay Trubetzkoy and Roman Jakobson, and the distributional method of Leonard Bloomfield. The term *structuralism* has any number of uses (P. Matthews 2001: Ch. 1); here I refer to the idea that "language is a [...] self-contained, self-regulating system, whose elements are defined by their relationship to other elements" (P. H. Matthews 2014: 383). In particular, I am referring to the positivistic flavor of structuralism as practiced by Bloomfield, which focused on the structural relations between elements, and on establishing a set of rigorous scientific discovery procedures for linguistic structures (Bloomfield 1933). Bloomfield saw lexical categories as something to be empirically discovered in the different syntactic distributions of words, rather than imposed on a language a priori (Rauh 2010: 33). Zellig Harris later refined and expanded this methodology (Harris 1951).

The signature methodological feature of this form of structuralism is the *distributional method*, a procedure for defining categories in terms of the set of contexts in which its words can appear—that is, their distributions (Harris 1951: 5; Croft 2001b: 11). As an illustration of distributional analysis applied to lexical categories, Croft (1991: 11–12) considers the distributions of the English words *cold*, *happy*, *dance*, and *sing* in two constructions: in the Predicate construction after *be*, and in the 3rd Person Singular Present Tense (*-s*) construction. Example data are shown below.

(11) English (Indo-European > Germanic)

a. i. Jack is cold.
   ii. * Jack colds.

b. i. Jack is happy.
   ii. * Jack happies.

c. i. * Jack is dance.
   ii. Jack dances.

d. i. * Jack is sing.
ii. Jack sings.

We can see that *cold* and *happy* have the same distributions in these tests (both may appear in the Predicate construction but not the Person-Tense inflection construction), while *dance* and *sing* have the same distribution (the inverse situation as *cold* and *happy*). The results of these two distributional tests are summarized in Table 2.1. Data like these are used to justify categories like Adjective and Verb in English.

Table 2.1: Distribution of English Verbs and Adjectives (adapted from Croft [2001b: 12])

	Predicate Construction	Inflectional Construction
Adjective: *cold*, *happy*, etc.	✓	✘
Verb: *sing*, *dance*, etc.	✘	✓

As applied in practice, however, the distributional method suffers from one serious drawback when used to argue for large, traditional categories like noun, verb, and adjective: distributional tests yield conflicting and overlapping results. Perhaps no two lexical items behave the same way in every distributional test. Each new test that is introduced therefore partitions the lexicon into smaller and smaller classes. This fact has been demonstrated empirically for English temporal nouns (Crystal 1967: 54), Russian numerals (Corbett 1978), and French verbs (Gross 1979). Distributional tables from each of these studies are reproduced in Table 2.4, Table 2.3, and Table 2.2 respectively. It is clear from these studies that distributional analysis does *not* lead to large, unified categories like noun, verb, and adjective, but rather a myriad of small constructions (Crystal 1967: 27; Croft 2005: 434). Each distributional test is in fact its own construction (Croft 2005: 436). This fact is a major motivation underlying constructional approaches to language.

Many scholars nonetheless choose to retain lexical categories as a necessary component of their linguistic theories or descriptions, at the expense of consistent application of the distributional method. Rather than considering all possible distributional contexts for a word,

	in a *N* or two	in that *N*	in the $N_{sg.}$ (no postmodification)[65]	in a *N* (no postmodification)[65]	in ø $N_{pl.}$ (no postmodification)[65]	in ø $N_{sg.}$	ø $N_{pl.}$	on the $N_{sg.}$	on a $N_{sg.}$ (no postmodification)[65]	on ø $N_{pl.}$ (no postmodification)[65]	on ø $N_{sg.}$	at that *N*	at the $N_{sg.}$	at ø $N_{sg.}$
afternoon	+	+	+	+	−	−	+	+	+	+	−	−	−	−
evening	+	+	+	+	−	−	+	+	?+	?+	−	−	−	−
weekend	+	+	?+	+	−	−	+	+	?+	+	−	+	+	−
night	+	+	+	?+	−	−	?−	+	−	−[66]	−	−	−	+
morning	+	+	+	+	−	−	+	+	−	−[66]	−	−	−	−
Monday...	+	−	−	−	−	−	+	+	+	+	+	−	−	−
January...	?+	+	+	+	−	+	−	−	−	−	−	−	−	−
hour	+	+	+	+	?−	−	−	+	−	−	−	+	+	−
minute	+	+	−	+	+	−	−	+	−	−	−	+	+	−
second	+	+	−	+	+	−	−	+	−	−	−	+	+	−
day	+	+	+	+	−	−	−	+	−	−[66]	−	−	−	−
summer	?+	+	+	?−	?−	+	?+	−	−	−	−	−	−	?+
winter	?+	+	+	?−	?−	+	?+	−	−	−	−	−	−	?+
spring	?+	+	+	?−	−	+	−	−	−	−	−	−	−	?+
autumn	?+	+	+	?−	−	+	−	−	−	−	−	−	−	?+
month	+	+	+	+	+	−	−	−	−	−	−	−	−	−
week	+	+	+	+	+	−	−	−	−	−	−	−	−	−
year	+	+	+	+	+	−	−	−	−	−	−	−	−	−
decade	+	+	−	+	?+	−	−	−	−	−	−	−	−	−
century	+	+	−	+	?−	−	−	−	−	−	−	−	−	−
fortnight	+	+	+	+	−	−	−	−	−	−	−	−	−	−
instant	+	?+	−	+	−	−	−	−	−	−	−	+	−	−
moment	+	?+	−	+	−	−	−	−	−	−	−	+	−	−
lifetime	−	?+	−	+	−	−	−	−	−	−	−	−	−	−
daytime	−	−	+	−	−	+	−	−	−	−	−	−	−	−
nighttime	−	−	+	−	−	+	−	−	−	−	−	−	−	−

Table 2.2: distributional analysis of English (Indo-European > Germanic) temporal nouns (Crystal 1967: 54)

these scholars instead treat certain constructions as definitional of the category. Other distributional tests which yield cross-cutting results are either ignored or treated as evidence of subcategories instead of categories. Many researchers even prefer the term *syntactic cate-*

		odin 1	*dvo* 2	*tri* 3	*pjat'* 5	*sto* 100	*tysjača* 1,000	*million* 1,000,000
	1. Agrees with N in syntactic number	+	−	−	−	−	−	−
	2. Agrees in case throughout	+	−	−	−	−	−	−
	3. Agrees in gender	+	(+)	−	−	−	−	−
	4. Marks animacy	+	+	+	−	−	−	−
	5. Has own plural	+	+	+	+	(−)	−	−
not the case that	6. Takes agreeing determiner	+	+	+	+	+	−	−
	7. Takes N in genitive plural throughout	+	+	+	+	+	±	−

Table 2.3: distributional analysis of Russian (Indo-European > Slavic) numerals (Corbett 1978: 359)

gories over *lexical categories* for this reason, focusing on just the syntactic evidence for categories (M. C. Baker 2003; Rauh 2010). A severe methodological problem for this approach is that there are no generally agreed-upon principles for determining which distributional tests should be considered definitional. In this regard, Schachter & Shopen (2007: 4) note, "there may be considerable arbitrariness in the identification of distinct parts of speech rather than subclasses" (see also Crystal [1967]). Different scholars choose or prioritize different kinds of evidence for lexical categories over others based on their theoretical commitments. This is the reason, as stated in Section 1.1, that disagreements about the existence of particular lexical categories in particular languages are typically *not* about the empirical facts. The results of a given distributional analysis are not usually controversial; the choice of distributional tests used to support one's analysis is. Unsurprisingly, then, debates over how to analyze lexical categories in various languages have been largely unproductive and unresolved (Croft 2005: 435). The problem only worsens when scholars attempt to apply the same criteria across languages. Distributions of lexical items with similar meanings vary drastically across languages (Croft 2001b: §1.4.1).

The real methodological problem here is *not* that we have yet to ascertain the correct

il V Ω		*Auxiliaire avoir*	*Auxiliaire être*	*N_0 est V_{pp} Ω*	*N_0 V Prép N_1*		Compléments directs ou indirects											Comp. indirect						
							Complétives						Noms							Noms				
											Pron													
							que P	*que Psubj*	*[pc z.]*	*$V^2\Omega$*	*ce (ci + la)*	*ppv*	*N_{hum}*	*ppv*	*N_{-hum}*	*le fait Qu P*	*ppv*	*N_0 V Prép N_2*		*N_{hum}*	*ppv*	*N_{-hum}*	*ppv*	*N_0 V $V^0\Omega$*
+	s'agir	—	+	—	+	de	—	+	+	+	+	—	+	—	+	+	—	—	pour	+	—	—	—	—
+	apparaître	—	+	—	+	0	+	—	—	—	+	+	—	—	+	—	+	—	à	+	+	—	—	—
+	apparoir	—	—	—	—	0	—	+	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—
+	s'avérer	—	+	—	+	0	+	—	—	—	+	+	—	—	+	—	+	—	à	+	—	—	+	+
+	y avoir avantage	+	—	—	+	à	—	+	—	+	+	—	—	—	—	—	—	+	pour	+	—	—	—	—
+	y avoir lieu	+	—	—	+	de	—	+	+	+	—	—	—	—	—	—	—	—	pour	+	—	—	—	—
+	n'empêcher	+	—	—	+	0	+	—	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—
+	être besoin	+	—	—	—	de	—	+	+	+	+	+	—	—	+	—	+	—	pour	+	—	+	—	—
+	être l'heure	+	—	—	—	de	—	+	+	+	+	+	—	—	+	—	+	—	pour	+	—	—	—	—
+	être question	+	—	—	+	de	—	+	+	+	+	+	+	—	+	+	+	—	pour	+	—	+	—	—
+	être temps	+	—	—	+	de	—	+	+	+	+	+	—	—	+	—	+	—	pour	+	+	—	—	—
+	faire bon	+	—	—	+	0	—	—	—	+	—	—	—	—	—	—	—	—	pour	+	—	—	—	—
+	falloir	+	—	—	+	0	—	+	—	+	+	+	+	+	+	—	+	—	à	+	+	—	—	—
+	s'en falloir	—	+	—	—	pour	—	+	—	—	—	—	—	—	—	—	—	—	de	—	—	+	—	—
+	paraître	+	—	—	+	0	+	—	—	—	+	+	—	—	+	—	+	—	à	+	+	—	—	+
+	paraître	—	—	—	+	0	+	—	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—
+	sembler	+	—	—	+	0	+	—	—	—	+	+	—	—	+	—	+	—	à	+	+	—	—	+
+	souvenir	—	+	—	+	de	+	—	+	+	+	+	+	—	+	+	+	—	à	+	+	—	—	—

Table 2.4: distributional analysis of French (Indo-European > Romance) verbs (Gross 1979: 860)

principles for selecting the right distributional tests. The problem is being selective regarding which tests to apply in the first place. If we take the distributional method seriously, then we must apply it consistently, without ignoring distributional evidence that contradicts our theoretical or pretheoretical assumptions. To do otherwise is a kind of *methodological*

opportunism (Croft 2001b: 30, 41).

Other scholars treat flexible items as members of *hybrid* or *mixed* categories simultaneously possessing properties of more than one part of speech (Lois et al. 2017: 149; Malouf 1999; Nikolaeva & Spencer 2020). Adjectives are frequently described as a hybrid category (Wetzer 1996; Stassen 1997: 343; Pustet 2003: 13–16; Genetti & Hildebrandt 2004: 95; van Lier 2017), as are participles (Hopper & Thompson 1984: 704) and gerunds (Denison 2001). Lois et al. (2017: 149) also distinguish hybridity from polycategoriality, stating that polycategoriality applies to roots or stems, while hybridity is a matter of the syntactic context that a word appears in.

An analysis couched in mixed categories does not avoid the problem of methodological opportunism, however. The existence of a mixed category implies that there are other, more basic categories that the mixed category is a hybrid of. Hybrid models of parts of speech merely exacerbate the distributional problem. There is however a sense in which thinking of minor lexical categories as "mixed" categories is useful: typological markedness theory states that lexical categories are epiphenomenal patterns that arise from combinations of the semantic classes of object, action, or property words with the discourse functions of reference, predication, and modification. Categories frequently discussed as "mixed" in the literature are precisely those combinations which are non-prototypical and therefore more likely to be typologically marked. Section 2.4.2 explains this approach to lexical categories in more detail.

Partly in response to these problems, a growing cadre of linguists in the last 30 years have adopted one of various *flexible* approaches to word classes. Flexible analyses of word classes come in many flavors, some of which arguably still commit methodological opportunism, and others of which introduce new difficulties. These flexible approaches are reviewed in the following section.

2.3 Flexible approaches

In this section I summarize the key concepts (§2.3.1), findings (§2.3.2), and criticisms (§2.3.2) of lexical flexibility research. Section 2.3.1 surveys the wide variety of definitions and theoretical perspectives on lexical flexibility. This review of the literature reveals that there is little consensus as to what exactly constitutes "lexical flexibility"; as such, there are numerous alternative terms for the phenomenon. Despite these incongruities, a few important findings do consistently surface across different empirical studies. These findings are summarized in Section 2.3.2. Then Section 2.3.3 looks at the arguments and evidence that researchers have presented against the notion of lexical flexibility, and some counterarguments.

2.3.1 Key concepts

It is only a small exaggeration to say that there are as many definitions and terms for what I am here calling "lexical flexibility" as there are scholars who research it. I use the term *lexical flexibility* in this dissertation merely because it is the most widely recognized of the cluster of terms that are used, not because it is necessarily the most precise or accurate. My own choice would be *functional expansion*, for reasons discussed below. The analytical or theoretical perspective adopted by each researcher generally determines their choice of terminology. The remainder of this section is devoted to explaining these perspectives in more detail.

Generally speaking, there are two ways to analyze flexible items. The first method assigns flexible items to members of specific categories in a language, whether those categories are the canonical four major classes (Noun, Verb, Adjective, Adverb), or a new large supercategory subsuming multiple discourse functions (e.g. Contentives, Non-Verbs, Flexibles), or a smaller subcategory of an existing major lexical category (e.g. Adjectival Verbs, Verbonominals). The second method of analysis assumes that lexical items are uncategorized at some level (root, stem, or inflected word), and that items receive their categorial assignment from context. Different researchers posit different mechanisms for how lexical items receive their

categorization in context.

The traditional approaches to lexical flexibility summarized in Section 2.2 are all instances of the former method of analysis, while the flexible approaches outlined in this section are a mix of categorial and acategorial analyses.

2.3.1.1 Lexical flexibility

Though awareness of lexical flexibility can be traced back to at least Gallatin (1836: 174–177) if not earlier, the term *lexical flexibility* itself seems to have originated with Hengeveld (1992: Ch. 4). This publication, perhaps because it was the first to assign a technical term to the concept, marks a shift in how scholars frame the concept of lexical flexibility. Previously, the issue was framed in terms of whether particular languages (especially those of the Pacific Northwest) distinguished noun from verb (Kuipers 1968; Jacobsen 1979; Hébert 1983; Kinkade 1983; van Eijk & Hess 1986; Jelinek & Demers 1994). After this point, an increasing number of publications began to ask whether lexemes were *flexible* instead. Though the difference in emphasis seems subtle, this change constitutes a turning point because it fostered an increased interest in lexical flexibility as a grammatical phenomenon in its own right instead of just a problem for traditional categorization schemes.

Hengeveld's (1992: Ch. 4) typology of parts-of-speech systems is a whole-language typology wherein languages are either *specialized*, with one morphosyntactic category for each of the functions of reference (Noun), predication (Verb), referent modification (Adjective), and predicate modification (Adverb[1]), or *non-specialized*. Non-specialized languages deviate from the four-category canon in one of two ways: one part of speech may assume more than one function with no additional morphosyntactic marking, in which case the language is considered *flexible*; or the language may lack a dedicated part of speech for that function entirely and use other, marked constructions instead, in which case the language is considered *rigid*.

Hengeveld gives examples from Dutch and Wambon to illustrate the distinction between

[1]Note that Hengeveld's typology only includes manner adverbs, not other semantic types of adverbs.

rigid and flexible languages. In the Dutch examples in (12), the same word *mooi* is used for both referent modification (12a) and predicate modification (12b), with no overt morphology indicating its function in either case. Wambon on the other hand uses medial verbs for manner expressions and must take the overt verbalizing suffix *-mo* shown in (13). In Hengeveld's framework, Dutch is a flexible language because one category subsumes both the functions of referent modification and predicate modification, while Wambon is a rigid language because derivational morphology (here, the verbalizing suffix *-mo*) is required to indicate the function of predicate modification.

(12) Dutch (Indo-European > Germanic)

a. een **mooi** kind
INDEF **beautiful** child
'a beautiful child' (Hengeveld 1992: 65)

b. het kind dans-t **mooi**
DEF child dance-3SG.PRES **beautifully**
'the child dances beautifully' (Hengeveld 1992: 65)

(13) Wambon (Trans-New Guinea > Greater Awyu)

jakhov-e **matet-mo** ka-lembo
they-CONN **good-VZR.SS** go-3PL.PAST
'did they travel well?' (de Vries [1989: 49], cited in Hengeveld [1992: 65])

Hengeveld's analysis is of the categorial type discussed at the beginning of Section 2.3.1, specifically the supercategory kind. Each lexeme is assumed to have a category, and new supercategories are introduced for lexemes which have multiple functions: *Contentives* for lexemes which perform all four functions, *Non-Verbs* for lexemes which perform all non-predicating functions, and *Modifiers* for lexemes which perform referent modifier and predicate modifier functions.

Hengeveld's parts-of-speech typology and the subsequent research it inspired (Don & van Lier 2013; Hengeveld & Rijkhoff 2005; van Lier 2006; Hengeveld & van Lier 2012; Luuk 2010; van Lier & Rijkhoff 2013; van Lier 2016) constitute important empirical contributions to the study of lexical flexibility. However, Hengeveld's definition of flexible languages and

his parts-of-speech typology still rely on large, language-specific categories of the kind that have been problematized by Croft (2001b: §2.2.2) and Croft & van Lier (2012), and are therefore subject to the same difficulties as traditional approaches to parts of speech. However, numerous scholars have since adopted Hengeveld's term *lexical flexibility* to describe cases where lexical items serve more than one discourse function, regardless of their theoretical commitments or analysis of flexible items. As a convenient cover term, *lexical flexibility* is now well established.

2.3.1.2 Polycategoriality

Vapnarsky & Veneziano (2017b: 4) introduce the alternative term *polycategoriality* as their preferred characterization of flexible items. (The term is also used by Carter (2006), but he does not give a precise definition for it.) While Vapnarsky & Veneziano use this term mostly interchangeably with *lexical flexibility*, there are important differences between the two concepts. Hengeveld's use of *lexical flexibility* is meant to imply the existence of large, flexible supercategories that subsume multiple discourse functions, whereas Vapnarsky & Veneziano are not committed to any particular schema for parts of speech. Central to their notion of polycategoriality is the idea that lexical categories exist, but that "there are lexical forms that are not specified for lexical category (or are not specified fully, or univocally) on some level of representation." (Vapnarsky & Veneziano 2017b: 4). In other words, one lexeme may belong simultaneously to multiple lexical categories. Under this definition, a language could still have all four major lexical categories but nonetheless exhibit rampant polycategoriality; this is not a possibility in Hengeveld's framework. Like Hengeveld, however, Vapnarsky & Veneziano are committed to the existence of large lexical categories in particular languages. Their analysis is therefore also of the categorial kind discussed at the beginning of Section 2.3.1.

2.3.1.3 Multifunctionality / Polyfunctionality

Another term for our phenomenon of interest, introduced by (van Lier 2012), is *multifunctionality*, in which a single lexical item can have multiple discourse functions. An advantage of this analysis is that it takes no theoretical position on the issue of whether lexical items are categorial or acategorial; it just focuses on their functions. The term *multifunctionality* is meant to stand in contrast with *conversion* or *zero derivation*. Van Lier takes conversion to be idiosyncratic and unproductive, producing meanings for forms in alternate discourse functions that are not predictable (see §2.3.2.4 and §2.3.3.2 for further discussion). Multifunctionality is also distinct from zero derivation from a common root. Instead, multifunctional lexemes are those whose semantic interpretation is entirely predictable from context, and whose uses in different contexts are productive. Their meanings should be *compositional*. For example: when an action word is used in a referring construction its predicted meaning is that of an *action nominalization*, '(the act of) X-ing'; and when an object word is used in a predicate construction its predicted meaning is that of a *predicate nominal*, 'be an X'. Examples of these predictable, compositional meanings for flexible items in Chamorro are shown in (14).

(14) Chamorro (Austronesian > Malayo-Polynesian)

a. para **batångga-n** karabåo esti
FUT **shed-LINK** carabao this
'this is going to be a carabao shed' (Chung 2012: 8)

b. para **gatbesa** ha'
FUT **decoration** EMPH
'[she] is going to be a decoration' (Chung 2012: 20)

In the two examples above, the meaning of the object words 'shed' and 'decoration' are predictable when used in a predicative context: 'be a shed/decoration'. However, lexical items used in their non-prototypical functions very frequently do not have predictable meanings. Consider the example in (15).

(15) Chamorro (Austronesian > Malayo-Polynesian)

ma **se'si'** i babui
AGR **knife** the pig
'they stabbed the pig' (Chung 2012: 29)

In this example, the meaning 'stab' cannot be predicted from the meaning of the object word 'knife'. It could have just as easily meant 'be a knife' or 'cut'.

Van Lier takes examples like those in (14) to be instances of genuine multifunctionality, and those in (15) to be cases of conversion. Others have also adopted a position similar to van Lier's, in which only the semantically compositional / predictable uses of a lexical item in different discourse functions are considered flexible (Croft 2001b: §2.2.2–§2.2.3; Evans & Osada 2005: §3.2).

2.3.1.4 Precategoriality / Acategoriality

The various approaches which analyze flexible items as being at some level uncategorized until they receive their interpretation from context may be lumped together under the umbrella terms *precategoriality* or *acategoriality*. Hopper & Thompson's influential (1984) paper is an early application of the concept of acategoriality to the analysis of flexible items:

> [L]inguistic forms are in principle to be considered as *lacking categoriality* completely unless nounhood or verbhood is forced on them by their discourse functions. To the extent that forms can be said to have an apriori existence outside of discourse, they are characterizable as *acategorial*; i.e. their categorical classification is irrelevant. Categoriality-the realization of a form as either a N or a V-is imposed on the form by discourse. (Hopper & Thompson 1984: 747)

The term *precategorial* has become a somewhat more common term for roughly the same concept (though some researchers use the term in more strictly-delineated ways) (Evans & Osada 2005: 357, 362–364; Bisang 2008; 2013). It is especially preferred by morphological models that presuppose stages of derivation, such that lexical items are precategorial before they reach a certain stage of the derivation (Halle & Marantz 1994; Arad 2005; McGinnis-Archibald 2016; Siddiqi 2018). Vapnarsky & Veneziano (2017b: 5) distinguish polycategoriality from acategoriality by defining acategoriality as implying "no primitive / original cat-

egorial marking at all", and polycategoriality as allowing a lexical item "to be only partially unspecified for category, with possible constraints on the relevant categories". Languages for which precategorial analyses have been advanced include Cherokee (Haag 2017), Gooniyandi (McGregor 2013), Kuikuro (Franchetto & Santos 2017), Mundari (Hengeveld & Rijkhoff 2005). Pfeiler (2017) also presents psycholinguistic evidence that the earliest utterances of L1 learners of Yucatec Maya are acategorial.

A central concern in precategorial approaches is the precise mechanism by which a lexical item receives its categorization in context (Hengeveld, Rijkhoff & Siewierska 2004: §3.7). There are two main theories of semantic indeterminacy in flexible items: *underspecificity* (Farrell 2001; Rijkhoff & van Lier 2013) and *vagueness* (Tuggy 1993; Hengeveld, Rijkhoff & Siewierska 2004; Hengeveld & Rijkhoff 2005). The essential difference is that underspecificity entails semantic minimalism, while vagueness entails semantic maximalism. An underspecified lexeme has a minimal, core meaning, and receives its categorial meaning from the discourse context it appears in; a vague lexeme has a maximal, broad meaning that covers all the possible discourse contexts it appears in. (There is of course quite a deal of variation in the literature as to how scholars use these terms, with many researchers conflating the two.) Hengeveld & Rijkhoff (2005: 414) offer the example of English *cousin* as a word that is semantically underspecified for gender, such that the gender of the referent must be understood from context. Denison (2018) argues that the English word *long* exhibits adjective ~ adverb underspecification in Old English and Middle English.

In contrast, Hengeveld, Rijkhoff & Siewierska (2004: 539–541) outline a theory regarding exactly how vagueness operates in the context of lexical flexibility:

> [E]ach flexible lexeme has a single (vague) sense. By placing the flexible lexeme in a particular syntactic slot or by providing it with certain morphological markers, the speaker highlights those meaning components of the flexible lexeme that are relevant for a certain lexical (verbal, nominal, etc.) function. Thus we contend that the meaning of a flexible lexeme always remains the same, and that morphosyntactic and other contextual clues signal to the addressee how to interpret this lexeme in an actual utterance. In other words, it is the use of a vague lexeme in a certain context (an actual linguistic expression) that brings out certain parts of its meaning, giving the category-neutral lexeme a

particular categorial (verbal, nominal, etc.) flavour. (Hengeveld & Rijkhoff 2005: 541)

(Note that Hengeveld & Rijkhoff distinguish *vagueness* and *ambiguity* by reserving the term *ambiguity* for cases of distinct, homophonous lexemes.)

Evans & Osada (2005: 363–364) and Kihm (2017) criticize both precategorial approaches for their imprecision, claiming that it would be impossible to formulate a definition for many flexible items that is broad enough to encompass all their uses. Kihm (2017: 87) illustrates this difficulty with the various meanings of the Arabic root *s-q-ṭ*, which could arguably be glossed FALL. A selection of stems containing this root are given in (16).

(16) Standard Arabic (Afroasiatic > Semitic)

saqaṭa	'to fall'
saqiiṭ	'hail'
saqqaaṭa	'door latch'
masqaṭ	'place where a falling object lands; waterfall'
isqaaṭ	'overthrow; shooting down; miscarriage; substraction'
tasaaquṭ	'fall of hair'
saaqiṭa	'fallen woman; harlot'
suquuṭ	'fall; crash; collapse'
saqṭ	'dew'
siqṭ	'miscarried fetus'
suqṭ	'sparks flying from a flint'
saqaṭ	'offal; rubbish'
saqṭa	'tumble; slip; mistake'
saaqiṭ	'fallen; mean; missing'

It is difficult to imagine a single definition of *s-q-ṭ* which could adequately demarcate just this set of meanings. This difficulty could perhaps be overcome, however, by loosening the requirement that the meaning of a lexical item be unitary. Word meanings are *polycentric*, where different senses of an item are related through *meaning chains* rather than all through a single, central member (Taylor 2003: 110). This is often referred to as a *family resemblance* structure for categories. The difference between monocentric and polycentric categories is illustrated schematically in Figure 2.2. In both diagrams, each letter A–E represents a sense of a lexical item. In the monocentric case, all the senses of the lexical item are related through its core sense A. In the polycentric case, senses A and E are related only through their intervening

connections.[2]

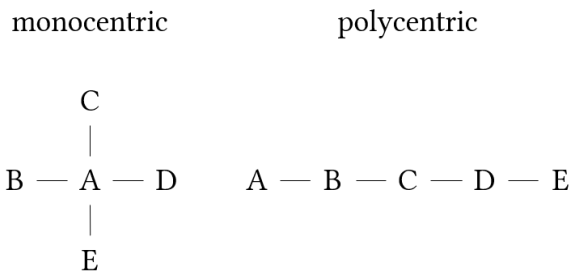


Figure 2.2: Monocentric vs. polycentric categories

Recognizing that word meanings are polycentric addresses Evans & Osada's (2005) and Kihm's (2017) criticisms of vagueness theory because it shows that the disparate senses of a lexical item can be related without having to share any core component of their meanings. The use of a lexeme in a certain context then profiles one of these senses over others. Kihm himself hints at this solution by referring to the related Arabic stems in (16) as a *lexical family*.

2.3.1.5 Monocategoriality

In the extreme case where all lexical items in a language are precategorial, the language could be considered *monocategorial*, possessing a single, open syntactic category. This is effectively the same as saying that the language lacks lexical categories altogether, the difference being primarily one of emphasis. David Gil analyzes both Tagalog (1995) and Riau Indonesian (1994) as being of this extreme monocategorial type. Moreover, he argues that monocategoriality must have been typical of an earlier stage of language evolution in which dedicated morphosyntactic constructions for different discourse functions had yet to evolve (Gil 2005; 2006; 2012). He names this abstract language type an *isolating-monocategorial-associational* (IMA) language.

[2]The terms *monothetic* and *polythetic* are sometimes used for this distinction instead (Lewandowska-Tomaszczyk 2007: 146).

2.3.1.6 Transcategoriality

It is also worth briefly mentioning *transcategoriality*, since the term arises occasionally in connection with lexical flexibility and is potentially easily confused with other terms mentioned above. Robert (2003) uses *transcategoriality* to describe the ability of a single form to serve both lexical and grammatical functions. This is common in grammaticalization scenarios in which the original, lexical use of a form continues to exist alongside its newer, functional use. This is commonly referred to in the grammaticalization literature as *divergence* (Hopper & Traugott 2003: 118). Since the focus of lexical flexibility is on *lexical* items and categories rather than *functional* ones, the concept of transcategoriality is not directly relevant to the study of lexical flexibility.

2.3.1.7 Conversion / Zero derivation

Conversion is the process whereby a lexical item simply changes its word class with no overt morphological marker of that change (Crystal 2008: 114). *Zero derivation* is an alternate analysis of the same phenomenon that posits the presence of a derivational marker with no phonological realization. I prefer the term *conversion* in this dissertation. Since the literature on conversion and zero derivation is extensive and the concepts are well-established, I will treat them only summarily here, focusing on their relationship to lexical flexibility.

The concept of conversion is based on the premise that lexical items in a language are fully categorized for part of speech, meaning that an analysis of lexical flexibility as conversion falls under the categorial (as opposed to acategorial) analyses of lexical flexibility mentioned at the beginning of Section 2.3.1. Conversion is generally characterized as a kind of word formation, implying that a new lexeme has been created. Therefore, conversion and lexical flexibility are mutually exclusive analyses of multifunctional items; lexical flexibility implies the existence of one polysemous lexeme which can fulfill multiple discourse functions, while conversion implies the existence of two homonymous / heterosemous lexemes with different discourse functions. Remember too from Section 2.3.1.3 that van Lier (2012) distinguishes

conversion from multifunctionality, where conversion is reserved for unproductive / unpredictable derivations. Not all scholars would delimit conversion in this way, however.

Conversion also implies directionality. In cases of conversion, one of the two uses of a form is in some way basic or prior to the other (Mithun 2017: 156; Vapnarsky & Veneziano 2017b: 5). Under a flexible analysis, by contrast, the different functions of a single flexible item have equal theoretical status. If it could be shown that certain seemingly flexible uses of a lexical item were in some way marked in relation to each other, this would therefore constitute potentially disconfirming evidence against a flexible analysis. This is in fact one of the major arguments presented against flexible analyses, to be discussed in Section 2.3.3. There are at least four ways in which one member of a putatively flexible set of lexical items might be considered more basic than the others: 1) diachronically, in which one use of the lexical item appears before the others historically; 2) semantically, in which the meaning of the derived item is more semantically complex than that of the basic one; 3) morphologically, in which the more basic item is irregularly inflected but the derived item is regularly inflected; or 4) frequentially, in which derived lexical items are used less frequently than their more basic counterpart (Plag 2003: 108–111). Speakers themselves also have intuitions about which member of a flexible set is basic and which are derived (Mithun 2017: 166). As will be explained in Section 2.4.2, the idea that certain uses of a lexical item are marked in relation to each other is also central to the typological markedness theory of lexical categories.

2.3.1.8 Functional shift / Functional expansion

Especially among researchers in North America, another common term for conversion is *functional shift* (Cannon 1985). In most research, the term is used essentially interchangeably with *conversion* or *zero derivation*. However, functional shift can be usefully distinguished from conversion by its emphasis on function over category, paralleling the distinction between polycategoriality (implying language-specific categories) and polyfunctionality (with no such implication). In its literal interpretation, the term suggests a shift in the meaning of a

lexical item from one discourse function to another, an analysis amenable to a constructional approach, and one that is not committed to the existence of language-particular categories. A slight improvement on this term would be *functional expansion*, since it emphasizes the expansion of a linguistic form into new functions / contexts as opposed to the wholesale shift from one function to another implied by *functional shift*.

2.3.2 Key findings

The emergence of lexical flexibility as an object of study has led to a number of edited collections or journal volumes focused on flexibility and word classes more generally (Vogel & Comrie 2000, Evans & Osada 2005 (target article), Ansaldo, Don & Pfau 2010, Lois & Vapnarsky 2003, Rijkhoff & van Lier 2013, Simone & Masini 2014, Błaszczak, Klimek-Jankowska & Migdalski 2015, Vapnarsky & Veneziano 2017a, van Lier 2017 (target article), Vapnarsky & Veneziano 2017b, Cuyckens, Heyvaert & Hartmann 2019), plus any number of individual articles (see especially Farrell [2001], Rijkhoff [2007], van Lier [2012], and Mithun [2019]). Out of these collections have emerged several recurring findings, each of which is summarized in this section.

2.3.2.1 Parts-of-speech hierarchy

In addition to laying out a theory of flexible categories, Hengeveld (1992) presents the results of a 30-language survey of parts of speech in which he finds that the categories which are most likely to occur as an independent class in a language are subject to an implicational hierarchy, shown in (17), which Hengeveld refers to as the *parts-of-speech hierarchy*.

(17) Verb > Noun > Adjective > Adverb

Categories to the left of the hierarchy are more likely to occur as a distinct part of speech than categories to the right. Applying this hierarchy to Hengeveld's flexible vs. rigid distinction yields the parts-of-speech typology in Figure 2.3 (adapted from Hengeveld [1992: 69] and

Rijkhoff [2007: 718]). The terms for the different categories in flexible languages are from Hengeveld, Rijkhoff & Siewierska (2004). Hengeveld points out that this is not a strict classification scheme; languages may sit at the boundaries between types and exhibit exceptions.

<table>
<tr><th></th><th>predication</th><th>reference</th><th>predicate modification</th><th>referent modification</th></tr>
<tr><td rowspan="3">flexible</td><td colspan="4">contentive</td></tr>
<tr><td>verb</td><td colspan="3">non-verb</td></tr>
<tr><td>verb</td><td>noun</td><td colspan="2">modifier</td></tr>
<tr><td rowspan="4">rigid</td><td>verb</td><td>noun</td><td>adjective</td><td>adverb</td></tr>
<tr><td>verb</td><td>noun</td><td>adjective</td><td></td></tr>
<tr><td>verb</td><td>noun</td><td colspan="2"></td></tr>
<tr><td>verb</td><td colspan="3"></td></tr>
</table>

Figure 2.3: Hengeveld's (1992: 69) typology of parts-of-speech systems

As mentioned in Section 2.3.1.1, Hengeveld's typology could be criticized for its reliance on large, language-specific lexical categories instead of constructions. One could however reframe Hengeveld's implicational hierarchy in terms of functions rather than categories, as in (18). I call this the *hierarchy of discourse functions*.

(18) predicate > referent > predicate modifier > referent modifier

In (18), functions to the left of the hierarchy are more likely to have dedicated morphosyntactic constructions than those to the right. This reformulation avoids a commitment to any language-particular categories while still capturing the implicational trend observed by Hengeveld.

This hierarchy of discourse functions has proven to be a fairly robust finding in the literature on lexical flexibility, now supported by a number of subsequent studies (Anward 2000; Rijkhoff 2000; Vogel 2000; Beck 2002; Rijkhoff 2002; 2003; Hengeveld, Rijkhoff & Siewierska 2004; van Lier 2006; Hengeveld 2007; Hengeveld & van Lier 2012; Hengeveld & Valstar 2010; Beck 2013; Bisang 2013; Hengeveld 2013).

2.3.2.2 Reference-predication asymmetries

The hierarchy of discourse functions also hints at another important feature of lexical categories: there is something privileged about the predicating function. A survey of the literature on lexical flexibility reveals patterned asymmetries in the behavior of lexical items with regard to predication vs. reference, even in very flexible cases. For starters, while it is quite common for languages to freely allow object words to be used as predicates with no special marking, the reverse case is much less likely Hopper & Thompson (1984: 745). The functional expansion of an item's uses from predication into reference always seems to be more marked (or at least as marked) as the shift from a referring function to a predicating function.

This fact has been observed independently by numerous researchers. For example, Stevick (1968: 251) and Marchand (1969: 373–374) both observe that conversion from noun to verb in English has always been more common than from verb to noun, and Kastovsky (1996: 98) points out that English does not even have a native noun > verb derivational suffix—any affixes of this type are borrowed from Romance languages. Central Alaskan Yup'ik is another example of a language with very many nominalizers but few verbalizers (Mithun 2017: 158).

Flexibility itself is frequently *unidirectional*, meaning that any object word many be used for predication, but that action words used for reference are marked (Croft 2001b: 69; Evans & Osada 2005: §3.3; Beck 2013). Nakayama (2001: 44) frames flexibility in Nuuchahnulth in terms of a stem's ability to predicate, reporting that "all inflectional stems are potentially predicative", but the reverse is not true. Discussing Classical Nahuatl, Launey (1994; 2004) introduces the term *omnipredicativity* to describe languages in which all lexical items are potentially predicative, but no corresponding term *omnireferentiality* has appeared in the literature. That said, languages which have undergone *insubordination* (in which subordinate clauses are reanalyzed as main clauses [Evans 2007; Mithun 2008; Evans & Watanabe 2016]) do often exhibit noun-oriented flexibility in the sense that verbal inflection mirrors nominal inflection. This is because one common insubordination pathway is nominalized subordinate clauses becoming reanalyzed as main clauses, so that nominal inflection marking is rean-

alyzed as verbal inflectional marking. This process of insubordination famously led to the claim that all lexical items in Eskimo languages are fundamentally nominal in nature (Sadock 1999). However, cases of insubordination do not constitute counterexamples to the predicating tendency in language. Even in these languages, the use of action words for reference is still less marked than the use of object words for predication.

Kastovsky (1996) argues that this asymmetry arises from the fact that "deverbal nouns have a much more diversified semantics than denominal verbs" (Kastovsky 1996: 96), meaning that the range of possible meanings for a deverbal noun (a noun derived from a verb) is broader than for a denominal verb (a verb derived from a noun). Examining data from English, Kastovsky shows that when an object word is used to predicate, its possible meanings are limited to combinations of BE, BE LIKE, BE IN, BECOME, HAVE, DO, DO WITH, and CAUSE. When an action word is used as a predicate, however, the range of meanings include any abstract representation of the event itself (an action nominalization), or any one of the arguments associated with the verb, which come in a variety of semantic roles.

A similar, cognitively oriented explanation for reference-predication asymmetries is given by Hopper & Thompson (1984: 745):

> [Deverbal] nominalization names an event taken as an entity; however, a "verbalization" does not name an "entity taken as an event", but simply names an event associated with some entity. In other words, a nominalization still names an event, albeit one which is being referred to rather than reported on in the discourse; it is, accordingly, still in part a [verb], and not a "bona fide" [noun]. However, a denominal [verb] no longer names an entity at all, and thus has no nominal "stains" to prevent its being a bona fide [verb]. (Hopper & Thompson 1984: 745)

Hopper & Thompson (1984: 746) analyze nominalizations as a kind of metaphor following Lakoff & Johnson (1980: 3a), in which an abstract event is conceptualized as a concrete object. However, no such metaphor exists for verbalizations, explaining the asymmetry in the directionality of lexical flexibility.

2.3.2.3 Locus of categoriality

The grammatical level at which a language exhibits flexibility—the root, the stem, or the fully inflected word—differs from one language to the next. In some languages, roots are strongly associated with a particular discourse function, but stems are flexible; in other languages, the reverse is true. I refer to the linguistic level at which a language associates different discourse functions as its *locus of categoriality*. Some linguistic theories include a premise that the locus of categoriality in every language always sits at a certain level (Halle & Marantz 1994; M. C. Baker 2003; 2015; Booij & Audring 2018; Siddiqi 2018), but the evidence from research on lexical flexibility gives strong empirical support to the position that locus of categoriality varies from language to language. In contrast, Błaszczak, Klimek-Jankowska & Migdalski (2015) argue that category information is distributed across different levels of representation.

As one illustration of how flexibility depends on grammatical level, we have seen that roots in Central Alaskan Yup'ik are generally categorical—except for 12% of roots, they are typically strongly associated with just one discourse function, and derivational affixes select for roots of a particular category (Mithun 2017: 162–167). While many derived stems are also strictly associated with just one discourse function, a large but indeterminate number have both referential and predicative uses. Examples of such flexible stems have already been shown in (7) in Section 1.1. Fully inflected words in Central Alaskan Yup'ik, however, never exhibit flexibility (Mithun 2019: 6). So Central Alaskan Yup'ik displays partial flexibility at the root and stem level but not the inflected word level.

As another example, in Mandinka all stems are flexible. No Mandinka stem except for *sǎa* 'die' is used in just one discourse function (Creissels 2017: 46). At the level of the inflected word, however, lexical items in Mandinka belong unambiguously to one category or another (Creissels 2017: 37). Mandinka therefore shows complete flexibility at the stem level but complete rigidity at the inflected word level. (Creissels does not include an analysis of roots in his discussion.)

Surprisingly, some languages display flexibility even at the level of the fully inflected word.

In many North American languages, it is common for fully morphological verbs to function as referents (Hieber forthcoming), as shown in the following examples.

(19) Chitimacha (isolate)

a. dzampuyna
dza-ma-(p)uy-na
thrust-PLACT-HAB-NF.PL
'they usually thrust / spear with it'
'spear' (Swadesh 1939a: 56)

b. pamtuyna
pamte-(p)uy-na
ford-HAB-NF.PL
'they usually cross (it)'
'bridge' (Swadesh 1939a: 17)

(20) Cayuga (Iroquoian > Lake Iroquoian)

a. ǫtekhǫnyáʔthaʔ
ye-ate-khw-ǫni-aʔt-haʔ
INDEF.AGT.REFL-meal-make-INSTR-IPFV
'one makes a meal with it'
'restaurant' (Mithun 2000: 200)

b. kaǫtanéhkwih
ka-rǫt-a-nehkwi
NEUT.AGT-log-EP-haul.IPFV
'it hauls logs'
'horse' (Mithun 2000: 200)

(21) Navajo (Na-Dene)

a. tsinaaʾeeɬ
tsi(n)-naaʾeeɬ
wood-it.moves.about.floating
'ship, boat' (Young 1989: 316)

b. chahaɬheeɬ
it.is.dark
'darkness' (Young 1989: 316)

Each of these flexible uses of a morphological verb sits somewhere on a continuum between being fully lexicalized as a referent, so that its predicating use is no longer available, to being a fully productive predicate, with both predicative and referential uses (Mithun 2000: 413).

The reason that lexical items may exhibit flexibility at one level of analysis but not another is because "*categorial* shift is often not *categorical*" (Mithun 2019: 1). When an item expands its use into new contexts, not all the morphological, syntactic, and semantic properties of the item shift to accommodate that new use at the same time. It takes time before the morphosyntactic properties of an item adjust to reflect its new use, a process referred to as *actualization* in the grammaticalization literature (De Smet 2012) and *post-constructionalization constructional changes* in the framework of diachronic construction grammar (Hopper & Traugott 2003: 27).

It is in part because the locus of categoriality can vary from language to language that I have used the vague term *lexical item* throughout this dissertation, which is intended to be a convenient cover term for root, stem, or inflected word.

2.3.2.4 Item-specificity

A final significant finding to emerge from the empirical research on lexical flexibility is the fact that flexibility is *item-specific* and even *sense-specific*. Individual lexical items or even individual senses of an item that are otherwise very similar in their meanings and morphosyntactic behavior can nonetheless differ in terms of their flexibility.

This fact is nicely illustrated by both Mithun's (2017) study of lexical flexibility in Central Alaskan Yup'ik and Creissels's (2017) study of Mandinka. Mithun (2017: 163–164), for example, considers roots for meteorological concepts, and shows that even within this small semantic domain, roots vary as to whether they exhibit flexibility. In (22a) the meteorological roots have predicative counterparts but in (22b) the meteorological roots do not.

(22) Central Alaskan Yup'ik (Eskimo-Aleut > Yupik)

a.	*amirlu*	'cloud'	*amirlu-*	'be cloudy'
	kaneq	'frost'	*kaner-*	'be frosted'
	aniu	'snow on ground'	*aniu-*	'to snow'
b.	*taituk*	'fog, mist'	**taitug-*	'be foggy'
	kavtak	'hailstone'	**kavtag-*	'to hail'
	mecaliqaq	'sleet'	**mecaliqar-*	'to sleet'

(Mithun 2017: 163)

Mithun also provides similar data illustrating flexibility gaps for the domains of clothing and instruments:

(23) Central Alaskan Yup'ik (Eskimo-Aleut > Yupik)

a.	*taqmak*	'dress'	*taqmag-*	'put on a dress'
	nacaq	'hat, parka hood, cap'	*nacar-*	'put on a hat, hood'
	atkuk	'parka'	*atkug-*	'put on a parka'
b.	**piluk*	'footwear'	*pilug-*	'put on footwear'
	**at'e*	'clothing'	*at'e-*	'don, put on clothing'
	**kive*	'pants'	*kive-*	'pull down pants'

(24) Central Alaskan Yup'ik (Eskimo-Aleut > Yupik)

a.	*ay'uytaq*	'hockey stick'	*ay'utar-*	'play hockey'
	iqsak	'fishhook'	*iqsag-*	'to jig for fish'
	kapkaanaq	'trap'	*kapkaanar-*	'to trap, get trapped'
	keviq	'plug, cork, stopper'	*kevir-*	'to plug, stuff, caulk'
	kuvya	'fishnet'	*kuvya-*	'fish by driftnetting'
b.	**kagi*	'broom'	*kagi-*	'sweep'
	**ipuk*	'ladle'	*ipug-*	'ladle, move with bow of boat high in air'
	**pangeq*	'double-bladed paddle'	*panger-*	'paddle with a double-bladed paddle'

On the basis of data like these and discussion with speakers, Mithun observes, "Speakers simply know whether a given root functions as a noun and what its meaning is, and whether it functions as a verb and what its meaning is. Gaps are not predictable[.]" (Mithun 2017: 163). These gaps also vary from dialect to dialect. While the dialect in the above examples has no predicative counterpart for *taituk* 'fog', the Nunivak Island dialect does have a pair of roots *nugu* 'fog' and *nungu-* 'be foggy'.

Creissels's (2017) study of Mandinka is another good illustration of the item-specific nature of flexibility. While Mandinka has nominal and verbal constructions that allow the predicative and referring functions of inflected words to be distinguished unambiguously, it is not as easy to separate stems into similar classes. In Mandinka, all items are flexible, but the *way* in which items are flexible varies. Stems in Mandinka may be divided into three classes based

on their semantic behavior with regards to flexibility:

- *verbal* lexemes are those whose meaning is predictable when used to refer and therefore analyzable as a case of "morphologically unmarked nominalization"; these are always event nominalizations
- *verbo-nominal* lexemes are those whose meaning in referring constructions is idiosyncratic and therefore not predictable
- *nominal* lexemes are those whose meaning when used as predicates is predictable and limited to 'provide someone with X'

In Mandinka, therefore, flexibility must be considered on an item-by-item basis since the behavior of each item with regard to flexibility may differ.

In fact, flexible behavior in Mandinka is not just item-specific, but sense-specific as well. Creissels (2017: 54) reports that polysemous lexemes may show different behavior for their different senses. The stem *díŋ*, for example, has two senses: 'child, young (of an animal)' and 'fruit'. However, only the 'fruit' sense is available for predication: when used as an intransitive verb, *díŋ* may only mean 'bear fruit', not 'give birth', even though 'give birth' is a perfectly conceivable meaning of this stem in predication. In the sense of 'child, young (of an animal)', *díŋ* behaves as a nominal lexeme, but in the sense of 'fruit' it behaves as a verbo-nominal lexeme.

When lexical items undergo functional expansion into new discourse functions, it is also only specific senses that do so, not every one of its senses. More evidence for this comes from the diachronic development of the word *run* in English: though the word *run* when used as a predicate has numerous senses, the earliest attestations of *run* used referentially are by and large with just the prototypical sense of 'fast pedestrian motion' (the exceptions to this stem from just one corpus file) (Gries 2006: 76). Other referential uses of *run* did not develop until later.

The existence of dialectal differences for flexibility as well as the unpredictable meanings of lexical items when used in various discourse functions show that the development of flexibility depends on conventionalization—whether a given form has assumed a conventionalized

meaning in its role for a specific discourse function. These conventionalizations are language-specific, dialect-specific, item-specific, and even sense-specific (Croft 2000: 97). Speakers can and do playfully use existing lexical items for new discourse functions, but it is not until that combination of form and discourse function is conventionalized with a specific meaning in a community of speakers that we can say the lexical item has undergone functional expansion. An excellent illustration of this is the word *friend* in English. Prior to the widespread adoption of the social networking sites MySpace and Facebook around 2006, the use of *friend* as a predicate had not been widely conventionalized. The growth of social networking sites then led to the specific use of *friend* to mean 'add as a connection on a social networking site'. Note that it does *not* have the more general sense of 'be a friend' or 'befriend'. Like with Yup'ik and Mandinka, this shows not just that flexibility is item-specific, but that the meaning of flexible uses is often item-specific as well; in many cases it is unpredictable and must be memorized by speakers.

2.3.3 Problems & critiques

Despite the robust findings in Section 2.3.2, researchers have challenged the very possibility of lexical flexibility and its presence in various languages. Some of these challenges stem from the fact that certain conceptions of lexical flexibility are based on traditional ideas about the existence of large, language-specific parts of speech, and therefore subject to the same set of criticisms. Other challenges stem from precisely the facts presented in the previous section, namely that both flexibility and the meaning of flexible words are item-specific and often unpredictable, such that these words are not truly "flexible". Moreover, languages must indicate the discourse function of their lexical items *somehow*—this is basic to our ability to communicate. In a certain sense, the idea that there are items which are fully ambiguous in their discourse function is doomed at the outset. The question is really where these indications of pragmatic function live—the root, the stem, the inflected word, or the clausal context. This section summarizes the main criticisms that scholars have raised against flexible analyses. In

Section 2.4, we then look at alternative theories of word classes and their approach to lexical flexibility.

2.3.3.1 Methodological opportunism

A methodological problem with certain theories of flexible items is that they, like traditional theories, commit the fallacy of *methodological opportunism* (Croft 2001b: 30, 41) presented in Section 2.2.3. They do not apply the distributional method consistently. Instead, the criteria which separate lexical items into categories are determined on the basis of additional theoretical commitments. Croft (2001b: §2.2.2) criticizes Hengeveld's parts-of-speech typology on this basis, noting that Hengeveld ignores distributional evidence for classes smaller than the ones he posits in his typology (noun, contentive, etc.). Evans & Osada (2005) raise similar concerns for Hengeveld's theory as applied to Mundari. They state that in order for two lexical items to be members of the same lexical class, they must have *equivalent combinatorics*, which is to say that their distributions should be identical (Evans & Osada 2005: 366). Evans & Osada also state that for a language to flexible, that flexibility must be *exhaustive* in the sense that all members of a putatively flexible class must show equal degrees of flexibility and *bidirectional* in the sense that nouns may be used as verbs and vice versa. Both these criteria are merely different ways of reframing the broader principle that items in a class should share the same distributions (Croft 2005: 434). Evans & Osada proceed to show various ways in which these criteria are not applicable to Mundari, and that Mundari is therefore not a flexible language. At the same time, however, Evans & Osada use these facts to argue for the existence of the equally problematic categories of Noun and Verb in Mundari, using just a "canonical subset of distributional facts" (Evans & Osada 2005: 434, fn. 17). Croft's (2005) commentary on Evans & Osada's (2005) target article is partially devoted to critiquing them on this point. The problem of methodological opportunism is present for any analysis which assumes that languages have a small set of large lexical categories—whether that analysis is flexible or traditional.

2.3.3.2 Semantic shift

Broadly speaking, however, the primary argument against theories of flexible word classes is that they ignore a great deal of item-specific knowledge that speakers have about lexical items and their uses in different functions (Evans & Osada 2005: §3.2; Beck 2013: 216). This issue has already been discussed in some detail in Section 2.3.2.4, but it bears explaining precisely why such item-specific knowledge constitutes a problem for theories of lexical flexibility.

For starters, when a lexical item expands into a new discourse function, there is a *semantic shift* in the direction of the meaning typically associated with the new context (Croft 1991: 74–77; 2001b: 73). For example, when a property word is used in a referring expression, its meaning shifts to a person or thing possessing that property, not a reference to the abstract property itself. The precise meaning that results from these shifts, however, cannot be attributed to some broader pragmatic principles—they are a matter of convention and require broader uptake in a community of speakers in order to be conventionalized (as illustrated with the English word *friend* above). Because the meaning that results from this semantic shift is conventional, language-specific, and often idiosyncratic, flexible items cannot be truly productive, as is implied by the term "flexible". There is always a conventionalized component to their meanings.

Examples of idiosyncratic and unproductive shifts in the meaning of flexible items abound in the literature. Consider again the examples from Mundari in (3), repeated here as (25).

(25) Mundari (Austroasiatic > Munda)

a. buru=ko bai-ke-d-a.
mountain=3PL.SUBJ make-COMPL-TR-IND
'They made the mountain.' (Evans & Osada 2005: 354)

b. saan=ko buru-ke-d-a.
firewood=3PL.SUBJ mountain-COMPL-TR-IND
'They heaped up the firewood.' (Evans & Osada 2005: 355)

As a predicate, the stem *buru* means 'heap up', but this meaning is not predictable from just the combination of the nominal sense 'mountain' and its predicative use. The word could

have just as easily meant ‘climb a mountain’ or ‘overcome’ or simply ‘be a mountain’. No general pragmatic principles could have predicted this meaning. Likewise consider the Central Alaskan Yup’ik examples in (7c) from Chapter 1. Why does the combination of *iqeq-* ‘corner of mouth’ + *-mik* ‘thing held in one’s mouth’, ‘to put in one’s mouth’ result in *iqmik* ‘chewing tobacco’? Why not ‘oral thermometer’ or ‘toothpick’? Mithun provides many more unpredictable examples, shown in (26).

(26) Central Alaskan Yup’ik (Eskimo-Aleut > Yupik)

a.	*mecur-*	‘get blood poisoning’
	mecuq	‘liquid part of something, sap, juice, green/waterlogged wood’
b.	*melug-*	‘suck; eat roe directly from the fish’
	meluk	‘fish eggs, roe, fish eggs prepared by allowing them to age and become a sticky mess’
c.	*qager-*	‘explode, to pop’
	qageq	‘blackfish which is boiled, allowed to set in its cooled, jelled broth’
d.	*qumig-*	‘hold inside (of clothing)’
	qumik	‘enclosed thing, thing inside, fetus’
e.	*aveg-*	‘divide in half, to halve’
	avek	‘half’; also ‘half-dollar; person who is half Native’
f.	*napa-*	‘stand upright’
	napa	‘tree’
g.	*yuurqar-*	‘sip’
	yuurqaq	‘hot beverage, tea’

Or consider the example from Cayuga in (20b), repeated here as (27).

(27) Cayuga (Iroquoian > Lake Iroquoian)

kaǫtanéhkwih
ka-rǫt-a-nehkwi
NEUT.AGT-log-EP-haul.IPFV
‘it hauls logs’
‘horse’ (Mithun 2000: 200)

Of all the possible nominal meanings that could reasonably derive from ‘it hauls logs’—cart,

tractor, ox—the fact that its nominal use means 'horse' is specific to Cayuga and must be memorized by speakers.

Conventionalizations of lexical items used in new discourse functions also vary across languages. While the principle of semantic shifts still broadly holds, the specific meanings of these conventionalizations are unpredictable. Croft exemplifies this point by comparing English *school* with Tongan *ako* 'school / study'.

> English *school* used predicatively does not mean the same thing as Tongan *ako* used predicatively, namely 'study'. Going in the opposite direction, English *study* used referentially does not mean the same thing as Tongan *ako* used referentially, namely 'school'. Finally, English *small* used referentially does not mean the same thing as Tongan *si'i* 'childhood' used referentially. (Croft 2000: 71)

Since the meanings of putatively flexible items in different discourse functions are not predictable, many scholars reason that these lexical items cannot be truly "flexible" in the sense of multifunctional or precategorial.

2.3.3.3 Lexical gaps

Just as unpredictable in flexible cases is which sense of a item will be co-opted into the new discourse function. In Wolof, for example, the referential use of the word *ndaw* can only mean 'young', whereas the predicative use may mean either 'be young' or 'be little, small' (Kihm 2017: 91). Not all senses of a lexical item are available in all its discourse functions. Moreover, not all lexical items within a morphosyntactic or semantic class necessarily have the same range of discourse functions. We have already seen these kinds of lexical gaps for Central Alaskan Yup'ik and Mandinka in Section 2.3.2.4 above. If a lexical item lacks any conventionalized use in different discourse functions, than it cannot rightly be considered flexible, even if the other members of its morphosyntactic class are.

2.3.3.4 Counterarguments

Pointing out that functional expansion involves both semantic shifts and functional gaps is generally intended to show that lexemes cannot be truly flexible in the sense of being multifunctional (§2.3.1.3) or precategorial (§2.3.1.4), and that uses of the same lexical item for different discourse functions should therefore be considered cases of conversion—that is, homonymy or heterosemy. There are however two major problems with this argument.

The first is that it creates a false dichotomy between homonymy and polysemy, when in fact the two phenomena are opposite endpoints on a continuum. Debates over the lexical unity of an item—that is, whether two uses of a lexical item are homonymous or polysemous—arise from an Aristotelian desire to neatly sort those uses into distinct lexemes, when in fact reality is much more complex. If this problem sounds familiar, that is because it is the same methodological problem that arises when trying to exclusively categorize lexical items into different classes. The complex adaptive nature of language makes categorical classification at either level impossible.

As discussed in Section 2.3.1.4, we know from cognitive research that mental categories are prototypal, and that the meanings of words display a polycentric, family resemblance structure. Two senses of a lexical item are often related only tenuously through a network of intervening semantic connections or meaning chains. Langacker (1988) calls this the *network model* of category structure. Taylor points out that "[o]ne consequence of adopting the network model is that the question of whether a lexical item is polysemous turns out to be incapable of receiving a definite answer." (Taylor 2003: 167)

Over time, as this lexical network expands, the meanings of a lexical item can diverge so drastically that speakers no longer have a direct cognitive association between them. Mithun exemplifies this nicely for both Cayuga and English. Discussing morphological Verbs used as referents in Cayuga, she notes the following:

> If asked the meaning of *kaǫtanéhkwih* [lit. 'it hauls logs'], Cayuga speakers normally respond 'horse'. Though it has the morphological structure of a verb, it has been lexical-

> ized as a nominal. The literal meanings of many verbal nominals are still accessible to speakers, but the origins of others have faded, and speakers express surprise at discovering them. Similarly, when asked "What would you like for breakfast?", most English speakers do not think about breaking their night-time fast, though they can usually be made aware of the literal meaning of *breakfast*. (Mithun 2000: 413)

Lexicalization is a process and a continuum. Words can be lexicalized in new discourse functions to varying degrees. The first use of a lexical item in a new discourse function is innovative; each subsequent use then contributes further to its conventionalization in that function.

Pointing out that functional expansion often creates idiosyncratic and unpredictable meanings essentially amounts to saying that senses of lexical items can be highly divergent. This point is not in itself an argument against flexible analyses. Flexible items themselves may sit anywhere on the continuum from having closely connected, productive and predictable meanings, to having extremely divergent, idiosyncratic, and unpredictable meanings. This is not a special fact about flexible items; it is simply true of words generally.

Croft (2001b: 73) expresses concern that ignoring semantic shifts in the analysis of flexible items overlooks important insights about how such semantic shifts are patterned (specifically, the universal fact that semantic shifts are always in the direction of the item's new discourse function; see §2.3.3.2). Given that so many researchers have indeed ignored semantic shift when arguing for flexible analyses, Croft's concern is warranted. However, it is entirely possible to define lexical flexibility in a way that both allows for the meaning of a lexical item to encompass multiple discourse functions and acknowledges that such multifunctional uses involve patterned semantic shifts. The way to do this is to ground the definition of lexical flexibility in the pragmatic functions of reference, predication, and modification rather than language-specific categories like Noun, Verb, and Adjective. I offer such a definition in Section 2.5.

The second significant problem with using semantic shifts as an argument against the existence of flexible lexemes is that it proves too much. If semantic shift is taken as evidence against the lexical unity of putatively flexible items, then it must also be taken as evidence against the lexical unity of non-flexible items. Put simply, semantic shift is an analytical

problem for all words, not just flexible ones.

This fact becomes clear when we ask, "What counts as a semantic shift? Just how 'large' of a change in meaning (if it were even possible to quantify such a thing) does a semantic shift require?" To illustrate this problem, consider the semantic contribution of plural marking crosslinguistically. In the canonical case, plural marking is considered inflectional rather than derivational (Corbett 2000: 2), meaning that it does not create a new lexeme. Instead, it modifies the meaning of the existing lexeme slightly, in line with the classic distinction between inflection vs. derivation. However, there are numerous cases of lexical items in English with more or less drastic differences in meaning between the singular and plural, and/or senses that are only available in one of the two numbers. Consider the examples in (28).

(28) English (Indo-European > Germanic)

a.	*air*	'atmosphere'
	airs	'affected manners'
b.	*arm*	'upper limb; anything resembling a limb'
	arms	'weapons, firearms'
c.	*blind*	'unable to see'
	blinds	'screen for a window'
d.	*custom*	'tradition; socially accepted behavior'
	customs	'department which levies duties on imports'
e.	*force*	'strength, energy'
	forces	'collection of military units'
f.	*good*	'excellent, high quality'
	goods	'merchandise or possessions'
g.	*manner*	'way of doing something'
	manners	'social conduct; socially acceptable conduct'
h.	*spectacle*	'visually striking performance or display'
	spectacles	'pair of glasses'
i.	*wood*	'fibrous material in the trunk of trees or shrubs'
	woods	'area of land covered with trees'[3]

Semantic shifts for plural marking in English are not limited to just a handful of specific

lexical items. Generic uses of the plural as in the expression *foxes are cunning* create a semantic shift away from a concrete entity (*a/the fox*) to a generic, unperceivable one—a use which strays from the prototypical function of nouns as concrete perceptible entities (Hopper & Thompson 1984: 708).

As with flexible items, the semantic shifts that occur with plural marking can become so substantial that speakers no longer cognize the morphological singular and plural as members of the same lexeme. Such is the case in the historical development of *brother* vs. *brethren* in English. The word *brethren* became so strongly conventionalized with its religious meaning in the plural that it was independently lexicalized as a plural-only (*plurale tantum*) noun, and the original plural underwent renewal with the emergence of the form *brothers*. This is exactly the kind of lexicalization process that occurred for many morphological verbs reanalyzed as nouns in Cayuga and many other North American languages.

A similar example comes from Chitimacha, which has a pluractional marker *-ma* indicating verbal number (plural agents, plural patients, or repeated action). In some cases the use of *-ma* is purely compositional, so that it can be considered merely an inflectional marker of verbal number. In other cases *-ma* so significantly alters the meaning of the word that it must be considered derivational. Compare the uses of *-ma* in each of the pairs of verbs in (29) (note that (29b) and (29c) are phrasal verbs with a preverbal particle).

(29) Chitimacha (isolate)

a.	*kow-*	'call'
	kooma-	'call multiple people'
b.	*qapx cuw-*	'come back; go about'
	qapx cuuma-	'travel; wander'
c.	*qapx qiy-*	'turn together; mix, join'
	qapx qiima-	'give a prayer, benediction; perform magic'

(Swadesh 1939a)

In (29a), the use of *-ma* is entirely compositional. The presence of *-ma* indicates that the verb has a plural patient argument. In (29b), the use of *-ma* is still arguably compositional, though

perhaps somewhat lexicalized given the high frequency with which the stem appears in the texts. 'travel, wander' could reasonably be interpreted as a continued repetition of 'go about'. In (29c), however, *qapx qiima-* has become lexicalized with a new meaning not directly related to that of *qapx qiy-*. The diachronic connection between the two meanings is that prayers and magical incantations were traditionally accompanied by circling gestures with the arms. *qapx qiima-* originally meant 'turn/circle around repeatedly', but over time lexicalized with its new religious meaning in the pluractional, 'give a prayer, benediction'. This lexicalization process parallels that of *brethren* in English. Such a range of inflectional vs. derivational uses of pluractionals is quite common crosslinguistically (Mithun 1988; Mattiola 2020).

Finally, there are many languages which do not typically mark plurality on nouns (Dryer 2013), and yet have senses available in semantically plural contexts but not singular ones (where the semantic number can be understood from the clausal context, usually through verbal number marking). For example, the word *soq* in Chitimacha may mean 'foot' or 'paw' in a singular context and 'feet' or 'paws' in a plural context, but may also mean 'tracks' (e.g. animal tracks) in a plural context—a significant and idiosyncratic shift in meaning, and one that is both language-specific and item-specific and thus conventional. This use constitutes a *morphologically unmarked semantic shift* in the meaning of the word, just as idiosyncratic meanings of words in cases of functional expansion also constitute morphologically unmarked semantic shifts. If we take such unmarked semantic shifts as evidence against lexical unity in the cases of flexible items, then we must also say that the 'foot' and 'tracks' meanings of *soq* constitute two distinct lexemes as well.

One might ask, if we start splitting up lexemes based on every degree of semantic shift, where does the splitting stop? This is exactly analogous to the problem of lumping vs. splitting in the context of lexical categories. The Radical Construction Grammar solution to this problem is to abandon the commitment to larger groupings of items (the major lexical categories) and acknowledge that languages consist of an interconnected network of smaller items (constructions) instead (Croft 2001b). This approach has the major advantage of sidestepping

unproductive debates about the existence or unity of lexical categories in particular languages, and shifts the focus instead to understanding the relationships and patterns among individual constructions. This is precisely what I propose to do for lexemes as well. If we abandon the idea that all the meanings associated with a form must be in some way grouped into lexemes based on their morphosyntactic contexts of occurrence, we sidestep unproductive debates regarding homonymy vs. polysemy, and can instead focus on the relationships and patterns among the various senses associated with that form—specifically, the nature of the semantic shifts that occur between uses of the form in different discourse functions.

In sum, idiosyncratic semantic shifts are not the problem for theories of lexical flexibility that they are often taken to be. Indeed, functional expansion would not be possible if hearers were not capable of determining the meaning of a form when used in even highly unusual contexts. Innovative uses of lexical items in new functions would be all but impossible, providing no opportunity for such innovations to receive broader adoption in the linguistic community. Each time a hearer encounters a novel use of a lexical item for the first time, they must accomplish the difficult task of discerning its meaning. This is no less true for flexible items as it is for non-flexible items, or for items whose meaning is predictable vs. unpredictable. *Every* use of a word is an instance of functional expansion because every use of a word is always in a slightly different discourse and social context than the one before. The meaning of a word in a given context is highly socially and situationally dependent, and that context can change completely from one utterance to the next. Every token of a word thus necessarily appears in a new pragmatic context, and that pragmatic context slightly shapes its meaning. Language use *is* language change. Semantic shift is therefore an integral and ubiquitous part of language use; the question is simply the degree of that semantic shift.

2.4 Functional approaches

Functionalism as an approach to linguistic explanation is multifaceted. It looks to factors outside of the structural form of language as an explanation for that form—most especially cognition, usage effects from frequency, and information structuring in discourse (Croft 2001a: 6323–6324). In this section I present Croft's (1991; 2000; 2001b) functional theory of lexical categories, which explains crosslinguistic patterns in the coding of reference, predication, and modification as arising from the interaction between our mental categories and the needs of discourse. I then use this theory as a framework for defining lexical flexibility in Section 2.5. I begin with a brief discussion of prototype theory as it pertains to lexical categories (§2.4.1), before expounding upon typological markedness theory (§2.4.2).

2.4.1 Prototype theory

It has long been recognized that the categories of human cognition are prototypal. In a series of studies, Eleanor Rosch and colleagues demonstrate that category membership is a matter of degree, and that there are better and worse representatives of any given mental category (E. Rosch 1973; E. H. Rosch 1973; E. Rosch 1975; Rosch & Mervis 1975; Rosch et al. 1976; E. Rosch 1978). Prototype theory was then popularized in linguistics by Lakoff (1987), Langacker (1987), Taylor ([1989] 2003), and Croft ([1990] 2003; 1991), among others.

The evidence for prototypal structure in mental categorization is robust (Taylor 2003: 46–47). When asked to rate whether an item is a good example of a category, participants consistently rate prototypical members as better examples of the category than non-prototypical ones. In listing experiments where participants are asked to list members of a category, prototypical members are listed earlier and more frequently than non-prototypical members. Finally, prototypical members of a category are identified by participants as being members of the category more quickly than non-prototypical members. Each of these effects is scalar, such that individual members of a category sit anywhere on a scale of more to less prototyp-

ical.

Prototype effects arise from the basic human need to interpret the world around us: "Strictly speaking, every entity and every situation that we encounter is uniquely different from every other. In order to function in the world, all creatures, including humans, need to be able to group different entities together as instances of the same kind. […] [C]ategorization serves to reduce the complexity of the environment." (Taylor 2003: xi) This fact is often referred to as the *principle of cognitive economy*, whereby we group simlar stimuli together in order to maximize information while minimizing cognitive effort (Evans & Green 2006: 255). The gradience within these groupings results from the fact that "concepts function as mental reference points. When we come across new phenomena, we tend to interpret them in terms of existing categories" (Lewandowska-Tomaszczyk 2007: 149).

Linguistic constructions are also subject to prototype effects (Taylor 2003: Ch. 12). Hopper & Thompson (1980), though not yet working in a prototype framework, nonetheless demonstrate that transitivity is very much a prototype category, with individual clauses showing greater or lesser degrees of transitivity depending on their features. Ross (1972) shows that lexical items are graded in their ability to undergo various transformations, with human beings being close to prototypical noun phrases, while inanimates, events, abstract concepts are quite atypical. Taylor (2003: §12.5) likewise points out that the transitive construction in English has steadily expanded its functions over time "to encode states of affairs which diverge increasingly from prototypical transitivity" (Taylor 2003: 235). The result of this diachronic development is significant gradation as to which verbs now lend themselves to transitivization. Taylor (2003: 236) gives the example of the transitive construction being used to imply a semantic path, in lieu of an explicit preposition. Compare the pairs of English sentences in (30).

(30) English (Indo-European > Germanic)

Preposition	*Transitive*
He regularly **flies across** the Atlantic.	He regularly **flies** the Atlantic.
He **swam across** the Channel.	He **swam** the Channel.
She **swam across** our new swimming pool.	?She **swam** our new swimming pool.
We **drove across** the Alps.	?We **drove** the Alps.
The child **crawled across** the floor.	*The child **crawled** the floor.

(Taylor 2003: 236)

These examples illustrate that there are indeed better and worse members of the English Transitive Path construction.

Individual lexemes are also a type of construction, and therefore also subject to prototype effects. This is unsurprising, since language forces speakers to map a non-discrete cognitive representation of the world onto discrete linguistic entities—we are forced to cut up and categorize the world around us into discrete objects and events/states so that we can refer to them and predicate statements about them. Reality, however, is not so neat. The result of this mapping is a linguistic form that imperfectly demarcates a portion of our mental world, centered on a clear prototype but with imprecise boundaries. Using a topological metaphor, we typically call some portion of our mental representation of the world a *semantic space* (Finch 2003: 140), and that space can be graphically represented using a *semantic map* (Croft 2001b: §2.4.3; Haspelmath 2003). Though semantic maps are most often used to represent a *functional* space for grammatical morphemes, they are equally applicable to lexical spaces as well. Gries (2006: 74) provides one such semantic map for the meanings of the English word *run*, shown in Figure 2.4, based on a comprehensive corpus analysis. As another example, Bowerman & Choi (2001: 485) present a semantic map of spatial relations based on data from 38 languages (25 families), with a relation indicating prototypical support from below (ON) at one end and a relation indicating prototypical containment (IN) at the other. As pictured in Figure 2.5, lexical items in different languages cut up this semantic space in different ways.

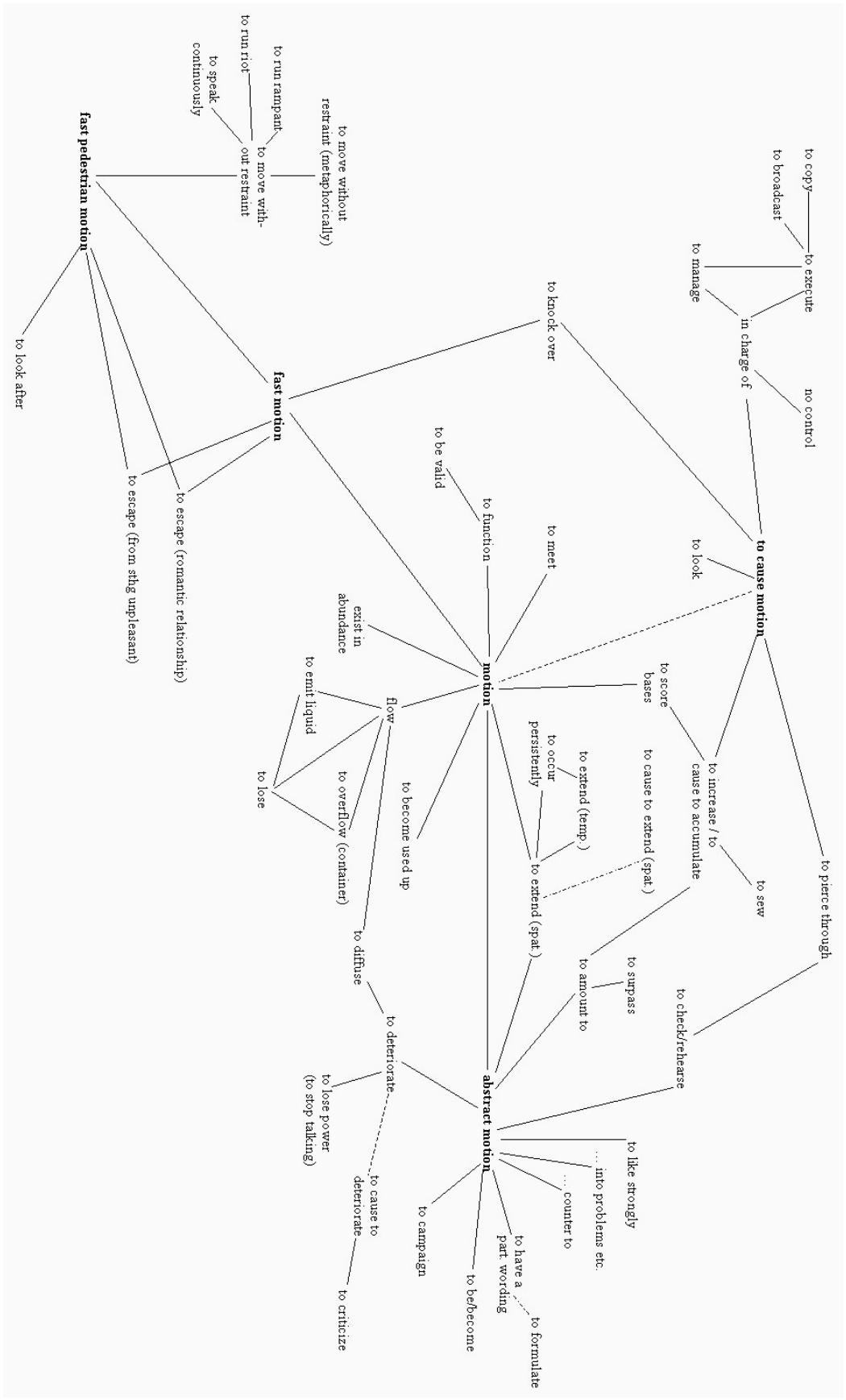
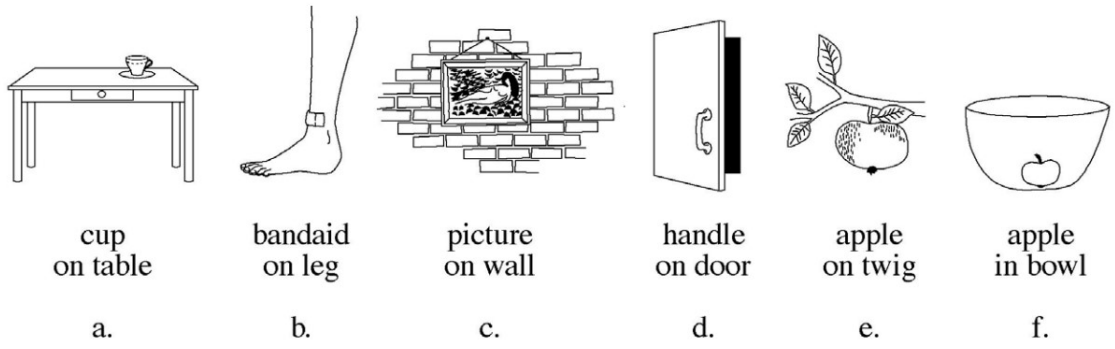


Figure 2.4: Semantic map of English *run* (Gries 2006: 74)



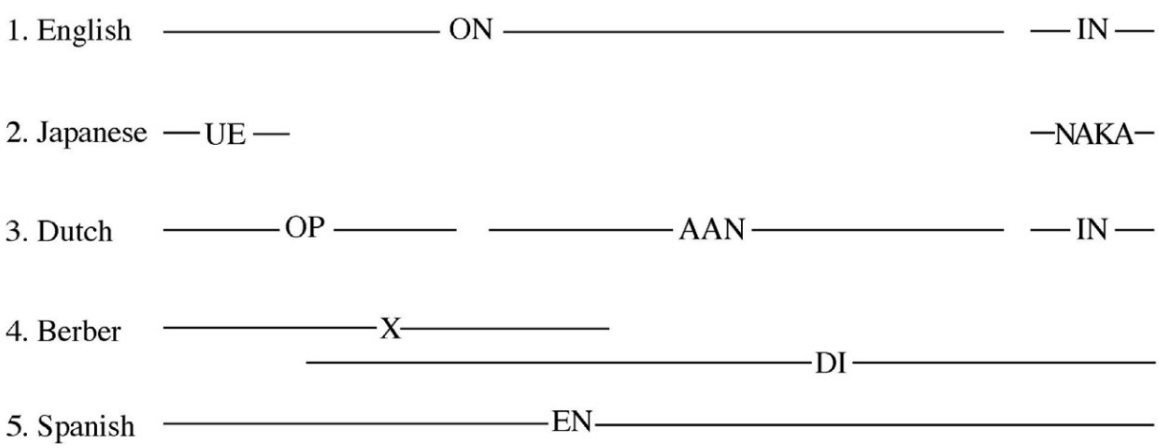


Figure 2.5: Crosslinguistic differences in the encoding of spatial relationships (Bowerman & Choi 2001: 485)

These examples illustrate that word meanings are polycentric and cover a range of possible uses, as mentioned in Section 2.3.1.4. Some of these uses may be more prototypical than others. The English expression *apple on a twig* is a slightly less prototypical use of *on* than *apple on a table*. The fact that lexical items cover a range of uses, and that some of these uses are more prototypical than others, is an important component of the typological markedness theory of lexical categories.

Even the formal categories that linguists use to describe linguistic structure tend to be prototypal (Taylor 2003: xii, 201). Taylor (2003: §11.1) argues that linguists' conceptions of the formal labels *word*, *affix*, and *clitic* are prototypal in nature, with better and worse members of the category. Haspelmath (2005) likewise shows that simple structural definitions of these categories are inadequate and reframes the word–affix continuum in functional terms instead.

Much research in the Canonical Typology framework (Corbett 2005) also demonstrates the prototypal nature of linguists' categories. Though Corbett is careful to distinguish between a *canon* and a *prototype* / *exemplar* (Corbett 2010: 142), his accumulated work nonetheless shows that linguists view phenomena in the world's languages as better or worse instances of various descriptive categories.

What type of category are lexical categories then? Are word classes categories of human cognition, categories within particular languages, categories of languages generally, or analytic categories of linguists? Or some combination of these? Typological markedness theory posits that parts of speech like noun, verb, and adjective are not categories of particular languages. Languages have constructions, not parts of speech. Speakers, however, have *mental prototypes* of objects, actions, and properties. And although there is no *one* Noun construction in English that would correspond to the mental category of OBJECT, there are numerous constructions in English which have the function of indicating *reference to an object*, such as the Definite Article construction or the Transitive Subject construction. Likewise, there is no one construction—in English or any language—that can be definitively called the Verb construction or the Adjective construction, but there are plenty of constructions which have the function of predicating or attributing properties. Naturally, then, speakers are more likely to use referring constructions when talking about something which they mentally categorize as an object, predicating constructions when talking about something they conceive of as an action, and modifying constructions when talking about something they conceptualize as a property.

Speakers' conceptualizations, however, are fluid. Speakers often conceptualize things in non-prototypical ways. They may construe events as bounded entities that they can refer to, or objects as properties with duration. As a result, speakers often use lexical items in constructions that do not align particularly well with the item's meaning, such as the appearance of an action word like *sing* in a referring construction like the Gerund in the phrase *his singing was beautiful*. When speakers use words in this atypical manner, those uses are much

more likely to be marked in some way—whether morphologically, behaviorally, semantically, or frequentially (Croft 1991: §2.2). As a consequence of this tendency, clear asymmetries emerge between the prototypical vs. non-prototypical uses of object words, action words, and property words. It is the unmarked use of these lexical items that most closely aligns with linguists' traditional conceptions of noun, verb, and adjective. Parts of speech as traditionally conceived are nothing more than the emergent effects of our cognitive prototypes on language. They do not have any real status in grammar or individual grammars. This is the fundamental idea behind typological markedness theory. Section 2.4.2 lays out this theory in more detail.

A last clarifying point is in order. Recognizing the existence of prototype-based categories, many linguists have described parts of speech as prototypal. Dixon (2004: 1–2), for example, says that the word classes noun, verb, and adjective each have a "prototypical conceptual basis" and "prototypical grammatical functions". Taylor (2003: 217) states, "A prototype view of NOUN entails that some nouns are better examples of the category, while others have a more marginal status." But languages have constructions, not parts of speech, and individual constructions are not gradient (Croft 2007). What linguists are in fact observing when they say that parts of speech are prototypal is not gradation in *linguistic categories* like noun, verb, and adjective (since those are not categories of particular languages), but rather gradation in the *mental categories* of objects, actions, and properties, which do indeed exhibit prototype structures, and which therefore have emergent effects on the organization of constructions in languages.

2.4.2 Typological markedness theory

I have already previewed various aspects of typological markedness theory at different points in this dissertation. In this section I present a concise overview of the specific claims made by this theory, and some of the evidence for those claims. The phrase *typological markedness* or *typological markedness asymmetries* simply refers to an implicational universal regarding

the behavior of basic versus non-basic members of a conceptual category. At its simplest, the theory posits that less basic or prototypical members of a category are marked in some way; basic or prototypical category members are unmarked by comparison (Greenberg 1966). This *cognitive* markedness is then realized *linguistically* in several ways. The marked member of a category *may* be literally marked with an affix or other overt morphological indicator, but this is just one of the ways an item can be a marked member of a category. The marked member of a category may also be less frequent, or have a smaller range of inflectional / distributional possibilities, or be semantically more complex. It is important to emphasize that *typological* markedness does *not* always entail *formal* markedness. Typological markedness is an *implicational* universal rather than an *absolute* universal. The more marked members of a category must be *at least as marked* as the unmarked member, but this does not preclude the possibility of all members being *equally* marked. Formal markedness is merely an emergent tendency of structures to reflect cognitive markedness.

As applied to word classes, typological markedness theory states that the most unmarked discourse functions for object, action, and property words are reference, predication, and modification, respectively. Therefore, when a lexical item is used for a function that does not align with its prototypical meaning, typological markedness theory predicts that it will be marked. Again, it must be emphasized that not *every* instance of a lexical item being used in a non-prototypical function will be marked in comparison to its prototypical function; but it will always be *at least as* marked. This theory of typological markedness for the major discourse functions is laid out in detail by Croft in various publications (Croft 1991; 2000; 2001b; Croft & van Lier 2012). It is also important to understand that typological markedness theory is *not* a theory of parts of speech in the sense of large partitionings of the lexicon into categories like noun, verb, and adjective. Instead, noun, verb, and adjective are epiphenomenal, crosslinguistic markedness patterns that arise from the interaction of semantic prototypes (object, action, property) and their use in different discourse functions (reference, predication, and modification). They are not categories of particular languages.

Throughout this dissertation, I have used the term *discourse function* to refer to the functions of reference, predication, or modification. These are what Croft (1991: 51) calls *pragmatic functions* or *propositional act functions* following the tradition of pragmatics and speech act theory in philosophy (Austin 1962; Searle 1969). These three functions are taken as fundamental to human communication, arising out of the communicative intent behind what speakers are attempting to *do* with language. This perspective was articulated early on by Sapir:

> There must be something to talk about and something must be said about this subject of discourse once it is selected. This distinction is of such fundamental importance that the vast majority of languages have emphasized it by creating some sort of formal barrier between the two terms of the proposition. (Sapir 1921: 87)

A similar point is made by Croft while articulating his theory of typological markedness as applied to lexical categories: "[N]o matter how complex a given situation is in terms of the number of entities involved and the number and kinds of relations that hold between them, a human being attempting to describe it in natural language must split it into a series of reference-predication pairs[.]" (Croft 1991: 124)

Modification is generally seen as less central a function than reference and predication, as illustrated by its lack of mention in the quotes above. For example, Hengeveld (1992: 55) takes the reference-predication dichotomy to be fundamental, yielding the major categories of noun and verb, while the modification function then combines with these two functions to yield the major categories of adjective and adverb, respectively. The primacy of the reference-predication distinction also appears to be reflected structurally in the world's languages, which do not always have dedicated morphological means for encoding modification but appear to always have constructions dedicated to reference and predication.

Croft (1991: 123) defines the pragmatic functions in terms of their discourse functions, following work in the discourse-functional tradition (Chafe 1976; Hopper & Thompson 1984; Chafe 1987; Du Bois 1987). Previous research defines *referents* as "discourse-manipulable participants" (Hopper & Thompson 1984: 711; Kibrik 2011), *predicates* as reported events (Hopper

& Thompson 1984: 726), and *modifiers* as a mix of these two functions (Thompson 1989). Croft (1991: 123) synthesizes ideas from this body of research and offers the following revised definitions instead:

- the act of *reference* identifies a referent and establishes a cognitive file for that referent
- the act of *predication* ascribes something to a referent
- the act of *modification* enriches the cognitive image of the referent with an additional feature

The exact pragmatic function chosen for any given mention of a concept is then just a matter of how the speaker chooses to portray or construe that concept—whether as a referent, predicate, or modifier (Croft 1991: 100); as Croft & van Lier note, "apparent instances of 'fuzziness' are actually variable construals" (Croft & van Lier 2012: 63).

With this understanding of discourse functions in mind, we can restate the dissertation of typological markedness theory as applied to lexical categories: Noun, verb, and adjective are epiphenomenal markedness patterns that arise from the use of different semantic prototypes (objects, actions, and properties) in different discourse functions (reference, predication, modification). Uses of these semantic classes in non-prototypical functions are typologically marked. As mentioned, there are four ways in non-prototypical uses can be marked: structurally, behaviorally, semantically, and/or frequentially.

The first type of marking, *structural coding* or *formal marking*, refers to the fact that non-prototypical uses of lexical items are at least as formally marked as prototypical ones. Structural coding in this context refers specifically to "dedicated formal markers in a specific language that indicate a lexeme's syntactic function" (Croft & van Lier 2012: 62). Figure 2.6 is a schematic representation of some of the formal realizations of these markedness patterns. It indicates the different morphosyntactic means that languages tend to develop for marking each of the non-prototypical uses of lexical items. For instance, participle constructions are

one way that languages have of indicating the non-prototypical case of an action word being used for modification.

		FUNCTION		
		reference	**predication**	**modification**
MEANING	**object**	prototypical noun	predicate nominal copula	genitive adjectivalization PP on noun
	action	action nominal complement infinitive gerund	prototypical verb	participle relative clause
	property	deadjectival noun	predicate adjective copula	prototypical adjective

Figure 2.6: Typological prototypes for noun, verb, and adjective (adapted from Croft (2000: 89) and van Lier (2012: 62))

The second way in which non-prototypical uses of lexical items can be marked is in terms of their *behavioral potential*, that is, the range of combinatorial possibilities for that lexical item. This is most clearly illustrated with an example from inflection: in many languages, property words used in predicate constructions are limited in their inflectional possibilities. In Munya, for example, property words functioning as predicates cannot inflect for person and number of the subject, and cannot take the imperfective marker, perfective marker, or direct evidential marker (Bai 2019: 96–97). The only grammatical markers allowed in property predication clauses are the stative aspect marker, a clause-final particle, and an egophoric marker. Hopper & Thompson's (1984) study of the discourse functions of different parts of speech is largely a study of behavioral potential. They conclude that "the closer a form is to signaling this prime [prototypical] function, the more the language tends to recognize its function through morphemes typical of the category—e.g. deictic markers for [Nouns], tense markers for [Verbs]." (Hopper & Thompson 1984: 703, abstract). Croft advances a cognitive explanation for these behavioral markedness patterns:

> In general, only the core members of the syntactic category will display the full grammatical behavior characteristic of their category because only they have all the semantic

> characteristics that the characteristic inflections tap into. This is to say that the inflectional categories of the major syntactic categories have been "tailored" to their semantically core members. This is an example of a processing constraint: languages inflect only for those properties that are of relevance to core members of the category; they do not inflect for properties of peripheral members of the category that are not of relevance to the core members of the category. (Croft 1991: 86)

Non-prototypical uses of lexical items may also be marked semantically by a *semantic shift* in their meaning towards the semantic class prototypically associated with the discourse function they are found in (Croft 2000: 96; 2001b: 73; Croft & van Lier 2012: 68). I have already discussed the semantic shifts that occur in functional expansion in some detail in Section 2.3.3.2. Croft (1991: 60–61) makes the even stronger claim that non-prototypical uses of lexical items will *always* be marked semantically, making semantic markedness an absolute rather than implicational universal.

These semantic shifts are caused by a combination of conventionalization and *coercion*, wherein the meaning of the constructional context is imposed on the meaning of the lexical item (Pustejovsky 1991; Croft 1991: 69, 108; Panther & Thornburg 2007: 252; Audring & Booij 2016). For example, predicate nominals (where an object word is used in a predicate construction) involve coercion of lexical items from denoting objects to denoting classifying or equational relations (Croft 1991: 69). In Nuuchahnulth, for instance, nominal predicates are always semantically durative and interpreted as either existential, classifying, or identifying expressions (Nakayama 2001: 47).

The final way in which lexical items used in atypical functions may be marked is in terms of their frequency. Croft (1991: 59, 87) also refers to this as *textual markedness*. Frequential markedness predicts that lexical items are used more frequently in their prototypical functions than in non-prototypical ones. This means that object words should be most frequent in their use in referring constructions, and that referring constructions should most frequently denote objects (Croft 1991: 87).

The field of linguistics has accumulated a good deal of empirical evidence in support of the typological markedness theory of lexical categories. Croft (1991) provides empirical evi-

dence from 12 languages for each of these markedness patterns. Dixon (1977) also provides evidence of typological markedness patterns as they relate to property words, using a combination of structural and behavioral evidence. As mentioned, Hopper & Thompson's (1984) study also provides empirical support from a variety of languages for markedness in terms of behavioral potential. Stassen (1997) is a massive study of intransitive predication in 410 languages, demonstrating the marked behavior of non-action words when used in predicate constructions.

Having explicated the basic tenets of typological markedness theory, I now turn to reframing the concept of lexical flexibility in a way that utilizes this framework.

2.5 Lexical flexibility: A functional definition

Within the framework of typological markedness asymmetries, lexical flexibility can be understood as follows:

lexical flexibility The use of a lexical item (root, stem, or inflected word) in more than one discourse function (reference, predication, or modification) with no difference in structural coding.

This definition qualifies as a valid *comparative concept* in the sense of Haspelmath (2010a) because it is couched in terms of universal *functions* rather than language-specific *structures* (Croft 2016). It also has the advantage of being intentionally equivocal with respect to the lexical and cognitive unity of the item, and with respect to the linguistic level (root, stem, or inflected word) at which the flexibility is realized. In some cases when a single lexical form appears in more than one discourse function, speakers may have a close cognitive association between the two uses. This is most likely the case for the predicative and referential uses of the word *run* in the phrases *I run every morning* and *I'm going for a run* respectively. In other cases, speakers may have little to no awareness of the diachronic connection between uses of a form. For example, the use of *run* in the sense of *to run a print job* is extremely distant from the

prototypical "fast pedestrian motion" sense in the semantic network for that form (Gries 2006: 74; see also Figure 2.4). It is unlikely that these two senses are closely cognitively connected by most speakers, even though they both share a predicating function. The definition of lexical flexibility given here allows for any degree of semantic shift. Croft admits this possibility explicitly: "It of course a priori possible to construct a typological classification of parts-of-speech systems using only structural coding and allowing any degree of semantic shift." (Croft 2001b: 68) Of course, I am not concerned here with constructing a classification of parts of speech—quite the opposite, in fact. This definition of lexical flexibility is intended to delimit exactly those cases where a language does *not* provide formal indicators of discourse function.

Allowing for any degree of semantic shift does *not* imply that semantic shift is in any way unimportant for understanding lexical flexibility. On the contrary, semantic shift is a key component of the process of functional expansion that leads to flexibility in the first place (see below). Moreover, carefully circumscribing the phenomenon of lexical flexibility without regard to the degree and type of semantic shifts involved puts us in a position to then compare the semantic shifts that occur in cases of lexical flexibility with those that occur in cases of overt derivation. This raises the intriguing question of whether semantic shifts in flexible cases differ in principled ways from overt derivation. Mithun (2017: 165) shows that for Central Alaskan Yup'ik the types of semantic relationships between flexible uses of words mirror those between basic and derived words. This would suggest that functional expansion follows the same principles as overt derivation. However, much more research is needed in this area.

As we have seen, a great abundance of evidence also shows that the meaning of any given combination of form and discourse function is a matter of convention, and often highly idiosyncratic (§2.3.2.4; §2.3.3.2). This fact suggests that flexible items are not truly "flexible" in the sense that speakers can use any lexical item for any discourse function and expect hearers to be able to infer their meaning from context. We know that item-specific gaps in usage exist. Certainly, novel cases of forms being used in new discourse functions do occur,

or else it would not be possible for functional shift to happen in the first place. But these cases are necessarily restricted by the cognitive limits on our ability to deal with ambiguity. If it were truly the case that any lexical item could be used in any discourse function at any time, it would barely be possible for hearers to interpret the intended pragmatic effects of each word. Instead, flexibility must rely on a degree of *conventionalization*. Conventionalization in turn implies *time*—conventionalization is a diachronic process. Thus, *lexical flexibility can be understood as a synchronic pattern resulting from the diachronic process of functional expansion*, where functional expansion is defined as follows:

functional expansion A diachronic expansion in the use of a lexical item (root, stem, or inflected word) into a new discourse function (reference, predication, or modification) with no additional structural coding.

Cases of lexical flexibility therefore arise whenever a new combination of form and discourse function is conventionalized in a community of speakers. This understanding of lexical flexibility is in line with cognitive research on lexicalization and constructional change. Functional expansion occurs because of speakers' need to construe concepts in different ways—as objects, actions, or properties. The semantic shifts that occur during functional expansion are the result of coercion by the new constructional context, and the resultant meaning then becomes conventionalized as the meaning of that particular form in that particular discourse function (Croft 1991: 108).

If lexical flexibility is the result of a diachronic process, it should be possible to enumerate some of the specific pathways which give rise to it. Here I will mention just a few. One pathway is insubordination, whereby subordinate clauses in a language are reanalyzed as main clauses (Evans 2007; Mithun 2008; Evans & Watanabe 2016) (see also §2.3.2.2). Insubordination frequently results in formal similarities between noun phrases and verb phrases, and this formal ambiguity can abet the functional expansion of lexical items from referential to predicative uses and vice versa.

A second pathway to lexical flexibility is relexicalization (or more precisely, reconventionalization). This is the process that occurred in the case of morphological verbs being reanalyzed as nouns in many North American languages (see §2.3.2.3) and certain English plurals like *brethren* or *arms*. In these cases, the conventionalized meaning associated with the form changed (e.g. from Cayuga 'it hauls logs' to 'horse'), so that the meaning more closely reflected its new discourse context.

A third pathway is topicalization, exemplified in the Wakashan family. Jacobsen (1979: 122, 142) observes the formal similarity between the Definite Article and the Third Person Singular Indicative markers in Wakashan languages, and argues for a diachronic connection between the two. It is likely that cleft constructions such as 'it was the dog that ran' became so common that speakers started to reanalyze the topicalized cleft as a definite noun phrase, 'the dog', thereby creating a formal similarity between referring expressions and predicating expressions.

Each of these pathways results in the functional expansion of lexical items into new discourse contexts with no new overt structural coding. Of course, functional expansion can also occur without any other accompanying grammatical changes. This happens in any instance where speakers simply use stems in new discourse functions. Lexical flexibility is the natural and expected result of the fact that non-prototypical uses of lexical items are *not* always structurally marked—as allowed for by the fact that typological markedness is implicational and not absolute—even if they are marked in other ways. The use of additional structural coding in cases of functional expansion is not obligatory, but merely a statistical tendency. Lexical flexibility occupies the theoretical space where structural coding asymmetries fail to apply.

When viewed in this light, *lexical flexibility is not so much a problem as it is a design feature of language*. The presence of lexical flexibility should be *expected* in every language, not treated as exotic. The cognitive-typological approach outlined in this chapter inverts the lexical flexibility question: the interesting question is not why some languages fail to make

distinctions in parts of speech (thereby framing lexical flexibility as a *deficit* in a way similar to colonial researchers), but rather why languages develop specialized constructions for different discourse functions in the first place (see Gil [2012] for an attempt to answer this question for predication). Lexical flexibility exists in any area of the grammar where specialized function-indicating morphology has yet to develop, or where such distinctions have been leveled via diachronic changes. Flexibility should therefore be considered the default state of affairs for language. Gil (2005; 2006) has in fact argued, partially on the basis of data from highly flexible languages, that early human language must have been *isolating-monocategorial-associational* before the development of dedicated function-indicating morphology.

The idea that the "natural state" of language is monocategorial or acategorial would seem to conflict with the point made above that lexical flexibility can result from diachronic processes, but the two positions are not mutually exclusive. Languages develop constructions which indicate different discourse functions, but languages are also subject to counteracting pressures. This is a classic case of competing motivations: on the one hand, the frequency with which speakers need to perform the discourse functions of reference, predication, and modification all but ensures the development of constructions dedicated to indicating those functions; on the other hand, speakers need to construe states of affairs in various ways—as objects, actions, or properties—creating pressures which have the potential to level or cut across those formally marked distinctions. Reconventionalization and the reanalysis of cleft constructions could both be viewed as diachronic processes motivated by this latter pressure.

In sum, then, lexical flexibility is a natural result of the cognitive and diachronic forces at work in language. Defining lexical flexibility in terms of typological markedness (or more accurately, the lack of formal marking for otherwise marked uses) provides a crosslinguistically applicable definition of the phenomenon which avoids methodological opportunism while still recognizing that lexical flexibility requires some degree of semantic shift and conventionalization. This cognitive-typological definition of lexical flexibility is the primary theoretical contribution of this dissertation. With this definition in place, the remainder of this disserta-

tion turns to exploring the prevalence of lexical flexibility in English and Nuuchahnulth and the semantic behavior of lexical items in cases of functional expansion.

Chapter 3

Data & Methods

This chapter describes the data used for this study and how those data were analyzed. It covers the languages chosen, the corpora used, and how samples from each corpus were created and annotated (Section 3.2). I describe the methods used to annotate the data, and the factors that influenced annotation decisions (Section 3.3). I also discuss the specific statistical measures used in this study in Section 3.4. Section 3.4.1 introduces a metric for quantifying the flexibility of individual lexical items in a corpus. This formulation of lexical flexibility is a key methodological contribution of this dissertation. Section 3.4.2 explains how I examine the relationship between lexical flexibility and corpus size by studying the cumulative flexibility rating for each stem as the size of each corpus grows. Finally, Section 3.4.3 presents and motivates a measure of corpus dispersion (Deviation of Proportions, or DP) that is used partly in place of, and partly as a complement to, raw token frequencies.

3.1 Introduction

The process of collecting, annotating, and analyzing the data for this study adheres to several self-imposed principles. First and foremost, the data in this study consist of naturalistic discourse data rather than elicited data. This principle has two motivations: First, as discussed in Section 1.2, few studies examine token frequencies of lexical items used for different discourse

functions, and those that do only report aggregated results. Most extant research consists of lexicon-based counts. This study therefore explores a previously unexamined aspect of lexical flexibility. Second, corpus-based methods study real-world instances of language in use, rather than made-up examples or examples produced by introspection, which are subject to various cognitive and social biases (P. Baker 2018: 168). Corpus data are also more likely to reveal prototype effects through statistical tendencies. For this study, I rely on specialized corpora of spoken narratives and conversational texts only. This ensures greater comparability between the corpora used in this study and other documentary corpora that these methods may be applied to in the future, since most documentary corpora likewise consist of spoken narratives and conversations.

The second self-imposed requirement for this study is adherence to the Austin principles of data citation in linguistics (Berez-Kroeker et al. 2018). In particular, the source for each data point discussed in this dissertation is uniquely identified with its location in the corpus, and the data used in this study are made freely available on GitHub at `https://github.com/dwhieb/dissertation`. All of the data and my annotations on that data may be viewed there.

Finally, as a matter of scientific accountability, this study is designed to be replicable using the same or other datasets. All of the technical details regarding how to acquire the data, annotate it, and run statistical analyses for those data are documented in the GitHub repository for this project, which may be viewed at `https://github.com/dwhieb/dissertation`.

The remainder of this chapter details the methods used to answer each of the major research questions presented in Chapter 1. The core empirical question addressed by this study is R1: "How flexible are lexical items in English and Nuuchahnulth?" The other two research questions build on this one. To answer this core question, I count the frequency with which stems are used for each of the three functions of reference, predication, and modification in corpora for each language. Section 3.2 describes the corpora used, where to acquire the data, and how lexical items in the corpora were selected for annotation. Section 3.3 describes the

details of this annotation procedure. Finally, Section 3.4 explains the specific statistical measures used in this study. Section 3.4.1 describes how to use the annotated data to calculate a measure of lexical flexibility for each of the lexical items in the sample. This procedure for quantifying lexical flexibility based on corpus data is the primary methodological contribution of this dissertation. Section 3.4.3 then discusses some shortcomings in the use of token frequencies, and presents a measure of corpus dispersion (Deviation of Proportions, or DP) as an alternative.

3.2 Data

In Section 1.3, I discussed the motivations for using English and Nuuchahnulth as the languages of focus in this study. Both languages have featured prominently in the literature on lexical flexibility. Some researchers have called these languages flexible, while others have claimed that they are rigid. For English, I opted to use the Open American National Corpus (OANC), a 15-million-token open access corpus of American English (Ide & Suderman 2005). I restricted my analysis to just the spoken portion of the corpus, comprising approximately 3.2 million tokens, so that the data would be comparable to the spoken corpus of Nuuchahnulth and other documentary corpora. The spoken portion of the corpus itself consists of two distinct subcorpora—the Charlotte Narrative & Conversation Collection (the "Charlotte corpus") and the Switchboard Corpus. The Open American National Corpus can be obtained for free at `http://www.anc.org/`.

The data for Nuuchahnulth come from a documentary corpus compiled by Toshihide Nakayama and published in Little (2003) and Louie (2003). The corpus consists of 24 texts by two speakers (Caroline Little and George Louie), containing 2,081 utterances and 8,366 tokens. The texts are personal narratives, traditional stories, and procedural texts. I manually retyped the corpus in scription format (Hieber 2021a), which is a simple way of formatting interlinear texts so as to make them computationally parsable. I then converted the corpus

to the Data Format for Digital Linguistics (DaFoDiL) (Hieber 2021b), which is a way of representing interlinearized data in JSON, allowing programmers to easily and programmatically work with linguistic data. The resulting corpus is available in both formats on GitHub at https://github.com/dwhieb/Nuuchahnulth.

The sheer size of the Open American National Corpus—even when considering just the smaller, spoken portion of 3.2 million tokens—made it practically impossible to tag every token in the corpus for its discourse function for the time being. At the opposite end of the spectrum, the Nuuchahnulth corpus is small enough (∼8,300 tokens) that it was possible to tag every single lexical token in the corpus. Given this size disparity, it was important to sample lexical items from each corpus in such a way as to make them reasonably comparable. I did this by extracting two kinds of samples from each corpus: 1) a 100-item sample of lexemes randomly selected from different frequency bins, and 2) a small corpus sample (<10,000 tokens) for which all lexical items in the sample were annotated.

To create the 100-item samples, I first *lemmatized* each corpus. For every lexical token in the corpus, I programmatically determined the lemma associated with that particular wordform. For example, the English wordforms *knows* and *knew* are associated with the lemma *know*. For English, lemmatization was accomplished with the Natural Language Toolkit for Python (Bird, Klein & Loper 2009), using the Wordnet lemmatizer. The OANC includes Penn tags for parts of speech, so I was able to use those part-of-speech tags with Wordnet's `lemmatize()` method to improve lemmatization. For Nuuchahnulth, lemmatization simply involved programmatically stripping away the inflectional morphology from each token, leaving just the stem. For example, token in (31) is lemmatized as an instance of the stem *ʔam-umɬ-* 'first-be.born'. Since the entire Nuuchahnulth corpus is interlinearized with glosses and stored in DLx JSON format (Hieber 2021b), this was accomplished with a simple Node (JavaScript) script.

(31) Nuuchahnulth (Wakashan > Southern Wakashan)

ʔaamumɬʔaƛquu
ʔam-umɬ-ʾaƛ-quː
first-be.born-FIN-COND
when.first.born
‘when [a baby] was born’ (Little 2003: Afterbirth 1)

It is important to mention that annotating the Nuuchahnulth corpus for discourse function would not have been practical without the detailed descriptive work of Toshihide Nakayama. The creation of text collections is often underappreciated as a worthwhile academic endeavor, but this process requires a high level of analytical skill and theory creation / testing. Moreover, this is the only way we gain new corpora of naturalistic discourse for minority languages. The empirical and theoretical findings of this project would not have been possible without this important work.

After lemmatizing each corpus, I calculated the raw frequencies for each lexeme. I then grouped lexemes into 100 bins based on their frequencies, and randomly selected one lexeme from each bin. This produced a sample of lexemes from a range of different frequencies. The frequencies of lexemes in the English sample, for instance, ranged from 44,687 for the word *know* to 53 for the word *central*. Lexemes with a frequency <4 were excluded, because the lexical flexibility measure described in Section 3.4.1 requires a minimum token frequency of 4 in order to return a statistically significant value.

Various other types of words were excluded from this process as well:

- words written using numeric characters (e.g. *12%* or *117*)
- obvious cases of code-switching or code-mixing (e.g. *union mančiʔaƛ* ‘became a union man’)
- transcategorial words (those with both lexical and grammatical uses) (e.g. *be*, *do*)
- discourse markers (e.g. *uh*, *well*)

Some types of items that were *not* excluded are compounds written as a single word (e.g. *guidepost*) and proper names (e.g. *San Francisco*), although neither of these wound up in the final list.

The output of this selection process was a list of 100 lexical items in each language to be examined for lexical flexibility. The list of 100 lexical items for each corpus is given in Appendix B, along with statistics about their frequencies, corpus dispersions, and flexibility. I then created a list of every instance of these 100 lexical items in each corpus. For English, this resulted in a list of 382,512 tokens to be annotated. For Nuuchahnulth, there were just 1,632 tokens to annotate. I annotated each one of these approximately four hundred thousand tokens for discourse function by hand. This procedure is described in the following section.

Having created the 100-item samples, I next created a small corpus sample (<10,000 tokens) for each language. The smaller size of these samples allowed me to annotate every single lexical item in the sample for its discourse function. The Nuuchahnulth sample simply consists of the entirety of the corpus (8,300 tokens), while the English sample consists of the first four texts in the corpus, totaling ∼9,700 tokens. These two subcorpora are both available in the GitHub repository for this study at `https://github.com/dwhieb/dissertation`.

With the two samples prepared, I next turned to the process of annotating each lexical item in the sample for its discourse function. This annotation procedure is described in the following section.

3.3 Methods

Within each of the samples, not every token was annotated for its discourse function. This section discusses the various reasons why tokens might be excluded from the analysis, and the factors that contribute to the determination of the discourse function for each token.

First, I only annotated lexical uses of words. Grammatical/functional words and discourse markers were ignored. Among lexical words, adverbial uses were also excluded. Ignoring adverbial uses of words sometimes results in lexical items with a very high overall corpus frequency, but very low occurrences of use for reference, predication, or modification. For example, the English word *never* has a high overall frequency (3,024 tokens), but has exactly

1 modifying use (*that's a **never** touch*). The rest of its uses are adverbial. Proper names *were* included, a decision which turned out to be fortuitous since proper names displayed flexible, non-referential uses in both English and Nuuchahnulth, as in (32) and (33).

(32) English (Indo-European > Germanic)
they settled down in the **Chicago** suburbs (Ide & Suderman 2005: JamiesonSean)

(33) Nuuchahnulth (Wakashan > Southern Wakashan)

qʷaa	ẏuuqʷaa	**ẇiikinanišitquu**
qʷaː	ẏuːqʷaː	**ẇiːkinaniš-it-quː**
thus	also	**NAME-PAST-COND.3**
thus	also	**who.was.Ẇiikinaniš**

'So was the one whose name was *Ẇiikinaniš*' (Louie 2003: GL 19)

The function of each lexical item was determined in relation to its most immediate syntactic constituent. As an illustration, consider how to analyze the word *time* in the phrase *all time favorite*. The phrase *all time* is functioning to modify the referring expression *favorite*, with the syntactic structure *[[all time] favorite]*. However, within the context of *all time*, the word *time* is a referent, not a modifier. Compare this to the expression *all time slots*, which has the syntactic structure *[all [time [slots]]]*, and where *time* is indeed modifying the referent *slots* directly. Thefore I annotated *time* as a referent in the phrase *all* $time_{REF}$ *favorite* and as a modifier in the phrase *all* $time_{MOD}$ *slots*. As another example, when annotating tokens of the word *woman* I excluded its appearance in the phrase *anti-women statements*, because it forms one part of the complex word *anti-women*, with the structure *[[anti-women]*$_{MOD}$ *statements]*. If the phrase had been just *women statements* instead, I would have analyzed *women* as a modifier.

In the remainder of this section I discuss some analytical issues specific to English and Nuuchahnulth respectively. The following points are specific to English:

- Words related through stress shifts (e.g. *con'duct* and *'conduct*) were treated as separate lexical items since their phonological forms are distinct. In the corpus, context always made it possible to determine which use was intended.
- Compound words were included in the analysis, but individual components of compound words were not. For example, when annotating tokens of the word *back*, in-

stances within the compounds *back yard* or *hard back book* or *back burner* were excluded from the analysis. Instances of lexical items within noun-verb compounds ("noun incorporation") were also excluded, such as *pie* in *pie baking*. However, compound words as a whole *were* included in the analysis. For example, the lexical item *back yard* was treated as a lexical unit and analyzed for its discourse function. Therefore I analyze *back yard* as a referent in *we were sitting in the [back yard]*$_{REF}$ and a modifier in *it was a [back yard]*$_{MOD}$ *party*.

- Lexicalized phrasal verbs such as *back up* were treated as a lexical unit, such that it was possible for the lexical item to appear in different discourse functions: *he doesn't [back up]*$_{PRED}$ *that point* vs. *please make a [back up]*$_{REF}$ vs. *you have a fairly good [back up]*$_{MOD}$ *quarterback*.

- Tokens used as gerunds, infinitives, or predicate nominals / adjectives were tagged separately and ultimately excluded from the analysis, since most researchers would consider these to be instances of morphologically marked conversion in English.

- Adverbial uses of participles similar in function to the Latin ablative absolute were excluded from analysis, e.g. *talking about the golf thing, [...]*.

- Stative (modificational) versus dynamic (predicational) uses of past participle forms required special consideration. It was not always possible to discern with certainty whether a given token of a past participle form was being used statively or dynamically. Compare the use of the word *relieved* in the phrases *she was relieved of duty* vs. *she was relieved to find her car*. The first use is arguably predicative while the second seems more like a predicate adjective. In cases where the discourse context does not make the intended use clear, I opted to code the data as a predicate, since this is the more conservative, historically prior form. Stative, predicate adjective uses were excluded from the analysis.

The analysis of discourse functions in Nuuchahnulth faces a different set of issues. A first difficulty arises from the holophrastic nature of Nuuchahnulth, in which it is extremely common for a single word to constitute an entire clause (52.2% of the time according to Nakayama [2001: 149]). While an individual lexical item may be functioning as a predicate within its clause, the clause itself may be functioning to refer or to modify. Since the inflected word and the clause are coterminous, however, the potential for ambiguity arises. For example, Nakayama (2001: 113) states that "[i]n *modification* one predicate restricts the interpretation of the other semantically main predicate." (Nakayama 2001: 113) This simultaneously treats a word as both a modifier and a predicate. This problem is exacerbated by the fact that, even

though Nuuchahnulth is highly polysynthetic, it is nonetheless quite common for stems to appear with no inflectional morphology indicating their discourse function. To the researcher not familiar with Nuuchahnulth morphosyntax and discourse patterns, it can seem at first glance as though determining clausal boundaries with any certainty in the language is near impossible.

Thankfully, this impression is just superficial. While there are indeed tokens that are ambiguous as to their discourse function, this is generally not the case. Converging evidence from morphology, word order, topic continuity, word-level translations, and utterance-level translations is typically sufficient to determine the discourse function of any token with a high degree of confidence. The following paragraphs briefly summarize the relevant factors for determining the discourse function of a given token.

Two features of Nuuchahnulth grammar in particular are extremely helpful in determining the discourse function of words. First, Nuuchahnulth is strongly predicate-initial. When a lexical argument is present, the predicate precedes the argument 84.9% of the time (Nakayama 2001: 149). Lexical arguments precede their predicates only in pragmatically marked situations like contrast or disambiguation, which is typically made clear by an accompanying topicalization construction in the English translation. Second, Nuuchahnulth speakers have a strong dispreference for using more than one lexical argument in a clause. In a sample of 734 clauses, only 39 (3.8%) have two lexical arguments, and none have three (Nakayama 2001: 149). This disinclination is so strong that speakers often express a single event in successive clauses, repeating the predicate (Nakayama 2001: 75). Consider the examples in (34a) and (34b).

(34) Nuuchahnulth (Wakashan > Southern Wakashan)

a. **hinaačiʔaƛ**	ƛaʔuukʷiʔatḥ	**hinaačiƛ**
hin-a·či(ƛ)-ȧƛ	ƛaʔuːkʷiʔatḥ	**hin-a·či(ƛ)**
there.MOM-go.out.to.meet-FIN	Clayoquot	**there.MOM-go.out.to.meet**
went.out.to.meet	Clayoquot	**went.out.to.meet**

minwaaʔathʔi
minwaːʔath-ʔi·
British.soldiers-DEF
the.British.soldiers

'The Clayoquots went [in their canoes] out to sea to meet the British soldiers.'
(Nakayama 2001: 75)

b.

sukʷiƛ	ḥawiɬuk	ƛaʔuukʷiʔatḥ	[…]	**sukʷiƛ**	miimixt
sikʷi(ƛ)	ḥawiɬ-uk	ƛaʔuːkʷiʔatḥ	[…]	**sukʷi(ƛ)**	miːmixt
take	chief-POSS	Clayoquot	[…]	**take**	NAME
take	their.chief	Clayoquot	[…]	**take**	NAME

'The Clayoquot chief took Miimixt.'
(Nakayama 2001: 75)

In (34a), the arguments *ƛaʔuukʷiʔatḥ* 'Clayoquot' and *minwaaʔathʔi* 'the British soldiers' are distributed over two clauses, with the predicate *hinaačiƛ* is repeated in each clause. Example (34b) follows a similar pattern. Awareness of just these few abovementioned facts does most of the work of determining the discourse functions of words by establishing the predicate and referent in each clause.

Certain inflectional markers, when present, also unambiguously indicate the discourse function of the word they appear with. Words which take the definite suffix *-ʔi·* (glossed as DEF) or one of the relative suffixes (glossed as REL) always function to refer. Except when they co-occur with either the definite or relative markers, the following kinds of mood suffixes always indicate a predicate. In Nuuchahnulth, most mood suffixes are fused with the following person suffixes, so each of the suffixes in this list has multiple realizations depending on the person and number of the clausal arguments.

- conditional (COND)
- dubitive (DUB)
- imperative (IMP)
- indicative (IND)
- interrogative (INTER)
- purposive (PURP)
- quotative (QUOT)

- subordinate (SUBORD)

In Nuuchahnulth, verb serialization is quite common, and the above mood suffixes only appear on the first (main) stem in a serial verb construction (Nakayama 2001: 42). Main predicates are also predominantly marked for person even if mood marking is not present (over 90% of main predicates in the first person) (Nakayama 2001: 29). Aspect markers, however, are not a completely reliable indicator of predication. Though it happens infrequently, aspect markers may occur with referents or modifiers as well (Nakayama 2001: 47–50).

Certain distributional behaviors also abet identification of the discourse function of a word. Nakayama notes the following in regard to referents: "Nominals can be modified with expressions of property concepts, quantity, or quantifiers, but not directly with qualifying expressions like *hiikʷaɬ* 'almost' or *ʔanatʼuu* 'barely'." (Nakayama 2001: 49). Syntactic patterns are also helpful: Negation is accomplished by means of a negative predicate *wik-*, which takes another predicate as its complement. Modifiers generally precede their heads, whether the head is a referent or predicate. In serial verb constructions, only the main predicate takes person and mood marking, and the other members of the serialization immediately follow the main predicate as bare stems.

Finally, discourse-level considerations play an important role in determining the pragmatic function of each word. Most helpful is topic continuity, wherein a referent is already established in the discourse. This is accomplished either directly via an overt referent in a lexical argument or bound person marker, or indirectly via other kinds of inflectional affixes or features of a word that imply the existence of an referent (what Kibrik (2011) calls *referential aids*). Each successive lexical item encountered in a text must be interpreted in the context of the previously established discourse referents, so that certain interpretations of the item are much more sensible than others. Lastly, in a few particularly ambiguous cases, I consulted the audio files accompanying the corpus in order to prosodic information into account. Clear prosodic breaks in the discourse help to determine clausal boundaries.

Small annotated extracts from each corpus are given in Appendix C in order to illustrate

the resulting annotations. While the actual annotations are stored in JSON format, these extracts are presented in a more human-readable format instead. The discourse function of each token is written as a subscript (REF, PRED, or MOD). Tokens without their discourse function indicated were excluded from the analysis for one of the reasons mentioned above.

3.4 Analysis

This section discusses the specific statistical measures used in this study. In Section 3.4.1, I present the measure used to quantify the lexical flexibility of individual items in a corpus, and in Section 3.4.3 I discuss the use of token frequencies versus dispersion.

3.4.1 Measuring lexical flexibility

Once the lexical tokens in a corpus are annotated for their discourse functions, it is possible to calculate the flexibility of each lexical item using a measure known as Shannon's diversity index. This section summarizes the rationale for using this metric and the procedure for calculating it.

Intuitively speaking, a lexical item is most flexible when it is used with equal frequency for reference, predication, and modification. A perfectly flexible lexical item which appears 300 times a corpus would therefore have a distribution like that in Table 3.1. By contrast, a perfectly rigid / inflexible lexical item with the same overall frequency would have a distribution like that in Table 3.2. What is needed is a metric that captures how evenly distributed the tokens of a lexical item are across the different discourse functions. A perfectly flexible item like that in Table 3.1 should receive a high rating (say, 1), while a perfectly rigid item like that in Table 3.2 should receive a low rating (say, 0).

I elected to use Shannon's diversity index (H) for this purpose (Shannon 1948; 1951). Originally devised as a measure of entropy in text (uncertainty or information content), the Shannon index has also become a popular measure of species diversity in ecology (Avolio

Table 3.1: Distribution of discourse functions for a perfectly flexible lexical item

lexical item	reference	predication	modification
stem	100	100	100

Table 3.2: Distribution of discourse functions for a perfectly rigid/inflexible lexical item

lexical item	reference	predication	modification
stem	300	0	0

et al. 2012) and attention diversity in political science (Boydstun, Bevan & Thomas 2014). Here I am using it as a measure of the functional diversity of lexical items. The normalized version of Shannon's H yields a value between 0 (low diversity) and 1 (high diversity). For a categorical variable with n possible values, H_{norm} is calculated using the formula in (35), where p_i corresponds to the percent frequency of the i^{th} possible value of the variable.

$$H_{norm} = \frac{-\sum_{i=1}^{n}(p_i \cdot \ln p_i)}{\ln n} \tag{35}$$

For this study, n will always be 3 (reference, predication, and modification). Future researchers may wish to adjust this number depending on the number of discourse functions examined (for example, if the predicate modifier function were included).

Frequently there will not be any instances of a lexical item being used in one discourse function or another. Since $\log 0$ is undefined, the above formula cannot be resolved in these cases. One common workaround to this problem is to increment the frequencies of each discourse function by 1 before performing the calculation. Another is to simply treat $\log 0$ as equal to 0 (Gries 2013: 120–121). I use the latter procedure in this study.

Applying Shannon's H to the fabricated data in Table 3.1 and Table 3.2 produces the desired results: a value of 1 for H in the perfectly flexible case and a value of 0 in the perfectly rigid case.

One limitation of the Shannon diversity index as applied to this study stems from the fact

that there are so few discourse functions under consideration (just three: reference, predication, and modification). This means that at low frequencies there are a limited number of possible values of Shannon's H. For example, a lexical item with a frequency of 2 will either have an H value of 0 or .63, because there are only two ways those tokens can be distributed across discourse functions (2 0 0 or 1 1 0). A lexical item with a frequency of 3 will have an H value of 0, .58, or 1, because there are only three ways those tokens can be distributed across discourse functions (3 0 0, 2 1 0, or 1 1 1), and so on.

To address this issue, I only included lexical items in the samples that had a raw frequency of at least 4. This cutoff was established based on the fact that 4 is the smallest frequency that can theoretically return a significant result for Shannon's H when a lexical item is maximally flexible, in one of the two ways one can compute a multinomial test (probabilities vs. a χ^2 test).

Shannon's H was calculated for each of the lexical items in the samples from both corpora to produce a flexibility rating for each item. The resulting flexibility ratings for the 100-item samples are provided in Appendix B.

One final methodological point is merited: many common constructions recognized by all speakers nonetheless do not appear in even a 1.5-million-word corpus. For example, in the spoken portion of the Open American National Corpus, the word *hate* occurs as a predicate and a modifier but never as a referent. We know that referential uses of *hate* are possible (for instance in phrases like *five-minute hate* or *don't spread hate*), but they are not attested in the OANC. As a consequence, the English stem *hate* in this study shows no flexibility in the reference dimension, even though we know such cases are possible. The flexibility ratings in this study are necessarily approximations, based on a representative sample.

3.4.2 Flexibility and corpus size

As discussed in Section 1.3, some researchers suggest that flexibility should increase as a function of corpus size. The intuition behind this claim is that the larger the corpus, the more

likely there are to be flexible uses of any given lexical item. This is the basis for R2, "Is there a correlation between degree of lexical flexibility and size of the corpus?". To test this claim, I calculated the flexibility of each stem each time a new token of that stem was encountered in the corpus, thereby collecting data on the *cumulative* flexibility of each stem as the size of the corpus grows. For English I used the 100-item sample, and for Nuuchahnulth I used the entire corpus. Only stems with a frequency greater than 4 were included (see Section 3.4.1 for the motivation behind this restrictions). The resulting data allows us to examine how the flexibility ratings of each stem change as the corpus increases in size.

3.4.3 Frequency vs. dispersion

Research question R3 asks, "Is there a correlation between degree of lexical flexibility for a lexical item and its frequency?". The intuition behind the notion of frequency, however, can be understood and quantified in different ways. In this study I examine two different metrics and their relationship to lexical flexibility: relative token frequency and corpus dispersion. This section describes the rationale and procedures for each of these metrics.

Token frequency is by far the most common statistic used in corpus linguistics (Gries 2008: 403), and is central to usage-based theories of language (Bybee 1985; Tomasello 2003; Goldberg 2006; Bybee 2007; 2010; Diessel 2019). It is computed by simply counting the number of instances (tokens) of a lexical item in a corpus. When working with multiple corpora it is important to normalize this statistic because the sizes of corpora vary. An item that occurs a large number of times in a million-word corpus may nonetheless be relatively infrequent compared to other items in the corpus. In order to compare the English and Nuuchahnulth corpora (which are drastically different in size), I report both the raw token frequency of lexical items as well as their *relative token frequencies*, calculated as the number of occurrences per 1,000 tokens in the corpus. Both metrics are reported for each lexical item in the 100-item samples in Appendix B.

Token frequencies can be misleading, however (Gries 2008; 2021; forthcoming). There

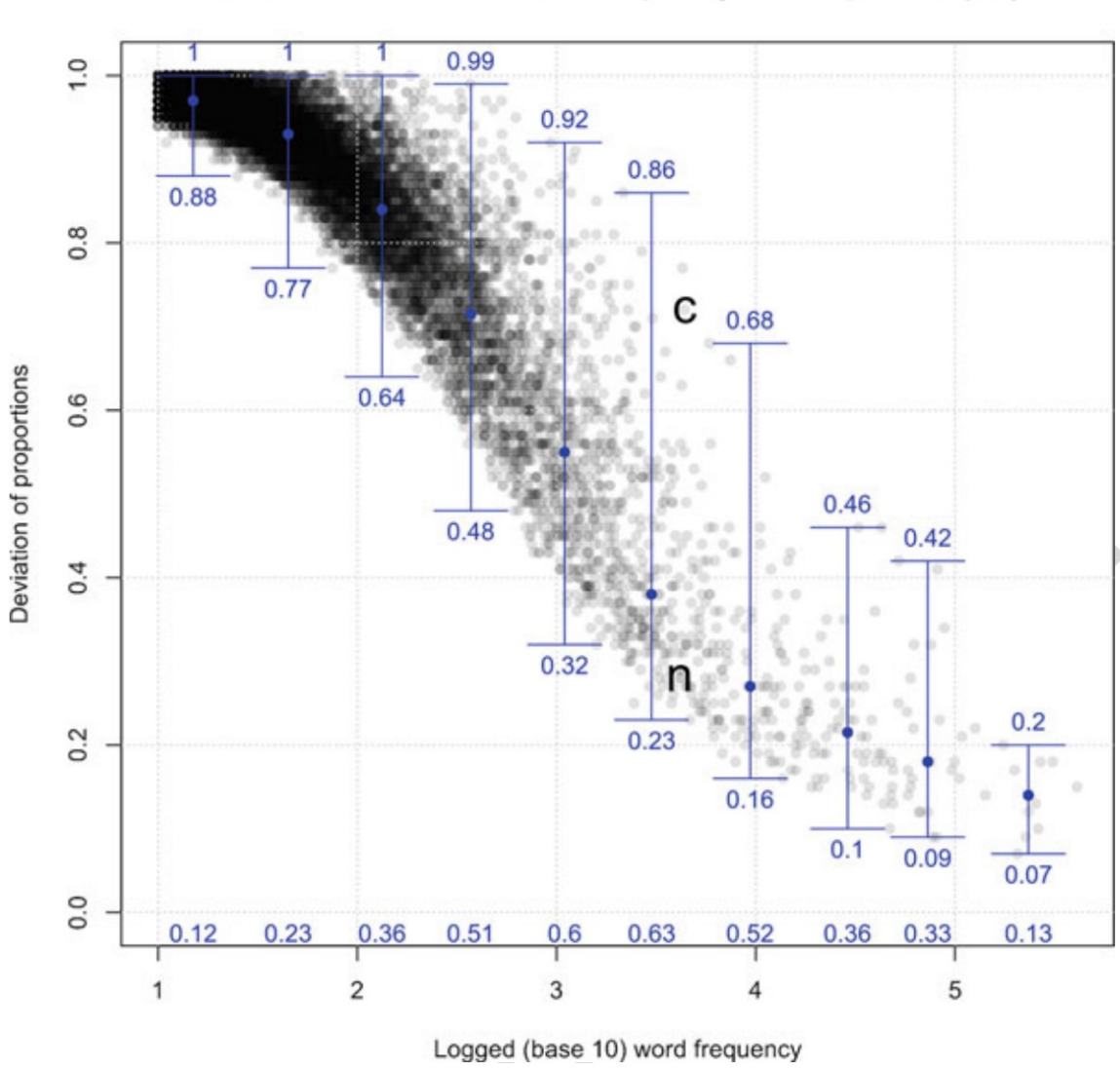


Figure 3.1: The relation between word frequency and dispersion (DP) (from Gries [2021: 112])

is often a great deal of within-corpus and between-corpus variability in the frequency of a lexical item. Moreover, words with the same token frequencies may differ significantly in how evenly distributed or dispersed they are in a corpus. For example, while the words *enormous* and *staining* both occur 37 times in the Brown corpus, all 37 instances of *staining* are clustered within just one corpus part. By contrast, the tokens of *enormous* are distributed mostly evenly across 36 corpus parts, with 35 of those parts containing a single use of *enormous* (Gries 2021: 100).

Disparities between token frequency and dispersion are especially common for lexical

items in the middle frequencies (between 1,000 and 10,000 tokens), as demonstrated in Figure 3.1 from Gries (2021: 112). In this plot, word frequency is shown on the x-axis (logged to the base of 10), and dispersion is shown on the y-axis (measured using *Deviation of Proportions* (DP); see below for details). Each word in the corpus is represented by a gray point. Lexical items are divided into 10 bins based on frequency, and the blue whisker in each bin represents the range of dispersion values in that frequency bin. The plot makes clear just how widely words within the same frequency bin can vary in terms of their dispersion, especially in the middle frequencies.

If what we are intending to capture with these statistics is some idea of the regularity with which speakers encounter a word, it is clear that raw frequency is a deceptive measure. Instead, recent work has shown that *corpus dispersion*—how evenly an item is distributed in a corpus—more accurately represents frequency of exposure or lexical access (Gries 2008; 2010; forthcoming). Corpus dispersion correlates more strongly with reaction time data than does frequency, for example (Gries forthcoming).

Thus for this project I report a measure of corpus dispersion in addition to relative token frequency. I use a measure called *Deviation of Proportions* (DP), created by Gries (2008). In a review of various measures of corpus dispersion, Gries (2008) discusses shortcomings with existing measures and proposes Deviation of Proportions as a conceptually simple alternative; it is also this measure which most strongly correlates with reaction time data, as mentioned above. In essence, Deviation of Proportions measures how much the frequency of an item within the various parts of a corpus deviates from what one would expect if the item were evenly distributed in the corpus. The procedure for calculating DP for a given lexical item is as follows:

1. Determine the sizes of each part of the corpus as a percentage of the overall corpus. These values represent the *expected* percentage of the time that one would expect the item to appear in each corpus part, if it were evenly distributed.

2. Determine the frequencies with with the target item occurs in each part, as a percentage

of its overall frequency of occurrence. These values represent the *actual* or *observed* percentage of the time that the item apperas in each corpus part.

3. Compute the pairwise absolute differences between the expected and observed percentages, sum them up, and divide the result by two.

4. The result is DP, which theoretically ranges from 0 (the item is evenly distributed across the corpus, given the size of the parts) to 1 (the item is unevenly distributed across the corpus, given the size of the parts).

The mathematical formulization of DP is shown in (36), where n is the number of corpus parts, v is the frequencies of the target item in each corpus part, f is the overall frequency of the target item in the corpus, and s is the percent size of each corpus part.

(36) $$DP = 0.5 \times \sum_{i=1}^{n} |\frac{v_i}{f} - s_i|$$

A more detailed explanation of this calculation, with examples, is in Gries (2008: §3). Note that while the theoretical range of DP is between 0 and 1, it will never actually reach these two limits because a particular proportion of the lexical item was expected to occur in each corpus part anyway. This issue is only noticeable in corpora with a very small number of parts.

Both the token frequencies and corpus dispersions of each lexical item in the 100-item samples are reported in Appendix B.

3.5 Summary

This chapter has presented the methodological tools necessary for answering the research questions put forth in Chapter 1. The methods adopted in this study are novel for several reasons. First, this is the first study to utilize naturalistic discourse data from corpora to examine lexical flexibility at the level of the individual lexical item. Second, this is the first study to

quantify the lexical flexibility of individual lexical items, in a crosslinguistically applicable way. The calculation of lexical flexibility using Shannon's H is intended as the main methodological contribution of this dissertation. Finally, this study incorporates findings from recent research in corpus linguistics which suggest that corpus dispersion is a better measure of frequency of exposure than just raw token frequency. As such, I report on both token frequency and corpus dispersion and examine their interaction as they relate to lexical flexibility in Section 4.5. With these methodological prerequisites in place, I now turn to answering this study's research questions in Chapter 4.

Chapter 4

Results

This chapter reports the results of applying the procedures described in Chapter 3: Data & Methods. I begin by demonstrating for the reader how to interpret the ternary plots used to visually represent the degree of lexical flexibility for individual items (R1) (Section 4.2). Next I look at the flexibility of lexical items in English and Nuuchahnulth, both independently and in comparison (Section 4.3). I then I investigate whether lexical flexibility depends on corpus size (R2) (Section 4.4), followed by the relationship between the degree of lexical flexibility and frequency / dispersion (R3) (Section 4.5). Finally, I discuss the behavior of flexible items with respect to their semantics (R4) (Section 4.6).

4.1 Introduction

This chapter presents the empirical findings of this study, answering the research questions posed in Chapter 1. I employ a useful visualization for displaying information about lexical flexibility called a *ternary plot* or *triangle plot*; I explain how these ternary plots are to be read in Section 4.2. Section 4.3 focuses on answering R1, "How flexible are lexical items in English and Nuuchahnulth?", both individually and in comparison. Section 4.4 is dedicated to answering R2, "Is there a correlation between degree of lexical flexibility and size of the corpus?", and Section 4.5 answers R3, "Is there a correlation between degree of lexical flexibility for a lexical item and frequency (or corpus dispersion)?". In the final section (§4.6), I look at the semantic behavior of more and less flexible items (question R4).

4.2 Interpreting the results

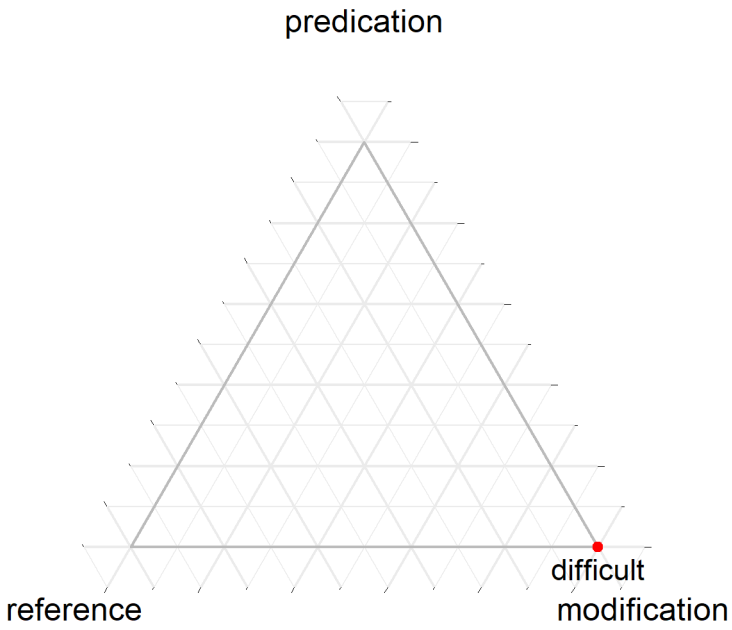
In Section 3.4.1 I describe the procedure for quantifying the lexical flexibility of an item in a corpus using a Shannon diversity index (H). While the resulting values nicely align with our intuitions about when a lexical item is more or less flexible, some information is lost in the process. Reducing the lexical flexibility of an item to a single number obscures the fact that items can be equally flexible in different ways. Consider the fictional frequency data for two different stems in Table 4.1. Stem A displays a great deal of reference-predicate flexibility, but no instances of use as a modifier. Stem B, in contrast, displays extensive reference-modifier flexibility, but no instances of use as a predicate. However, the overall flexibility ratings of the two stems are the same.

Table 4.1: Stems with different distributions of discourse functions and the same flexibility

stem	reference	predication	modification	flexibility
Stem A	25	25	0	0.631
Stem B	25	0	25	0.631

One way to address this reduction in fidelity is to report frequencies and corpus dispersions for each function in addition to the overall flexibility rating for each stem. I provide this information in Appendix B alongside each item's flexibility rating. However, it is also possible to visualize the relative usage of an item for each discourse function in an intuitive way by using a *ternary plot* (also called a *triangle plot*, *simplex plot*, *Gibbs triangle*, or *de Finetti diagram*). A ternary plot depicts the ratios of three variables as points within an equilateral triangle. Each corner of the triangle corresponds to one of the three possible categories (in this case, reference, predication, or modification). The closer a data point is to a particular corner, the larger the ratio of that category is. To illustrate with an example: Figure 4.1 is a ternary plot for the functions of the word *difficult* in English, along with the underlying frequency data and resulting flexibility rating. Because the word *difficult* only appears as a

Figure 4.1: Flexibility of English *difficult*



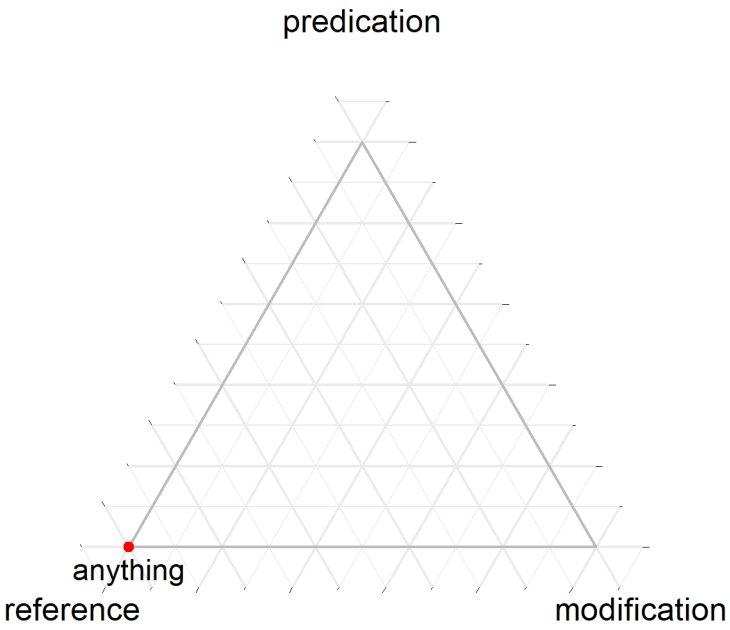
reference	predication	modification	flexibility
0	0	54	0.000

modifier in the corpus, it has a flexibility rating of 0. In the ternary plot, this is evident from the fact that the plot point for *difficult* sits in the modification corner of the triangle.

Compare the plot for *difficult* in Figure 4.1 to that of *anything* in Figure 4.2. The stem *anything* also has a flexibility rating of 0 because all of its tokens are used for reference. Even though its flexibility rating is the same as that of *difficult*, it is plotted in a different corner of the ternary plot (reference).

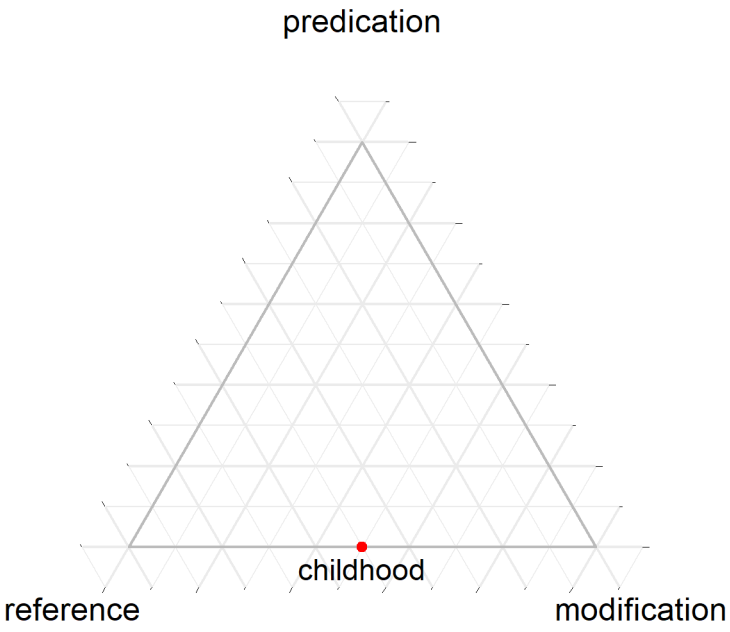
Figure 4.3 shows a case where a stem (*childhood*) is flexible between reference and modification, but not predication. Finally, a perfectly flexible item which has equal use as a referent, predicate, and modifier, would sit exactly in the center of the triangle. The Nuuchahnulth stem *ʔu·q* 'good' is one such case, shown in Figure 4.4. The closer a point is towards the center of the triangle, the more flexible it is.

Figure 4.2: Flexibility of English *anything*



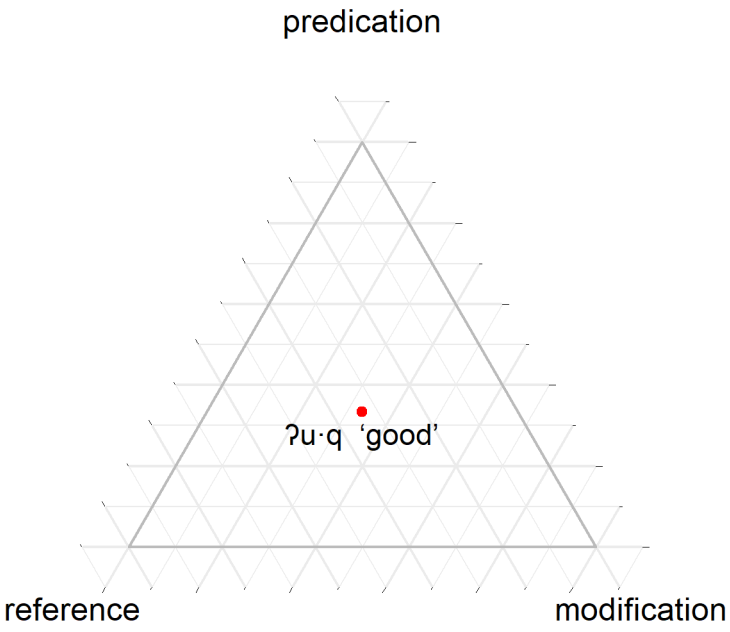
reference	predication	modification	flexibility
2,081	0	0	0.000

Figure 4.3: Flexibility of English *childhood*



reference	predication	modification	flexibility
2	0	2	0.631

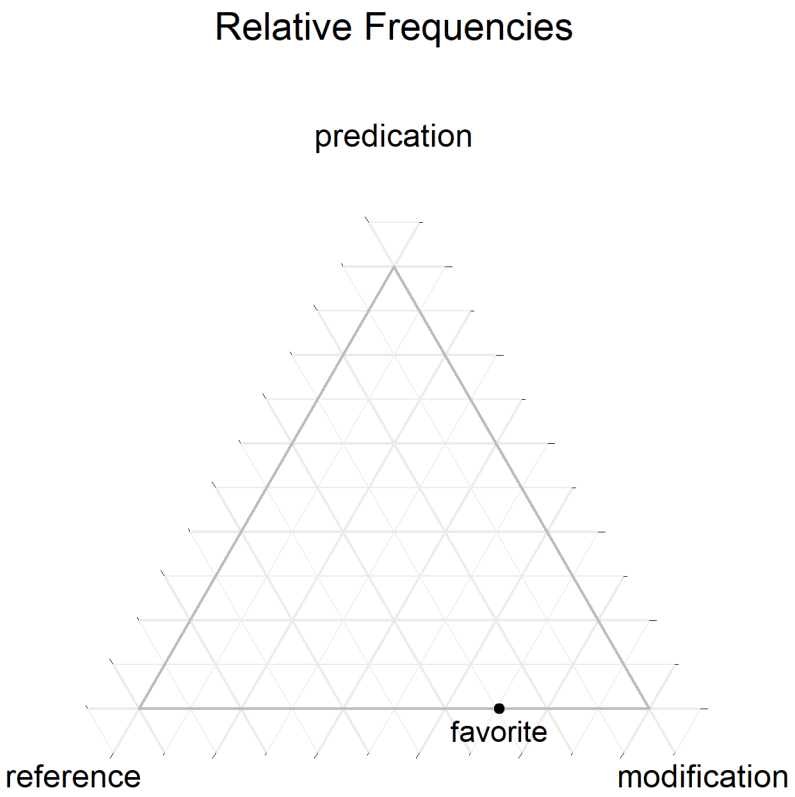
Figure 4.4: Flexibility of Nuuchahnulth *ʔu·q* 'good'

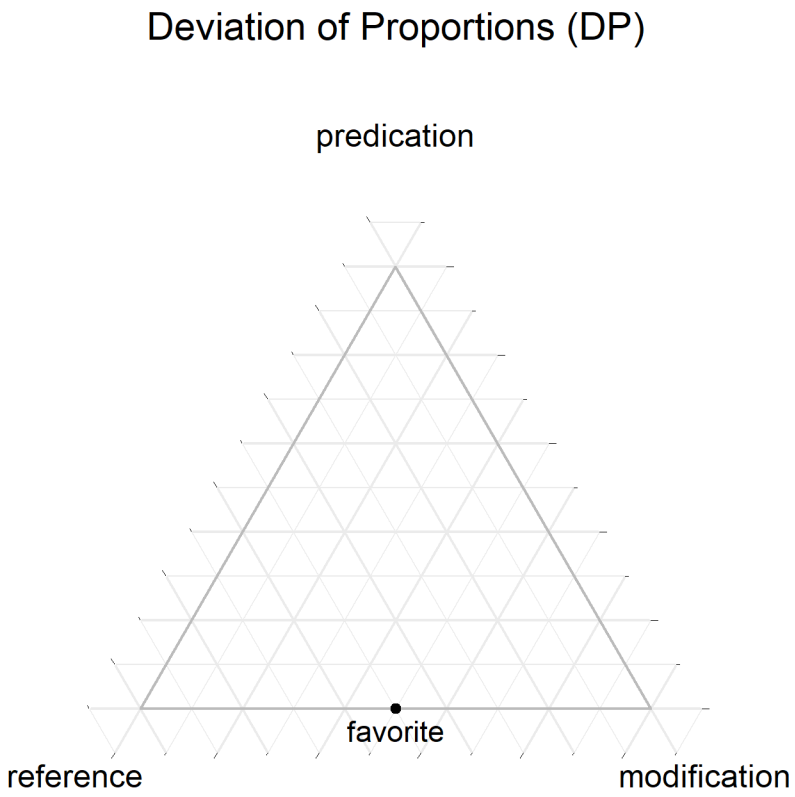


reference	predication	modification	flexibility
1	1	1	1.000

Also remember from Chapter 3 that corpus dispersion is a better measure of frequency of exposure than just raw frequency. Thus in addition to relative frequency data, I also report corpus dispersions for the discourse functions of each lexical item in Appendix B. Note that the corpus dispersions are calculated separately for each discourse function (in addition to the overall corpus dispersion of the lexical item). A particular lexical item might be used for one function evenly throughout the corpus, and thus have a low DP for that function, but might only be used for another function in one or two texts, thus giving that function a high DP. The ratios of these corpus dispersions for each function can be plotted on a ternary plot just like frequency. Plots based on corpus dispersions are sometimes notably different from plots based on frequencies, as Figure 4.5 illustrates for the English word *favorite*. In most cases however the plots are identical or near-identical. As such, for the remainder of this study I will use ternary plots based on corpus dispersion rather than frequency, noting where the two diverge only when relevant.

Figure 4.5: Flexibility using frequency vs. corpus dispersion for English *favorite*





Frequency	Flexibility (Shannon's H)	Dispersion (DP)	Frequencies			Dispersions (DP)		
			Reference	Predication	Modification	Reference	Predication	Modification
17	0.551	0.999	5	0	12	0.999	1.000	0.999

4.3 R1: Degree of lexical flexibility

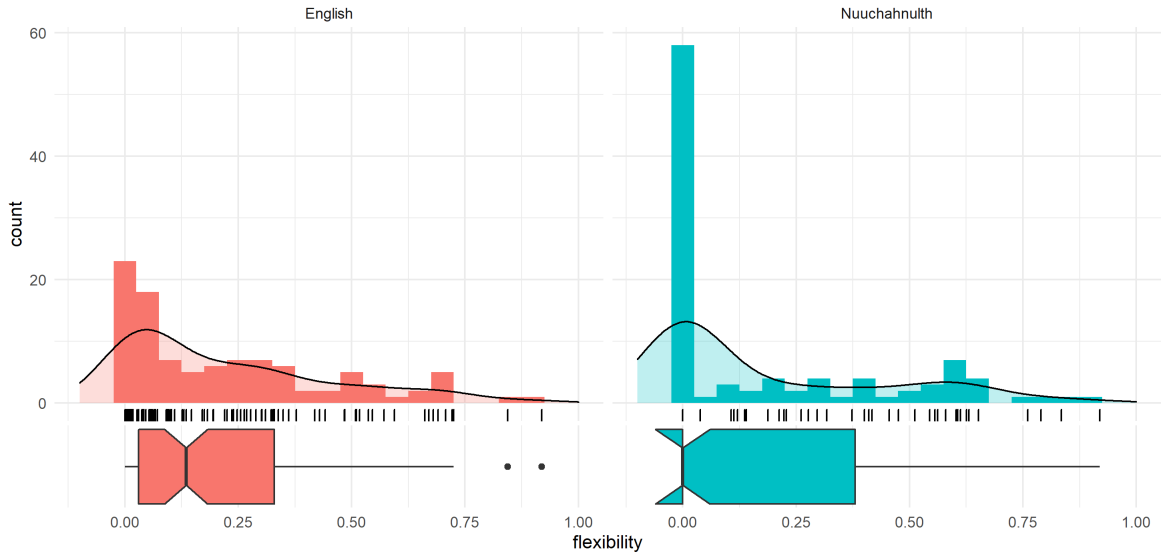
In this section I examine the degree of lexical flexibility for words in English and Nuuchahnulth from several angles, both independently and in comparison, using the lexical flexibility ratings calculated with the methods in Section 3.4.1. The result of these calculations for the 100-item samples are shown in Appendix B.

Figure 4.6 visualizes the distributions of the flexibility ratings for the 100-item samples from English (lefthand side) and Nuuchahnulth (righthand side). The top portion of each figure is a histogram showing the number of lexical items at different flexibility ratings. Beneath the histograms are boxplots showing the median flexibility rating for each language. Figure 4.7 shows the same visualizations for the small corpus samples.

One immediately obvious observation to be made from these flexibility ratings is that individual lexical items may vary widely in their flexibility, both within and across languages. While this finding is entirely unsurprising, the results very well could have been otherwise. The way Nuuchahnulth is often described, one might expect all the lexical items in the language to fall within a more limited range of high-flexibility values. This is clearly not the case. Flexibility ratings for Nuuchahnulth range from the theoretical minimum of 0 to a maximum of 0.920 (100-item sample) or 0.985 (small corpus sample). However, 282 of 483 stems in the small corpus Nuuchahnulth sample (69.97%) have a flexibility rating of 0 (58 of stems in the 100-item sample), potentially challenging the claim that all Nuuchahnulth stems are flexible.

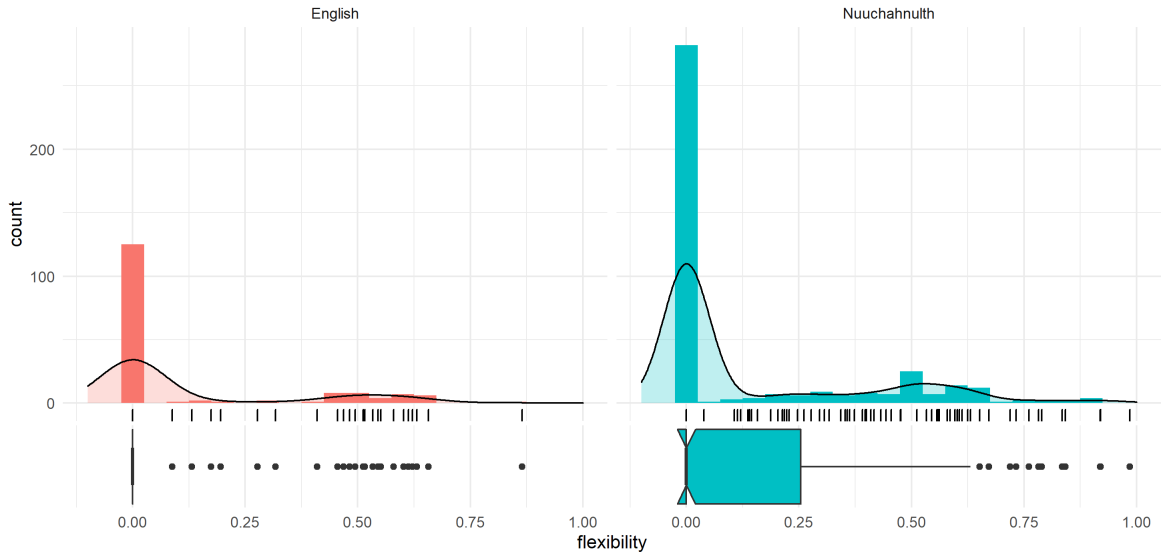
Likewise, those who claim that English parts of speech are well-defined must confront the fact that the range of flexibility values for English is nearly the same as for Nuuchahnulth for both samples: 0 on the lower end and $.919$ (100-item sample) or 0.865 (small corpus sample) on the upper end. In fact, in the 100-item samples there are fewer English stems with a flexibility rating of 0 than there are Nuuchahnulth stems with a flexibility rating of 0 (8 stems out of 100). The percentage of zero-flexibility stems in the small corpus samples are about equal (125 of 166 stems, or 75.30%). In this respect, then, English could be viewed as similarly flexible

Figure 4.6: Distribution of flexibility ratings for the 100-item samples of English and Nuuchahnulth



	English	Nuuchahnulth
mean	0.223	0.183
median	0.134	0.000
standard deviation	0.230	0.259

Figure 4.7: Distribution of flexibility ratings for the small corpus samples of English and Nuuchahnulth



	English	Nuuchahnulth
mean	0.122	0.143
median	0.000	0.000
standard deviation	0.226	0.243

Table 4.2: One-sided, one-sample sign tests for deviation from zero for each corpus sample

sample	V	p-value
English 100 items	4371	p < .0001
Nuuchahnulth 100 items	903	p < .0001
English small corpus	861	p < .0001
Nuuchahnulth small corpus	7381	p < .0001

to Nuuchahnulth. Of course, it may be that this difference is due to the large difference in corpus sizes between English and Nuuchahnulth, an issue which is explored in Section 4.4.

Thus the answer to the question, "Are some lexical items more flexible than others?" is unsurprisingly "yes". To pose a related question, "Can it be shown empirically and quantitatively that some lexical items are more flexible than others, as many linguists have claimed?". The answer is again, "yes". If we want to evaluate the claim that some languages are more or less flexible than others, it must be possible to quantify that flexibility at the level of the individual lexical item and compare them in a meaningful way. The data and methods in this dissertation show that this is indeed possible, and that we can provide clear empirical answers to these kinds of questions. The flexibility of individual lexical items varies widely both within and between languages.

A slightly different question than whether individual stems vary in their flexibility is whether they exhibit flexibility to any substantive degree in the first place. Or, to invert the question, is lexical flexibility a marginal / rare phenomenon which has merely been given disproportionate attention in the literature? A quick look at the flexibility data above shows that this is not the case. When lexical items in English and Nuuchahnulth exhibit flexibility, it is typically not to a marginal degree. A stem is more likely to have a flexibility of, say, .200 than something like .002. According to one-sided, one-sample sign tests, the median flexibility in all samples differs highly significantly from zero (see the summary table in Table 4.2).

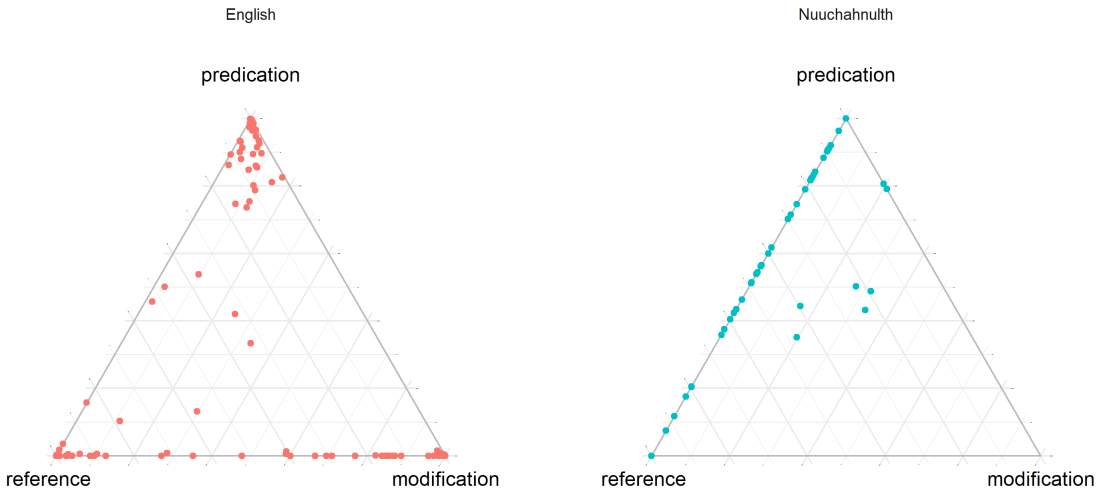
This result may seem obvious, but it must be recognized that the result could have been different. Flexibility for English stems could have been so marginal as to not significantly de-

viate from zero. This would have supported an analysis of lexical flexibility in English as mere occasional language play, something exceptional rather than rampant or productive. The data show otherwise: lexical flexibility is a prevalent feature of both English and Nuuchahnulth, though to different degrees.

Another question to ask of these data is whether English and Nuuchahnulth differ in their overall flexibility. The answer to this is not immediately obvious, given how similar the mean and median flexibility ratings for English and Nuuchahnulth are in Figure 4.6 and Figure 4.7. But to reduce the entire lexicon of a language to a single measure of central tendency obscures important details. The *way* in which the two languages exhibit flexibility is arguably more interesting.

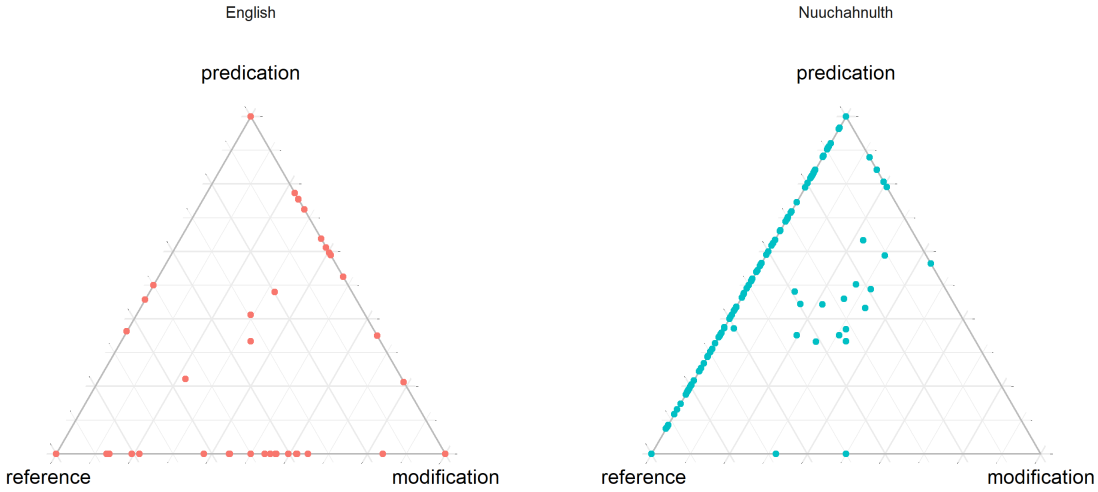
How then is lexical flexibility realized in English and Nuuchahnulth? In addition to the histograms in Figure 4.6 and Figure 4.7, the ternary plots in Figure 4.8 and Figure 4.9 illustrate the way that flexibility operates in these two languages. In these figures, each lexical item is represented by a single point on the ternary plot.

Figure 4.8: Distribution of functions for the 100-item samples of English and Nuuchahnulth



Beginning with English, we can see that most lexical items exhibit some flexibility, but

Figure 4.9: Distribution of functions for the small corpus samples of English and Nuuchahnulth



to a relatively small degree. After zero-flexibility cases, the next most frequent flexibility rating is in the 0–0.05 range. This is also evident from the ternary plots, where lexical items tend to cluster near (but not precisely on) the corners for their most prototypical functions. Interestingly, the small English corpus appears to show *more* flexibility than the 100-item sample. This could be an effect of the specific words chosen, but it could also be the case that it takes a certain number of tokens for the prototypical function of an item to become evident. This possibility is examined further in Section 4.4.

Nuuchahnulth differs from English in several notable ways. First, a much higher proportion of items display no flexibility whatsoever. However, for those items which do exhibit flexibility, the average flexibility rating is generally higher than that of English stems. In both samples, the biggest cluster of items with non-zero flexibility ratings have ratings around .6. English items with non-zero flexibility, by comparison, generally have ratings closer to .2. Thus for Nuuchahnulth lexical items are either totally inflexible or generally strongly flexible.

This bifurcation of the data is very likely due to the small size of the Nuuchahnulth corpus,

as will be discussed in Section 4.4. It may be that Nuuchahnulth words are generally highly flexible, but that more tokens are needed to see this trend. Alternatively, it may be that certain Nuuchahnulth stems are strongly associated with a specific discourse function and thus inflexible, while others are generally flexible. This would suggest a probabilistic division of Nuuchahnulth stems into two classes: those that are productively flexible, and those that are not.

This second possibility would challenge existing analyses of Nuuchahnulth. The existence of a productively flexible class of stems would be counterevidence to the many claims that Nuuchahnulth word classes can in fact be clearly defined using selectional criteria such as ability to take possession or the definite suffix (Jacobsen 1979; Davis, Gillon & Matthewson 2014; Braithwaite 2015). Similarly, Nakayama (2001: 57) characterizes word classes in Nuuchahnulth as strong statistical tendencies in discourse. For many Nuuchahnulth stems, however, there is no clear prototypical use. The data show that many stems are used roughly equally for predication as they are for reference, making it difficult to assess which use is more basic or unmarked.

As the ternary plots for Nuuchahnulth in Figure 4.8 and Figure 4.9 make clear, the distribution of lexical items across functions in Nuuchahnulth differs strongly from that of English. For starters, there is very little clustering around prototypical functions in the corners, in direct contrast to English. Secondly, Nuuchahnulth shows very little flexibility in the modification direction, but rampant flexibility along the reference-predication axis. For the small corpus sample in particular, there is a smooth cline of values between reference and predication. Nuuchahnulth stems sit anywhere on a continuum from prototypical referents to prototypical predicates, but none show prototypical modifier behavior.

These findings nicely reflect the intuitions of many researchers about these two languages. English is mostly rigid, but most words exhibit a marginal degree of flexibility. English words are *primarily* associated with one discourse function, but not exclusively so. Nuuchahnulth, by contrast, shows a very high degree of reference-predicate flexibility. However, Nuuchah-

nulth stems are not frequently used for modification. This is in line with the analysis of most researchers regarding lexical categories in Nuuchahnulth. Nakayama (2001: 50), for example, says that the categories noun and verb must be recognized for Nuuchahnulth, but that there is not sufficient evidence to justify an adjective category, even as a statistical tendency. He instead treats "adjectivals" as a subclass of verbs. The central location of the points in the Nuuchahnulth plot in Figure 4.9, however, suggest that Nuuchahnulth modifiers are as noun-like as they are verblike. The low frequency with which stems are used for modification also mirrors the results from Croft's (1991: 88–89) four-language survey of the textual frequency of different lexical classes. He also finds that "the overall frequency of roots denoting properties and occurrences of modifiers is extremely low compared to the frequencies of object and action roots and of referring expressions and predications" (Croft 1991: 88–89).

4.4 R2: Lexical flexibility and corpus size

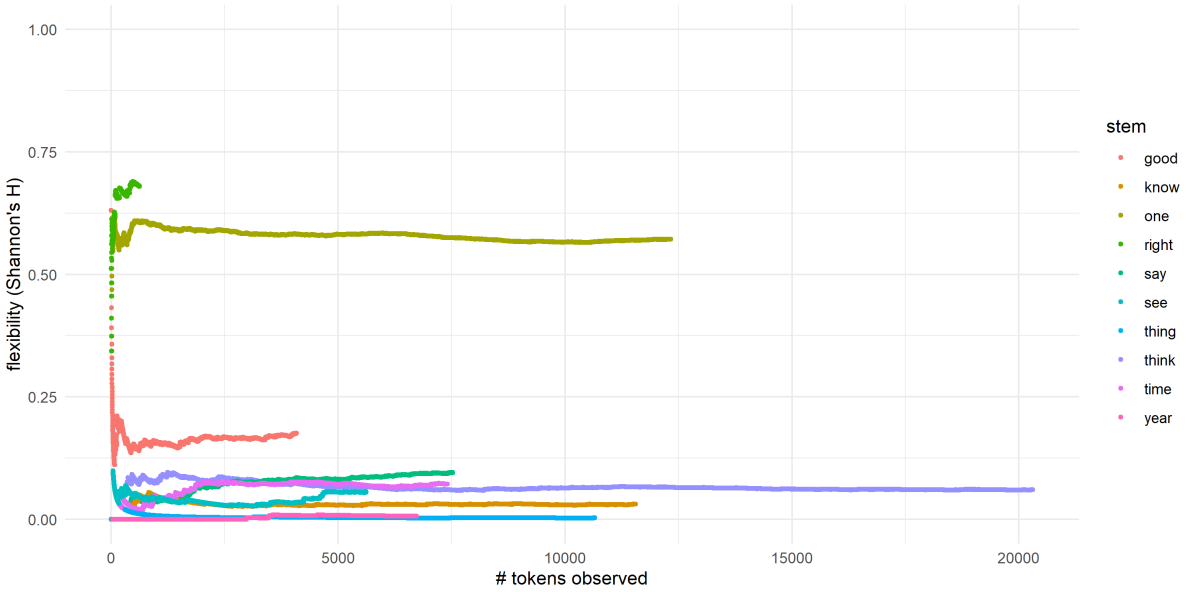
It seems intuitively plausible that the more tokens of a word one encounters, the more likely one is to find flexible uses of a word. With a large enough corpus, all items would exhibit flexibility. This has been claimed by Mosel & Hovdhaugen (1992: 77). It may be the case that larger corpora are statistically more flexible than smaller corpora. However, to my knowledge this claim has never been tested empirically, although the fact that the median flexibility for the small corpus sample of English is 0 while the median flexibility of the much larger 100-item sample is 0.134 suggests that the hypothesis might be true. In this section I examine the results of comparing the number of tokens encountered for a stem to its cumulative flexibility rating, the question being, "Does the cumulative flexibility for the lexical item increase as one encounters more tokens?".

Only stems with a frequency of at least 4 were studied (see §3.4.1 for the motivation behind this restriction). For English, I examined the 100-item sample, and for Nuuchahnulth I used the entire corpus. Using a script and going sequentially through the corpora, each time I

encountered a new token of a lexical item, I recalculated its flexibility and recorded that value and token frequency at that point in the corpus.

Figure 4.10 shows the result of these calculations for the ten most frequent words in the English corpus, and Figure 4.11 shows the same for Nuuchahnulth. The number of tokens encountered is shown on the x-axis, and the cumulative flexibility is shown on the y-axis. I show only the most frequent words here merely because they provide the clearest visual representation of the data; more comprehensive (but more difficult to read) plots for each language are given in Figure 4.12 and Figure 4.13. For ease of visualization, a version of the English data with $\log_{10}$ frequency on the x-axis is also given in Figure 4.14.

Figure 4.10: Cumulative lexical flexibility for English (10 most frequent words)



The first thing to notice from both plots of high-frequency words is that it takes a certain number of tokens for the flexibility of a word to become evident and stable. For English, the trend lines are generally no longer stochastic after ∼1,000 tokens encountered (this can be more easily seen in Figure 4.14). If we take 1,000 tokens as a reliability threshhold for determining the flexibility of a lexical item, then no Nuuchahnulth item appears with sufficient frequency in the corpus to be certain of its flexibility. That said, the flexibility of the ten

Figure 4.11: Cumulative lexical flexibility for Nuuchahnulth (10 most frequent words)

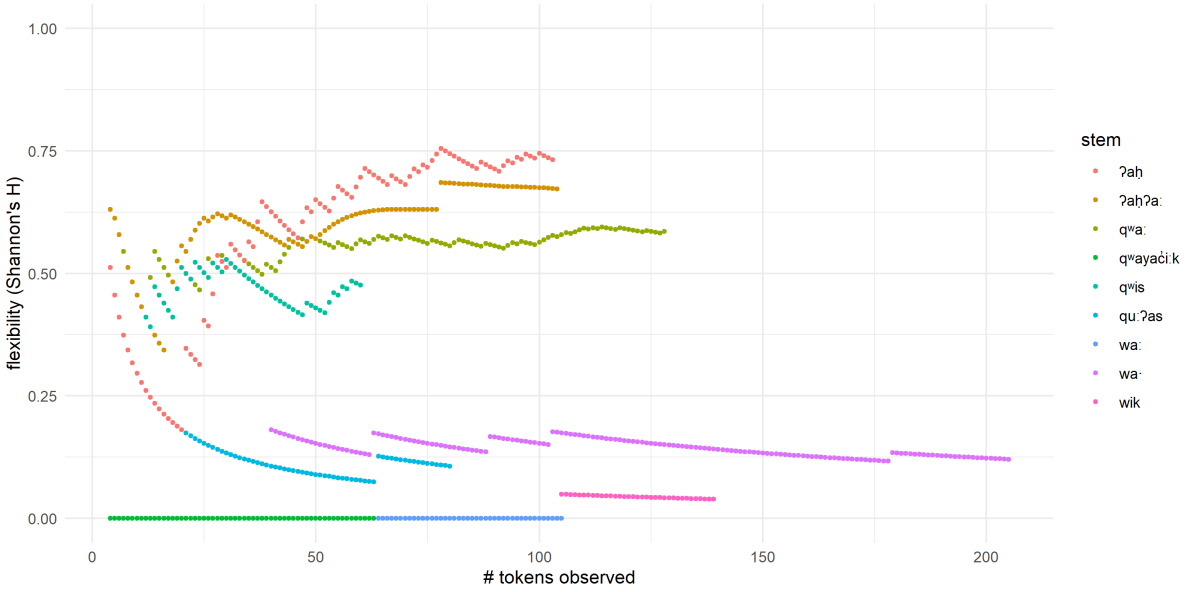
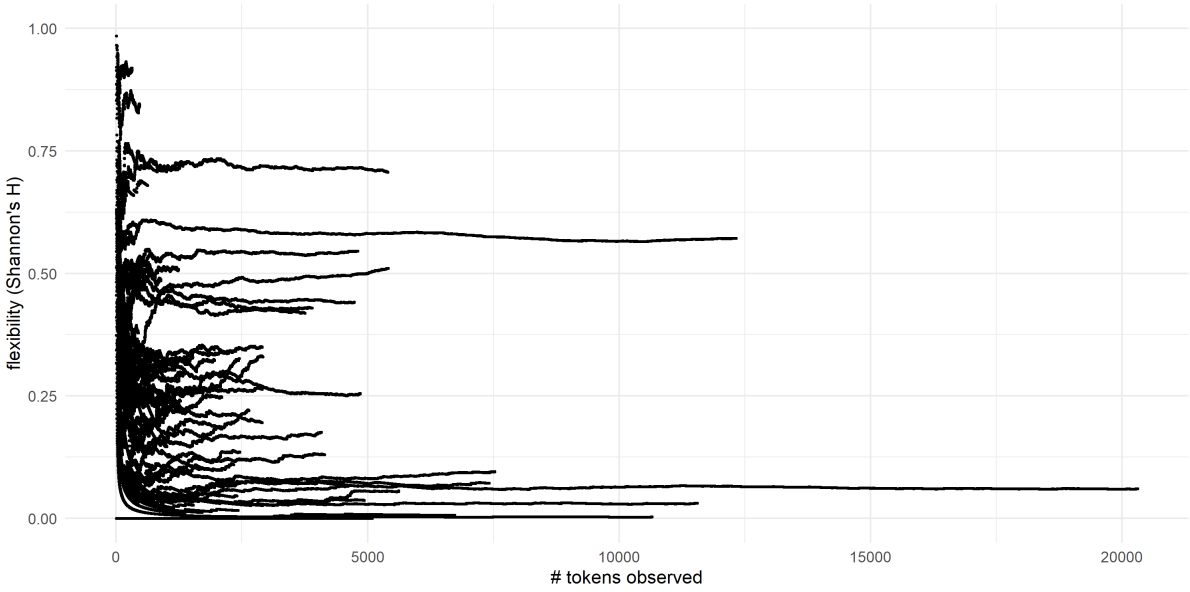


Figure 4.12: Cumulative lexical flexibility for English (all words)



words in the Nuuchahnulth sample appears to be relatively stable after 50–75 tokens. There are some words in the English sample which achieve a relatively stable flexibility rating as early as 100 tokens as well. One way to interpret these data is that, since some stems appear in a wider range of discourse contexts than others, it takes a higher number of tokens before

Figure 4.13: Cumulative lexical flexibility for Nuuchahnulth (all words)

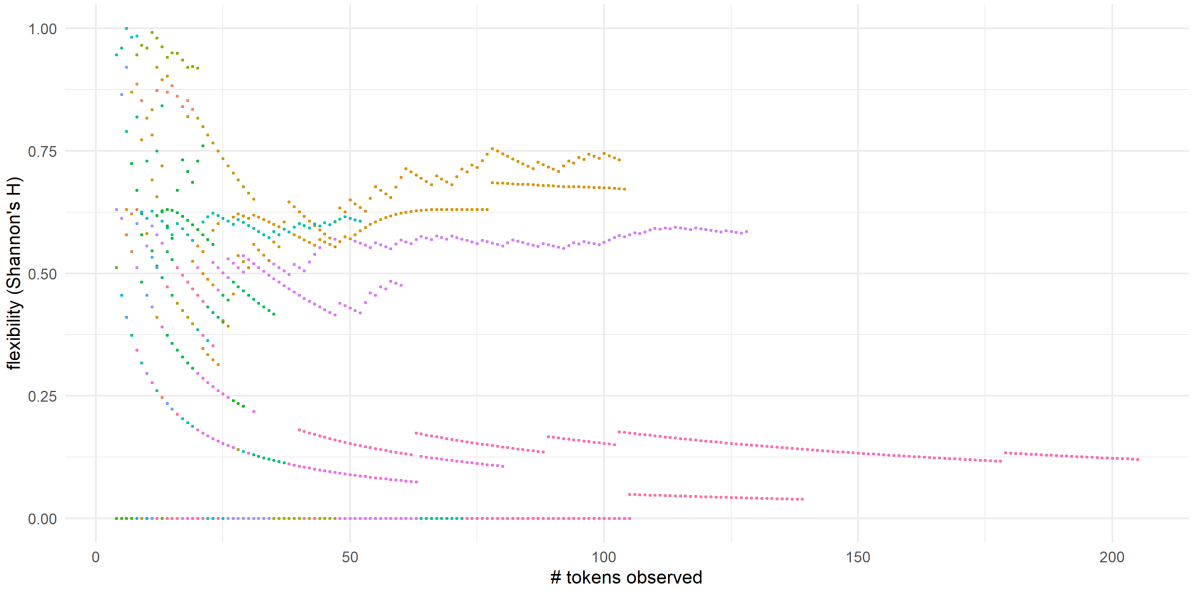
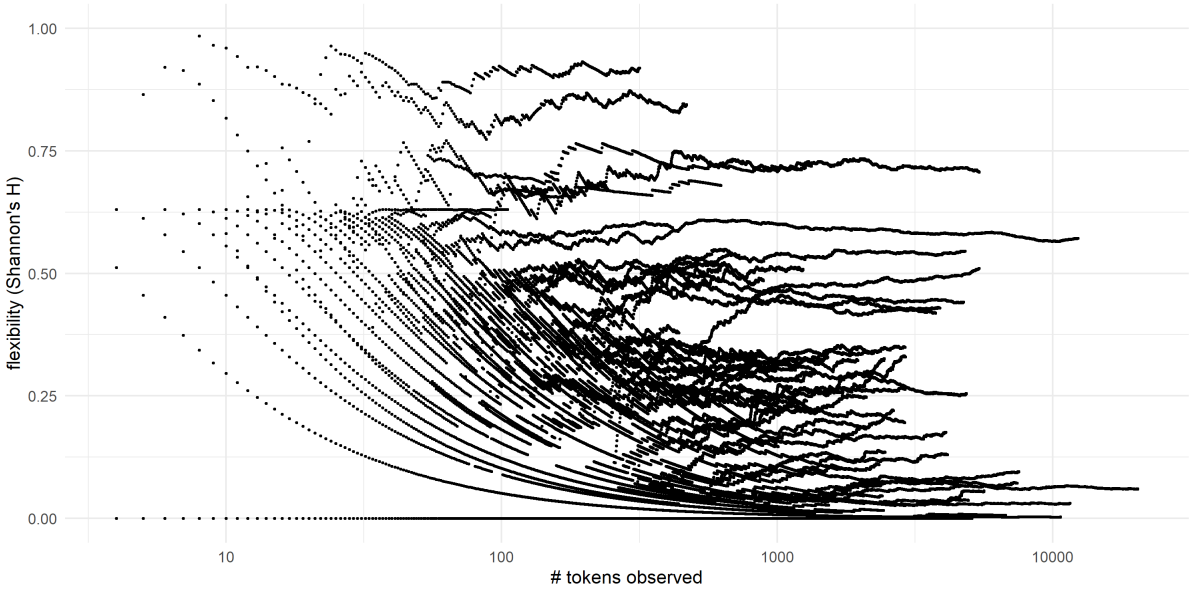


Figure 4.14: Cumulative lexical flexibility for English (log_10 scale)



the overall flexibility of those stems becomes evident; in contrast, the flexibility of stems that appear in a relatively small range of discourse contexts should become clear right away.

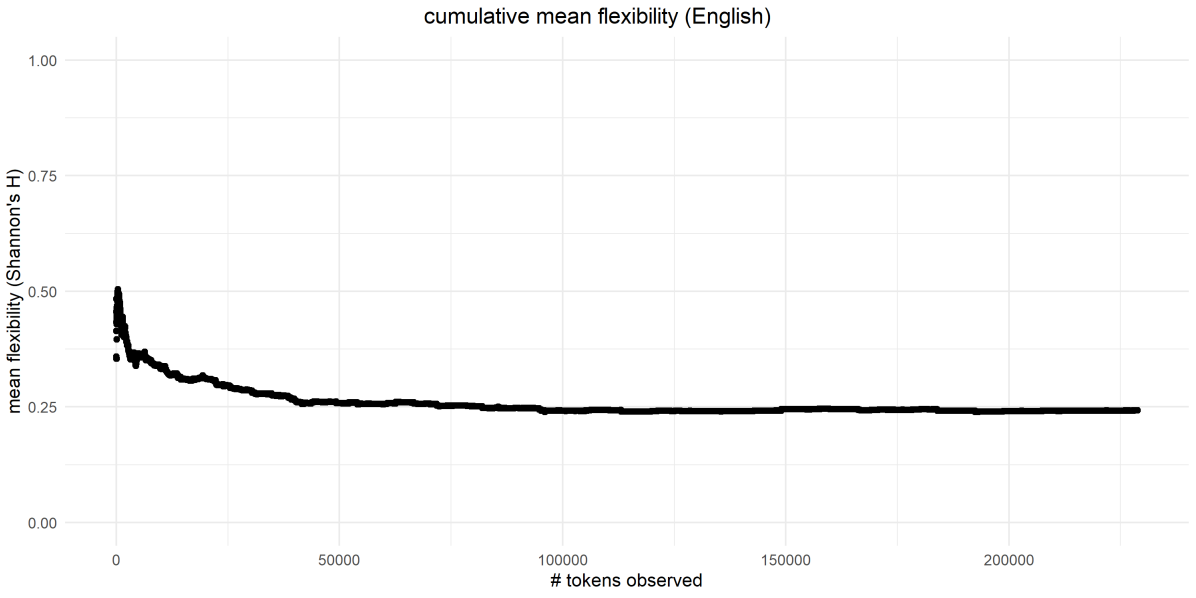
The second observation to make regarding these data is that, once the trend line for cumulative flexibility becomes smooth, it stays flat. This shows that corpora do not become more flexible as they increase in size. If this were true, we would expect to see a continual and

gradual increase in flexibility for many of the stems in the dataset, and this is not the case.

On the other hand, by the time one encounters 5,000 tokens of a word in English, there are no stems with a flexibility of zero. English flexibility ratings cluster in the lower range (~ 0.3), but when sufficient tokens are encountered, there do not seem to be any truly inflexible words. Therefore it does seem to be true (for English at least) that words will eventually display *some* flexibility as the size of the corpus increases, but not that the overall flexibility of the word will increase.

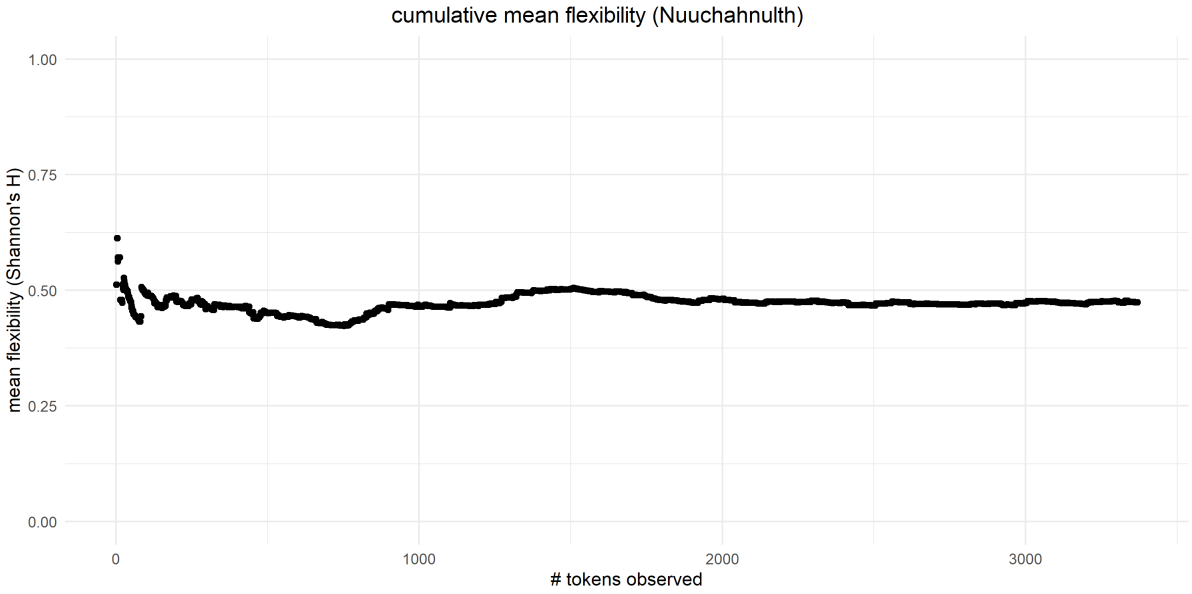
We can also look at the data for each language in aggregate. Figure 4.15 shows the cumulative mean flexibility for English per token encountered. Each time a new token of a lexical item was encountered, I calculated the current flexibility ratings of each lexical item encountered up to that point, and calculated their average. The resulting plot shows number of tokens encountered on the x-axis and mean flexibility for the entire corpus up to that point on the y-axis. Figure 4.16 shows parallel data for Nuuchahnulth. Both graphs clearly show that the average flexibility of the corpus does not increase as the corpus grows larger. Instead it remains flat after a sufficient number of tokens are encountered.

Figure 4.15: Cumulative mean flexibility for English



To summarize, once enough tokens of a word are encountered to give a reliable flexibility

Figure 4.16: Cumulative mean flexibility for Nuuchahnulth



rating, that flexibility rating does not increase as the number of tokens encountered continues to grow. Lexical items appear to have (synchronically) fixed degrees of flexibility, that vary from word to word. This suggests that the discourse functions of any given stem are conventionalized, so that speakers know which uses a word has, and generally use them with the same proportionate frequency. Logically, aggregating the data at the language level produces the same result: languages have (synchronically) fixed degrees of flexibility, that vary from language to language.

4.5 R3: Lexical flexibility and frequency / dispersion

In this section I examine the interactions between lexical flexibility, token frequency, and corpus dispersion for individual lexical items. Given that many linguistic phenomena correlate with frequency / corpus dispersion, it is reasonable to investigate whether lexical flexibility displays such correlations as well. Are high frequency or evenly dispersed words more flexible than low frequency or unevenly dispersed words? This is an interesting question in part because if such a correlation were found the direction of causation could go in either direc-

tion. It may be that stems are more frequent precisely because they are more flexible—there is a wider range of discourse contexts that they can occur in. On the other hand, it could be that high frequency words are more cognitively accessible and therefore more prone to novel uses in discourse. Or, in contrast, a higher frequency could also result in a greater degree of entrenchment, so that high frequency words are less likely to be flexible.

To investigate the possible interactions among flexibility, frequency, and dispersion I deploy a Generalized Additive Model (GAM) in order to account for the possibility of interactions not just between flexibility and frequency / dispersion, but for interactions between frequency and dispersion as well. For example, it may be the case that there are correlations between flexibility and dispersion, but only for high frequency words. A Generalized Additive Model allows for the exploration of multiple interactions in this way.

Frequency is represented in this model as $\log_2$ of the relative frequency of the stem. Since relative frequency and corpus dispersion utilize different scales, I also use a tensor smooth to examine the combined contribution of frequency and dispersion to flexibility, over and above their individual contributions. I again used the 100-item sample for the English model, and the entire corpus for Nuuchahnulth.

Figure 4.17 shows heat maps of the interactions of the three variables for English and Nuuchahnulth. The x-axis shows log_2 of relative frequency, and the y-axis shows corpus dispersion as Deviation of Propotions (DP), with more evenly dispersed items to the bottom of the scale and less evenly dispersed items to the top of the scale. Light-colored areas indicate a high degree of flexibility, while dark-colored areas indicate a low degree of flexibility.

Figure 4.18 shows 3D representations of the same data, rotated for ease of visualization. $\log_2$ relative frequency is shown on the x-axis (with higher relative frequency to the left—the reverse of Figure 4.17), flexibility is shown on the y-axis (with higher flexibility at the top of the scale), and corpus dispersion is shown on the z-axis (with more evenly dispersed values further away).

In English, high frequency, evenly dispersed items appear to have low flexibility ratings,

Figure 4.17: Interactions among frequency, dispersion, and flexibility for English vs. Nuuchahnulth (heat map)

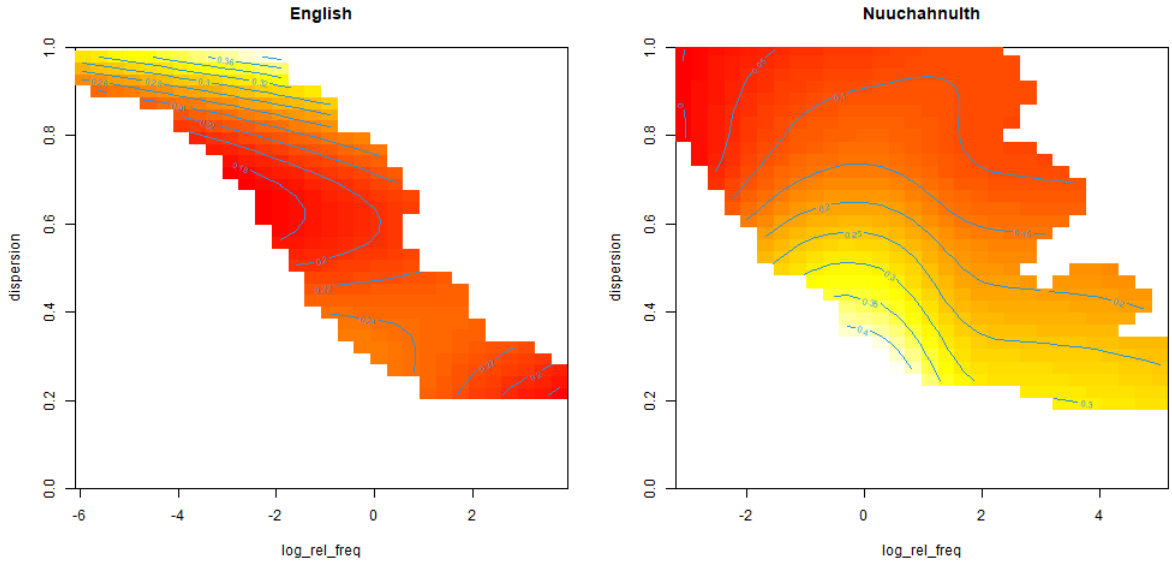


Figure 4.18: Interactions among frequency, dispersion, and flexibility for English vs. Nuuchahnulth (3D map)

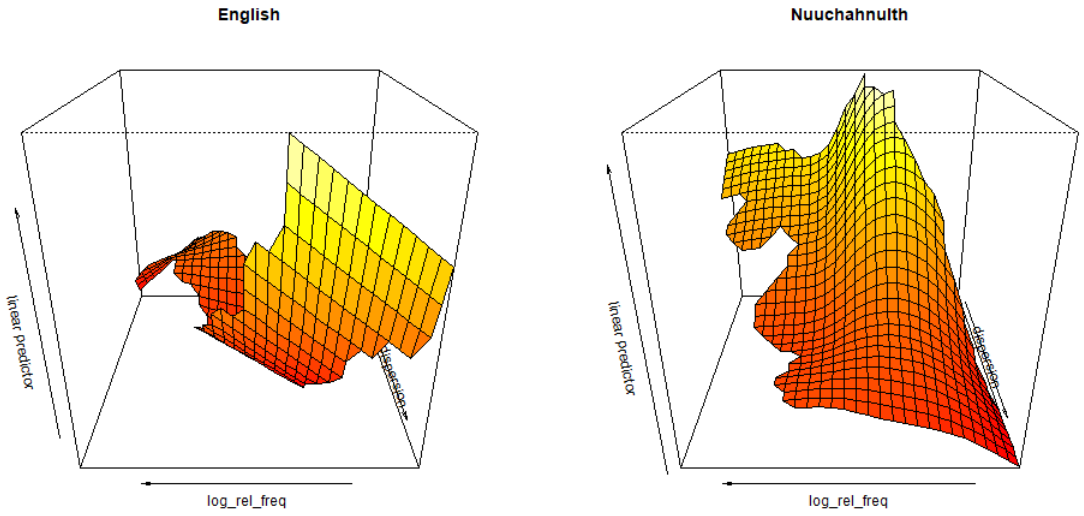
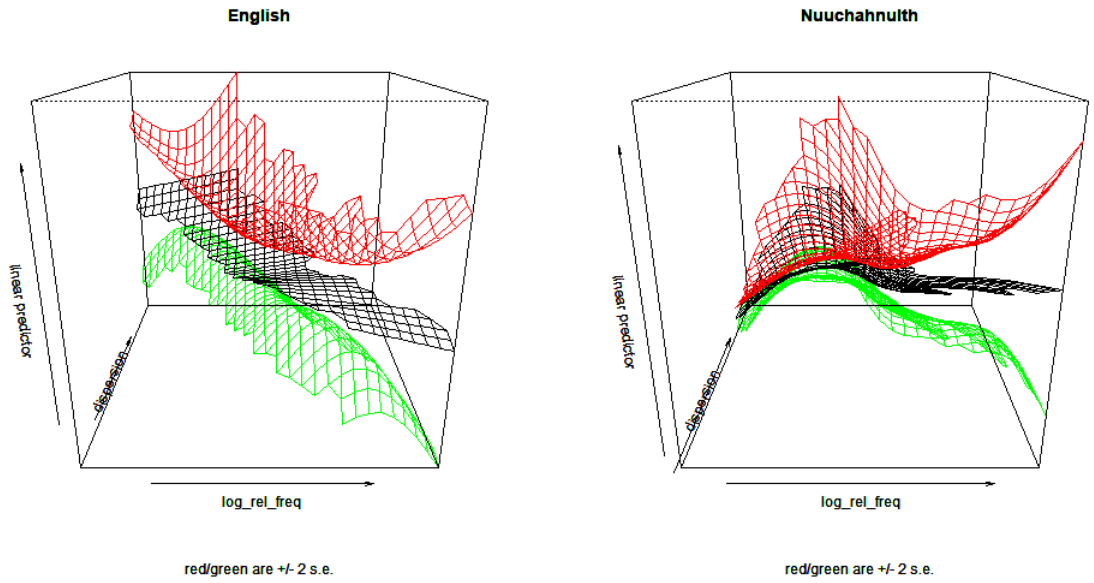


Figure 4.19: Interactions among frequency, dispersion, and flexibility for English vs. Nuuchahnulth, with standard deviations (3D map)



while low frequency, unevenly dispersed items appear to have high flexibility ratings. However, none of the interactions for the English model are significant. The reason for this becomes apparent when we look at the same 3D interaction plot but with maps added at a standard deviation of 2, as in Figure 4.19. There is so much variability in the data for English that no firm conclusions can be drawn.

The model for Nuuchahnulth, on the other hand, shows a couple of significant interactions. First, higher-frequency words show a greater degree of flexibility than lower-frequency words. This correlation is highly significant ($F = 37.582$, $p < .001$). Corpus dispersion, however, shows only a marginally significant correlation with flexibility ($F = 2.384$, $p < .1$), so no conclusion can be drawn regarding the direct relationship between corpus dispersion and flexibility. However, the combined interaction of corpus dispersion and relative frequency does correlate with flexibility, above and beyond the contribution provided by relative frequency alone ($F = 2.979$, $p < .05$). In total, these factors account for 18.2% of the deviance in the data. Low frequency, unevenly dispersed items have low flexibility ratings, while high frequency, evenly dispersed items have higher flexibility ratings.

These results for Nuuchahnulth should not be accepted unquestioningly as representative of the overall state of affairs for the language, however. Remember from §4.4 that a certain minimum threshhold of number of tokens is required in order to be certain of that word's flexibility. Given the relatively low frequencies of items in the Nuuchahnulth corpus, the flexibility ratings of many stems are likely inaccurate. In particular, the high incidence of items with zero-flexibility ratings is almost undoubtedly due to the small number of tokens encountered for those items. In fact, the 3D interaction plot for Nuuchahnulth in Figure 4.19 shows that as stems increase in frequency, the standard deviation for their flexibility ratings grows dramatically, resembling that of English. Therefore it is likely that the strong correlations that currently appear for the Nuuchahnulth data would disappear with a larger corpus.

In summary, the data on lexical flexibility and frequency / corpus dispersion are not clear enough to draw any firm conclusions regarding their interactions.

4.6 R4: The semantics of lexical flexibility

In this section I take a brief look at the semantics of lexical flexibility, in particular whether there are semantic commonalities to high or low flexibility words. I restrict myself here to aspects of the semantics of lexical items which can be discerned from the existing data and annotations used to answer other research questions for this project. Little additional data coding or annotation was done for the specific purpose of answering this research question. This section is therefore primarily exploratory, with the aim of discovering just what conclusions can be drawn about the semantics of lexical flexibility using merely the simple annotations of discourse functions prepared for this study. I begin with English before moving on to Nuuchahnulth.

4.6.1 English

The first observation about the semantics of lexical flexibility in English is purely anecdotal but nonetheless merits comment: the second most flexible word in the 100-item sample of English is *back*, used 272 times for reference, 54 times for predication, and 143 times for modification, with a flexibility rating of .844. Going into this study, I postulated that body part terms would display a high degree of flexibility. The motivation for this hypothesis is that body part terms commonly undergo metaphorical extension into other domains, and in general make themselves available for all sorts of extensions of meaning. This is undoubtedly due to the fact that our experience of the world is necessarily mediated through our own bodies (Lakoff & Johnson 1980). The methods I chose to adopt in dissertation prevented any detailed exploration of this hypothesis, but it is notable that the only body part term in either of the 100-item samples is one of the single most flexible items in this study, anecdotally supporting the hypothesis that body part terms are in general highly flexible.

Several semantic classes stand out as being among the lowest flexibility words in the 100-item English sample: indefinites; adult human animates (less so for non-adult humans, as the data for *child* shows); property words denoting size, age, or physical properties; and words of cognition and perception generally have flexibility ratings lower than 0.100, and most are within the 25 lowest flexibility words in the sample (exceptions are *feel*, *need*, and *wonder*). Indefinites in particular rank lowest among the ratings (all with a flexibility rating of 0). Table 4.3 shows the statistical data from the sample for each of the semantic classes just discussed, and their rank in terms of flexibility (out of the 100 items sampled). (Note that there are some ties for rank.)

It is easy to see why some of these classes of words would have such low flexibility ratings: each is highly prototypical of one particular discourse function. Adult human animates are one of the most prototypical classes of nouns crosslinguistically, while *thing* and its variants are the most generic terms there are for referents. Words denoting size, age, or physical

Table 4.3: Low-flexibility stems in English

Stem	Rel. Freq.	Disp.	Flex.	Ref.	Pred.	Mod.	Rank
Cognition & Perception							
need	0.833	0.501	0.220	164	2,475	3	43
wonder	0.206	0.793	0.194	26	589	4	46
feel	0.832	0.529	0.135	73	2,382	5	51
decide	0.242	0.752	0.097	3	652	10	57
think	6.477	0.262	0.060	162	20,089	58	66
consider	0.146	0.834	0.058	0	336	4	67
see	2.540	0.343	0.056	46	5,563	11	68
understand	0.275	0.724	0.053	4	752	3	71
want	1.552	0.374	0.037	7	4,899	23	75
know	13.729	0.214	0.030	7	11,496	51	76
hate	0.140	0.840	0.026	0	442	2	78
believe	0.312	0.709	0.014	0	953	2	81
enjoy	0.481	0.677	0.005	0	1,485	1	90
like	1.158	0.447	0.003	1	3,105	0	94
Human Animates							
child	0.784	0.677	0.326	2,165	0	283	28
woman	0.342	0.827	0.146	969	0	38	50
man	0.287	0.765	0.101	752	1	16	56
father	0.137	0.867	0.040	401	0	3	74
person	0.360	0.690	0.013	1,011	1	1	84
friend	0.390	0.653	0.012	1,237	1	1	85
husband	0.424	0.668	0.011	1,281	0	2	86
Indefinites							
anything	0.755	0.449	0.000	2081	0	0	94
everything	0.606	0.518	0.000	1960	0	0	94
something	1.665	0.341	0.000	5092	0	0	94
thing	3.277	0.267	0.000	10649	0	0	94
Property Words							
little	1.738	0.362	0.511	1,345	0	4,062	15
pretty	1.170	0.440	0.170	1	1	51	49
old	0.607	0.565	0.054	5	3	838	70
big	0.830	0.474	0.046	21	0	2,381	72
large	0.156	0.845	0.042	2	1	428	73
hard	0.486	0.587	0.000	0	0	380	94

properties are among the core semantic classes for modifiers crosslinguistically (Dixon 1977). It is entirely unsurprising that these categories of words would nearly always be construed by speakers in the discourse functions that they are the most prototypical exemplars of. At the same time, these data show that such classification is not absolute. Even words that are strongly prototypical of a given discourse function are still occasionally used for other functions.

It is less clear why words of cognition or perception have low flexibility ratings, except that in most cases there are corresponding overtly-derived referential terms which potentially block the use of the word as a referent: *enjoy* is blocked by *enjoyment*; *believe* is blocked by *belief*; *hate* is blocked by *hatred*; *know* is blocked by *knowledge*; and so on. These referential counterparts do not necessarily *prevent* the use of these stems as referents (e.g. *to be in the* ***know***), but they are likely a significant contributing factor. In fact, the highest flexibility words in this category are ones which do not have morphologically-derived counterparts: *feel*, *need*, and *wonder*. Farrell (2001: 111) reports finding the same pattern for English: unless a word is "pre-empted or blocked", it generally exhibits flexible behavior.

Regardless, it is unclear why these words have morphologically derived referential counterparts but most of the highest-flexibility words such as *paint*, *work*, *order*, and *transfer* do not.

4.6.2 Nuuchahnulth

When we look at the semantic classes that align with high and low flexibility in Nuuchahnulth, one class in particular stands out as being especially flexible: property-denoting words, and especially numerals and quantifiers. 12 of the top 20 most flexible stems in Nuuchahnulth are property words. With few exceptions, property-denoting words in Nuuchahnulth have high flexibility ratings, above 0.5. All of the core deictic stems in Nuuchahnulth also feature in the top 25 most flexible words. The statistical data for both these classes of stems, along with their rank in terms of flexibility, are listed in Table 4.4.

Table 4.4: High-flexibility stems in Nuuchahnulth

Stem	Gloss	Rel. Freq.	Disp.	Flex.	Ref.	Pred.	Mod.	Rank
Property Words								
hiš	all	0.956	0.580	0.985	3	3	2	1
ʔaƛakʷaɬ	eight	0.956	0.614	0.921	2	3	1	2
muː	four	0.837	0.755	0.921	2	3	1	3
čamiḥta	proper(ly)	0.717	0.566	0.921	2	3	1	4
ʔuːš	some	2.391	0.556	0.920	9	8	3	5
c̓awaːk	one	1.673	0.437	0.842	3	8	2	6
ƛaʔuː	another	2.271	0.322	0.835	11	6	2	7
hiːtkin	strange	0.717	0.773	0.790	1	4	1	8
ʔaƛa	two	1.434	0.423	0.783	1	7	3	9
ʔiːḥ	big	1.554	0.561	0.719	1	9	3	12
ʔaya	many	4.064	0.424	0.652	2	23	6	14
mixt	aged	0.478	0.886	0.631	2	2	0	21
ʔiːc̓im	old	0.598	0.801	0.613	2	3	0	29
Deictic Words								
ḥaːɬ	there	2.510	0.506	0.761	5	14	2	10
ʔaḥ	this	12.551	0.317	0.732	73	16	14	11
ʔaḥʔaː	that	12.790	0.275	0.672	55	48	1	13
ʔaḥkuˑ	right.here	0.717	0.688	0.631	3	3	0	20
hiɬ	there	6.216	0.393	0.606	20	32	0	30

What accounts for the consistently high flexibility rating for property words? Why is it that property words are so rigid in English yet so flexibile in Nuuchahnulth? First, Nuuchahnulth does not have any dedicated morphosyntactic constructions that express the function of modification, except that modifiers precede their head syntactically and take no inflectional affixes when they do so. Yet while this syntactic construction is available to speakers, its use is fairly uncommon. Instead, speakers avail themselves of two strategies for communicating property concepts: a) lexical affixation, and b) construing property concepts as either referents or predicates.

Wakashan languages and the languages of the Pacific Northwest in general are well known for their use of *lexical affixes*, affixes with concrete lexical meanings rather than grammatical / functional ones (Mithun 1997). Nuuchahnulth's large set of lexical suffixes allows speakers to use property-denoting roots in complex stems, where the root denotes the property being attributed, and the lexical suffix denotes the referent being modified. Example (37) shows two such uses of property-denoting roots.

(37) Nuuchahnulth (Wakashan > Southern Wakashan)

a. niyasu hihiqtup
ni-yasu· **hihiq**-tu·p
dip-in.water **all**-thing
sink.under.water everything
'everything was under the water' (Little 2003: Flood 027)

b. ʔaƛċiq
ʔaƛ-ċiq
two-canoes
two.canoes
'there were two boats' (Louie 2003: GL 099)

The use of property-denoting roots with lexical affixes is by far the most common strategy for attributing properties to referents in Nuuchahnulth. The choice between a bare modifier and the use of lexical affixes is intimately connected with information flow in discourse. Already-activated discourse referents are typically expressed through lexical affixes, whereas newly-introduced discourse referents are presented as independent noun phrases (Mithun 1984: 887–

889). Nakayama (2001: 144) also shows that referentiality is a key deciding factor between the two constructions.

The other manner by which speakers express property concepts is with either referring or predicating constructions. The fact that speakers use *either* referring or predicating constructions (as opposed to just referring constructions or just predicating constructions) likely has to do with the dual function of property concepts identified by Thompson (1989). In a corpus analysis of English and Mandarin, Thompson finds that property words have primarily two functions in discourse: to introduce new discourse-manipulable referents, and to predicate attributes of an already-known referent. In English these two functions are realized via attributive adjectives and predicative adjectives respectively. Nuuchahnulth appears to follow a similar pattern: when a property word is used to introduce a new referent into the discourse, it typically appears as an independent word modifying a nominal head. As with the English data from Thompson's (1989) study, the head is typically a semantically empty or generic referent whose primary function is to serve as a carrier of the property word. Example (38) demonstrates this phenomenon in Nuuchahnulth.

(38) Nuuchahnulth (Wakashan > Southern Wakashan)

a.

ʔatquu	**čamiḥta**	quuʔas	qawiqaaɬ
ʔat-quː	**čamiḥta**	quːʔas	qawiqaːɬ
even.if-COND.3	**proper**	person	Qawiqaalth
although	**proper**	person	Qawiqaalth

'although Qawiqaalth was a proper person' (Louie 2003: Qawiqaalth 011)

b.

ʔucḥinƛ	ƛuɬaqakʔi	ḥakʷaaƛ	muuḥinƛas
ʔu-cḥinƛ	**ƛuɬ**-aq-ak-ʔi·	ḥaːkʷaːƛ	muːḥinƛ-as
she-marry.to	**nice**-very-DUR-DEF	girl	sawbill-female
get.married.to	very.beautiful	girl	Sawbill.woman

'He got married to very beautiful Sawbill Woman' (Louie 2003: Mink 287)

By contrast, when a property is being predicated of an already-established discourse referent, the lexical affix strategy is used instead.

Returning to the discussion of semantic classes, if we focus on just the numerals, we find a potential trend: for the numerals 1–3, the flexibility of the stems decrease as their numeric

values increase. The cardinal numbers and their flexibility ratings are shown in numeric order in Table 4.5 for those stems that occur in the corpus. Given the low frequencies involved for these stems, it would be unwise to make strong claims about the potential trend in this table. The irregularity here is of course for the numerals 'four' and 'eight'. However, since all the instances of 'four' and 'eight' appear in the same text, the values for these stems may not be representative. As such, the data are potentially suggestive of the idea that cardinal numerals adhere to an implicational hierarchy, wherein the flexibility of a numeral decreases as its numeric value increases. If true, this trend would be in line with other well-documented implicational universals for cardinal numerals (Dehaene & Mehler 1992; Croft 2003: 141).

Table 4.5: Flexibility of numerals in Nuuchahnulth

Stem	Gloss	Rel. Freq.	Disp.	Flex.	Ref.	Pred.	Mod.
ċawaːk	one	1.673	0.437	0.842	3	8	2
ʔaƛa	two	1.434	0.423	0.783	1	7	3
qacċa	three	0.598	0.694	0.512	0	3	1
muː	four	0.837	0.755	0.921	2	3	1
ʔaƛakʷaɬ	eight	0.956	0.614	0.921	2	3	1

Much as in English, animate human beings are generally among the lower-flexibility stems in Nuuchahnulth (below 0.5), although their ratings are still higher than those for English. The animate human stems and their flexibility ratings are shown in Table 4.6. Of particular note is the fact that the word *quːʔas* 'person, man' has one of the lowest flexibility ratings in the Nuuchahnulth corpus (excluding those with ratings of zero). Yet this was the very stem that Swadesh (1939b) used to demonstrate Nuuchahnulth's extreme flexibility! This is an excellent example of why we need more empirical coverage for the study of lexical flexibility—this claim about the flexibility of the word 'person, man' in Nuuchahnulth has been repeated verbatim for nearly a century, but entirely unbacked by the kind of comprehensive data needed to support it. The marginal flexibility of 'person, man' and other human animates does however illustrate that even highly prototypical referents exhibit degrees of flexibility.

Because the Nuuchahnulth corpus is a fully glossed interlinear corpus, it is possible to

Table 4.6: Low-flexibility stems in Nuuchahnulth

Stem	Gloss	Rel. Freq.	Disp.	Flex.	Ref.	Pred.	Mod.
ɬuːcma	wife	2.988	0.559	0.477	18	5	0
ḥaẇiɬ	chief	4.184	0.549	0.417	26	6	0
ḥaːkʷa·ƛ	girl	2.869	0.868	0.158	23	1	0
quːʔas	person	9.682	0.341	0.106	78	2	0

answer certain questions that cannot be as easily answered for the English corpus. In particular, it is a fairly straightforward task to analyze relationships between specific kinds of morphemes and discourse function. Nuuchahnulth has a definite suffix *-ʔi·*, for example, which is sometimes said to have a disambiguating function (Mithun 1999: 60-63; Nakayama 2001: 48). In most cases, context and the meaning of the stem serve to disambiguate referential versus predicative uses of the same stem. However, in cases where a stem is non-prototypically serving as a referent, the definite suffix is more likely to appear.

I set out to investigate the possible connection between the use of the definite marker and non-prototypical uses of stems by examining the frequency with which the definite marker occurs with stems marked for different aspects. (Note that in Nuuchahnulth, aspect markers are not limited to just predicative stems. They may appear with referential uses of stems as well [Nakayama 2001: 47–48].) The intuition behind this procedure is that some Nuuchahnulth aspects, like the continuative or progressive aspects, are more prototypically predicative in their meaning than others, such as the durative or momentaneous aspects. Thus, I hypothesized that the definite marker would occur more frequently on continuative and progressive aspects than the durative or momentaneous aspects.

Unfortunately, there were insufficient data to answer this question. The reason the data are insufficient is telling, however. To begin with, the definite marker appears on 213 of the 1935 attested stems in the corpus (11.01%). However, only 17 of those stems (7.98%) also ever appear with an aspect marker (either continuative, durative, momentaneous, or telic). The dataset is simply too small to draw any conclusions about the interaction of definiteness and aspect. That said, the *near* mutually exclusive distribution of aspect markers and the definite

marker in Nuuchahnulth is noteworthy precisely because it provides additional support for Hopper & Thompson's (1984) claim that the prototypical uses of lexical items exhibit inflectional behaviors characteristic of their class. Even in a language with extensive flexibility like Nuuchahnulth, that flexibility is constrained by typological universals.

Chapter 5

Conclusion

This chapter summarizes the methods and main findings of this study, and the considers the implications of those results for theories of lexical categories. I argue that the data provide compelling evidence in favor of functional approaches to lexical categorization, most especially cognitive prototype theory and Croft's theory of lexical categories as typological markedness patterns. I also argue for a reversal of the canonical position on parts of speech: instead of working from the default assumption that all languages have clearly-defined or even loosely-defined parts of speech, we should begin from the understanding that dedicated referring, predicating, or modifying constructions develop diachronically, and that even when they do, they do not do so for the entire lexicon, or in all areas of the grammar equally. Even languages like English, whose lexemes pattern strongly with the standard prototypes of noun, verb, and adjectives, nonetheless exhibit varying degrees of flexibility for different lexemes. Lexical categories are not a given in grammar. I conclude by discussing some limitations of the present study and avenues for future research, followed by closing remarks.

5.1 Introduction

This chapter presents a summary of the study and its major findings (Section 5.2). It provides a discussion of the theoretical implications of those findings (Section 5.3) and directions for future research (Section 5.4). I conclude that researchers should shift from treating lexical flexibility as an exotic analytical problem to a foundational feature of language (Section 5.5).

Lexical flexibility—the use of a lexical item in more than one discourse function (reference, predication, or modification) with no overt derivational morphology—has historically been

an intractable problem for theories of parts of speech. The Classical tradition inherited from Ancient Greek and Latin requires that each lexeme be sorted into mutually exclusive lexical categories defined by a clear set of necessary and sufficient conditions. Forms that seem to cross-cut these categorial boundaries thus present a theoretical quandry.

One common solution to this problem is to analyze any form used for more than one discourse function as a case of heterosemy—a special case of homonymy in which two lexemes share the same form but belong to distinct word classes (Lichtenberk 1991). A second common solution is to adjust the features that define the relevant word classes so as to preserve the traditional classification scheme. This always involves privileging certain kinds of evidence for lexical categories over others, or excluding certain morphosyntactic evidence entirely. A final solution is to define new kinds of lexical categories such as "contentives", "flexibles", or "non-verbs" (Hengeveld & Rijkhoff 2005; Luuk 2010) for the purpose of accommodating the flexible forms.

What these approaches have in common is their commitment to a small set of well-defined word classes. They also generally agree on the empirical facts of the matter. Disagreements over the analysis of flexible forms arise primarily from disagreements over the relative importance of different pieces of evidence rather than the accuracy of the evidence itself (Wetzer 1992: 235; Stassen 1997: 32; Croft & van Lier 2012: 58). Yet, though researchers have debated the definitional criteria for lexical categories for as long as modern linguistics has existed, there is still no consensus. Analyses of lexical flexibility depend primarily on the theoretical commitments of the researcher rather than any crucial pieces of evidence. Methodological opportunism, in which researchers select the definitional criteria for lexical categories that best support their theoretical commitments while dismissing or deemphasizing contradictory criteria (Croft 2001b: 30), is a rampant problem in research on word classes.

A consequence of this methodological opportunism is that until recently lexical flexibility was not appreciated as the interesting phenomenon it is. Flexible forms were placed into one lexical category or another and the problem was considered solved. But to lump flexible

forms in with overtly derived forms ignores the fact that there is something unique about them—namely that they can appear in different discourse functions with no overt derivational morphology. Just how prevalent is this phenomenon? Why do these words in particular behave this way while others do not? How productive is it? Are the meaning shifts that occur in functional shift different from or the same as the meaning shifts that occur in cases of overt derivation? An attitude that treats flexible forms as a problem to be solved preempts these kinds of questions—or at least shifts focus away from them. Regardless of one's theoretical analysis of flexible forms, their behavior is substantively different from non-flexible ones, and this fact merits investigation.

In the past three decades, however, more and more researchers have come to treat lexical flexibility as an object of study in its own right and attempted to answer questions like the ones above. The theoretical perspectives on lexical flexibility remain every bit as varied as before, with some researchers fitting flexible forms into the Classical categories (M. C. Baker 2003; Dixon 2004; Floyd 2011; Chung 2012; Palmer 2017), other researchers proposing new ones (Hengeveld & Rijkhoff 2005; Luuk 2010), and still other researchers abandoning the commitment to lexical categories entirely (Gil 1994; Broschart 1997; Gil 2005). Nonetheless, more and more scholars are interested in how lexical flexibility operates within and across languages, as evidenced by the growing number of edited volumes on the topic (Vogel & Comrie 2000; Lois & Vapnarsky 2003; Evans & Osada 2005; Ansaldo, Don & Pfau 2010; Rijkhoff & van Lier 2013; Simone & Masini 2014; Błaszczak, Klimek-Jankowska & Migdalski 2015; van Lier 2017; Vapnarsky & Veneziano 2017b,a; Cuyckens, Heyvaert & Hartmann 2019).

Our understanding of lexical flexibility has, however, still been quite limited. In particular, we knew little about the extent of lexical flexibility within and across languages, and whether there are semantic commonalities among flexible items. This dissertation makes a first contribution to addressing these questions, as described in the following section.

5.2 Summary of the study

This dissertation is a quantitative corpus-based study of lexical flexibility in English (Indo-European > Germanic) and Nuuchahnulth (Wakashan > Southern Wakashan). It has focused on answering the following four research questions using corpora of naturalistic spoken data from each language:

R1: How flexible are lexical items in English and Nuuchahnulth?

R2: Is there a correlation between degree of lexical flexibility and size of the corpus?

R3: Is there a correlation between degree of lexical flexibility for a lexical item and frequency (or corpus dispersion)?

R4: How do the semantic properties of lexical items pattern with respect to their flexibility?

Answering R1 required establishing a means of measuring the degree of lexical flexibility for individual lexical items in a language. This metric needed to be able to capture the intuition that lexical items which are used equally as frequently for different discourse functions are maximally flexible, while lexical items which are used for only one discourse function are minimally flexible. To do this, I first counted the number of times each stem was used for the discourse functions of reference, predication, and modification in samples of spoken discourse from English and Nuuchahnulth. I then used a statistical diversity measure (the Shannon diversity index [Shannon 1948; 1951]) to calculate how evenly the three discourse functions are distributed across its tokens. This resulted in a flexibility rating for each stem ranging from 0 (maximally inflexible) to 1 (maximally flexible). These ratings are provided for each stem in both samples in Appendix B.

Determining the flexibility ratings for the lexical items in a corpus allows us for the first time to study the extent of lexical flexibility in a comprehensive and empirically accountable way. It was found that the overwhelming majority of English stems exhibit some degree

of flexibility. That degree of flexibility is generally small (~ 0.2), but not so small as to be statistically insignificant. English stems are usually slightly flexible. They tend to have clear prototypes focused around a single discourse function, but regularly display marginal uses in other discourse functions as well. These data present a more complicated picture of English than has previously been claimed. It is not wholly accurate to say that English has clear and rigid lexical categories (Rijkhoff 2007: 710; Schachter & Shopen 2007: 4, 11, 12; Velupillai 2012: 122, 126), but nor is it accurate to say that English exhibits rampant flexibility between different discourse functions (Crystal 1967: 47–48; Vonen 1994; Croft 2000: 75–76; 2001b: 69; Farrell 2001; Cannon 1985).

Lexical items in Nuuchahnulth differ from English both in their average degree of flexibility and the way that flexibility is realized. Stems in Nuuchahnulth typically have a high degree of flexibility ~ 0.6, but that flexibility is primarily between reference and predication. Most Nuuchahnulth stems sit somewhere on a spectrum between all referential uses and all predicative uses, with a relatively smooth cline of attested cases between. Nuuchahnulth stems are infrequently used for modification. These findings align well with existing claims about the language. Many have analyzed Nuuchahnulth as lacking an adjective class (or as having a subclass of verbs called "adjectives") (Swadesh 1939b; Jacobsen 1979; Nakayama 2001), and the fact that Nuuchahnulth does not show a clean division between predicating stems and referring stems is preicsely what has garnered the language (and other, similar languages of the Pacific Northwest) so much attention in the literature.

The second question addressed in this dissertation is whether the degree of lexical flexibility for a language or its lexemes correlates with the size of the corpus examined R2. The motivation for this question stems from the intuition, advanced by some researchers (Mosel & Hovdhaugen 1992), that all lexical items exhibit flexibility if one examines enough tokens of that lexeme in a corpus. Larger corpora could potentially exhibit more flexibility than smaller corpora. If true, this could mean that the lexical flexibility metric developed in Section 3.4.1 needs to be adjusted for corpus size.

To investigate this question, I determined the cumulative flexibility for individual stems in English and Nuuchahnulth as the number of tokens encountered increased. I also ran this procedure in the aggregate, calculating the cumulative flexibility for the entire language as the size of the corpus used grew. No notable correlations were found in either case. Lexical flexibility ratings for both stems and languages remained flat as the size of the corpus grew. However, this procedure did reveal that it takes a certain minimal number of tokens for one to be certain that they are getting a reliable flexibility rating, and that this minimum varies from word to word. Some stems show notable stochasticity in their flexibility ratings up to ∼2,000 tokens, whereas others show a smooth and consistent flexibility rating as early as ∼50 tokens. The reason for this variation is not entirely clear, but may be due to the fact that some stems occur in a wider range of syntactic contexts than others, and therefore it takes a larger sample for their average flexibility across these uses to become clear.

In sum, the flexibility of a language or lexeme does not vary as a function of corpus size. Flexibility is synchronically fixed on a per-lexeme basis. This fact is likely a result of the fact that the different discourse contexts in which a lexical item can appear are largely conventionalized. Speakers have item-specific knowledge about which discourse functions a stem can (or cannot) be used in. Some stems have a greater proportion of contexts for one discourse function over others, thus explaining inter-word variation in flexibility ratings.

For R3, I explored the interactions among lexical flexibility, relative frequency (per 1,000 words), and corpus dispersion (how evenly distributed a lexical item is in the corpus, measured using Deviation of Proportions; [Gries 2008]). There are multiple ways in which flexibility might be hypothesized to correlate with frequency. First, it might be that a higher degree of flexibility makes stems available to a greater number of discourse contexts, thus leading to increased frequency. Conversely, high frequency words are more cognitively accessible and therefore might make themselves available for more novel uses in different discourse functions. Alternatively, high frequency could also result in a greater degree of entrenchment, such that high frequency words are less flexible than low frequency ones. We have no apriori

reason for assuming one of these positions to be true—this is an empirical question requiring an empirical answer.

Corpus frequency itself, however, is perhaps not the best way to capture the idea of how regularly a speaker encounters lexical items. The main reason for this is that tokens of a lexeme may be clustered in just a small number of places in a corpus rather than evenly distributed throughout the corpus. Corpus dispersion—how evenly a word is distributed in a corpus—more closely aligns with our intuitions about what we are attempting to capture when we talk about frequency of exposure. Corpus dispersion has been shown to correlate more closely with various experimental results than does token frequency (Gries 2008; 2010; forthcoming). In this study I therefore examined the interactions among all three of flexibility, frequency, and dispersion.

For English, no significant correlations were found among the three variables. For Nuuchahnulth I found a highly significant correlation between higher frequency and greater flexibility. The combined interaction of frequency and corpus dispersion also significantly correlates with flexibility. However, given the relatively low frequencies involved for most of the items in the Nuuchahnulth corpus, I hesitate to draw any firm conclusions regarding the interaction of the three variables. It would also be strange if frequency or dispersion correlated strongly with flexibility in some languages but not others, since none of the putative explanations for this trend (discussed in Section 4.5) are not language-specific. It is more likely that these results are simply skewed by the large number of Nuuchahnulth stems with zero-flexibility ratings, a fact which is itself almost certainly due to the small size of the corpus (since nearly all Nuuchahnulth stems with a relative frequency greater than 2.5 display a degree of flexibility). The trends in the Nuuchahnulth data appear to be an artifact of the fact that many of the stems in the Nuuchahnulth sample simply do not appear enough times in the corpus to show a reliable flexibility rating, as discussed in Section 4.4.

Finally, R4 is a preliminary exploration of the semantics of lexical flexibility. Since the stems in either sample were not annotated in any comprehensive way for semantic class, these

results should be taken as preliminary observations in need of further empirical support. With this caveat in mind, human animates were consistently among the low-flexibility items in both languages, undoubtedly a reflection of their highly prototypical status as discourse referents. Prototypical property words, however, showed opposite patterns in the two languages. In English, property words having to do with size, age, or physical attributes have consistently low flexibility ratings, yet in Nuuchahnulth property words are by far the most flexible items.

An explanation in terms of prototypicality cannot account for this difference. Instead, it seems that the discrepancy has to do with the existence or non-existence of dedicated morphosyntactic constructions for modification in each language. While not robustly marked, English does have morphological constructions specific to modification (comparatives and superlatives). Nuuchahnulth, on the other hand, has no morphology dedicated to modification, just a conventionalized syntactic construction in which the modifier precedes its head. Some linguists analyze Nuuchahnulth as lacking an adjective class entirely (Nakayama 2001). Since English has dedicated modifying constructions, speakers make use of those constructions for prototypical property words. But since Nuuchahnulth does not have dedicated modifying constructions, speakers avail themselves of other strategies that vary depending on the discourse context. When property words are used to introduce a new referent into the discourse, referring constructions are used (usually with the definite suffix *-ʔiˑ*); when property words are used to attribute a property to an existing referent, predicate constructions are used (often with the durative aspect marker), and the referent serves as the subject of the predicate. This dichotomy nicely parallels the dual discourse function of property words described by Thompson (1989) for English and Mandarin. Building on the predicate strategy, Nuuchahnulth speakers also have the option of attributing properties to referents via a combination of a root indicating a property and a lexical affix indicating the referent that the property is being attributed to. This strategy is most common when the referent is indefinite or non-identifiable (Nakayama 2001: 144).

A last observation for Nuuchahnulth is that, while object words *may* take aspect mark-

ers and action words *may* take the definite suffix *-ʔiˑ*, these two inflectional markers are almost entirely mutually exclusive, co-occurring on only 17 wordforms out of the 1,935 attested wordforms in the corpus (0.88%). Despite Nuuchahnulth's extensive flexibility, the language still adheres to the crosslinguistic tendency described by Hopper & Thompson (1984) for prototypical uses of a lexical item to exhibit inflectional behaviors characteristic of its class. This shows that there are still principled limits on lexical flexibility, even in highly flexible languages like Nuuchahnulth.

5.3 Discussion

The primary motivation behind this study was to expand the empirical coverage on lexical flexibility. Much has been written about lexical flexibility in the last three decades especially, but as yet there have been few attempts at comprehensive empirical reporting on the phenomenon (exceptions being [Croft 1984; Cannon 1985; Evans & Osada 2005; Mithun 2017]). This dissertation is a first quantitative report on lexical flexibility in discourse. What have we learned?

First, it is possible to quantify the degree of lexical flexibility for both languages and individual lexical items in a way that maps to our conception of what lexical flexibility is. By using a diversity index like Shannon's H we can compare flexiiblity across lexical items and languages in a meaningful way.

Second, we have seen that lexical flexibility is a matter of degree at both the word and language level. The difference between English and Nuuchahnulth in terms of their flexibility is a matter of degree rather than a difference in kind. Ultimately, both English and Nuuchahnulth display a prominent degree of flexibility—Nuuchahnulth merely displays it to a greater extent than English. The two languages also display that flexibility in different ways. English shows a relatively marginal degree of flexibility for most of its lexemes, whereas Nuuchahnulth shows a relatively high degree of flexibility for most of its lexemes, but primarily

between reference and predication, not modification. At a high level, what this also shows is that languages differ in the degree to which individual lexemes are associated with specific, mutually exclusive discourse functions. In a language like English, lexemes tend to be strongly associated with a single discourse function, while less commonly but still frequently allowing for use in other functions. In a language like Nuuchahnulth, lexemes sit anywhere on a continuum of associating more strongly with reference versus predication, but few show a strong degree of association with modification.

The data presented in this dissertation therefore provide strong empirical support of Nakayama's (2001: 50) claim that lexical categories in Nuuchahnulth are best described as statistical tendencies in discourse rather than clearly-defined morphosyntactic classes. Yet this analysis is equally valid for English and Nuuchahnulth; English lexemes merely display a stronger statistical tendency towards a single discourse function than do Nuuchahnulth lexemes. In fact, given the fact that mental categorization is prototypal and that morphosyntactic constructions dedicated to specific discourse functions take time to develop (see Chapter 2), it is sensible to assume that *all* languages operate in this way. Lexemes should be described in terms of the range of contexts they appear in and how frequently they appear in those contexts, rather than as rigidly belonging to one class of words or another.

A third finding from this dissertation is that there are also principled limits on flexibility. For starters, the degree of flexibility for any given lexical item appears to be synchronically fixed. Speakers know the range of contexts that a given form may appear in and use it that way. They do not appear to be productively using forms for new discourse contexts all the time as the situation dictates. If this were the case, we would a) expect a higher overall degree of flexibility even for a language like Nuuchahnulth, and b) might expect to see a great deal more stochasticity in the cumulative flexibility ratings for a form (see Section 4.4). It would also be difficult to explain why some forms display greater or lesser flexibility than others. Instead, it appears that forms are conventionally used for certain functions, with individual lexemes varying as to which and what range of functions they are conventionalized in.

Lexical flexibility also adheres to well-established crosslinguistic patterns. The fact that human animates are among the lowest flexibility items in both English and Nuuchahnulth is consistent with the hypothesis of frequential markedness, wherein lexemes are used most frequently in their most prototypical function (Croft 1991; 2000; 2001b; Croft & van Lier 2012). Additionally, the near-mutually exclusive nature of definite marking and aspect marking in Nuuchahnulth shows that even extremely flexible languages nonetheless adhere to the pattern that prototypical uses of a word are more likely to exhibit inflectional marking characteristic of their class (and by extension, that non-prototypical uses are less likely to show such inflection) (Hopper & Thompson 1984).

Overall, the findings in this dissertation confirm much of what we thought we knew about lexical flexibility and its behavior in individual languages. Researchers have noted the flexibility of Nuuchahnulth—particularly between reference and predication—for almost a century, and the data have shown this impression to be true. Researchers generally see English lexical categories as fairly well defined, but acknowledge the many cases of functional shift as well. Again, the data show this impression to be correct. We can now say for the first time that these impressions are indeed backed by quantitative empirical evidence. The methods in this dissertation open the door to exploring all sorts of other questions about lexical flexibility in an empirically rigorous way, which I now turn to in the following section.

5.4 Limitations & future research

By far the biggest limitation of this study was the size of the two corpora utilized. For English, the limiting factor was how large the corpus is, while for Nuuchahnulth the limiting factor was how small the corpus is. In total I manually annotated approximately 380,000 tokens of English for the 100-item sample, a process which took about three months of regular work. Obviously, scaling this to additional words or corpora would require a huge investment of person-hours, but this is the logical next step. We could gain a much more comprehensive

picture of English by looking at a 1,000-item sample, for example, perhaps carefully sampled from different semantic classes of words.

While the Nuuchahnulth corpus is sizeable for a documentary corpus (∼8,300 tokens), Zipf's law entails that the frequencies of most items in a corpus of that size will nonetheless be quite low. Fortunately, other corpora of Nuuchahnulth exist. Nakayama (2001) mentions that he recorded other texts not included in Little (2003) or Louie (2003). Sapir & Swadesh (1939) also collected an extensive collection of texts in Nuuchahnulth. Typing up this corpus for digital annotation and searching would only take a few weeks (it took me approximately four weeks to type the entire Nakayama corpus), and would result in a significantly larger corpus, and a more accurate picture of flexibility in Nuuchahnulth.

The fact that the Nuuchahnulth corpus contains interlinear glossing also makes it possible to investigate a wide range of research questions unavailable to flat corpora like the OANC. Thanks to Nakayama's detailed analysis, future research can explore the correlations between flexibility or discourse function and any kind of morphological marking. One could explore, for example, whether different kinds of aspect marking correlate more strongly with certain discourse functions over others. For many languages, it is also possible to do some automated annotation of discourse function based purely on morphological criteria. If it is known that a given morpheme in a language is only ever used in one discourse function, than researchers can programmatically annotate every token containing that morpheme, saving a good deal of manual annotation. Interlinearized glossed documentary corpora are thus highly compatible with research into lexical flexibility.

There are a few other obvious ways in which to expand the empirical coverage on lexical flexibility. First, we can examine additional languages. It is my hope that other researchers will adopt the quantitative methods presented in Chapter 3 and apply them to the investigation of a range of languages. A few in particular would be excellent choices:

- **Cayuga** has been the center of a debate on lexical flexibility (H. J. Sasse 1988; H.-J. Sasse 1993; Mithun 2000).

- **Classical Nahuatl** is famously claimed to exhibit omnipredicativity (Launey 1994; 2004). It is worth investigating this empirically to see just how often stems are used to predicate in the language.
- **Latin** is the idealized model of a language with rigid parts of speech. It would be interesting to see whether lexical categories are as inflexible in the language has is generally assumed.
- **Mandarin** is a strongly isolating language with few morphological indications of discourse function, sometimes claimed to lack parts of speech (McDonald 2013; Sun 2020).
- **Riau Indonesian** is claimed to have no parts of speech whatsoever (Gil 1994), but this has not yet been shown in a comprehensive way.
- **Swahili** and other Bantu languages seem to show a great deal of referent-predicate flexibility for stems, but have never to my knowledge been discussed in the literature on lexical flexibility.
- **Spanish and French** are both generally thought to display little to no flexibility, but hardly any work has been done to show this (though see [Kihm 2017]).
- **Pacific Northwest** languages all show similar tendencies to Nuuchahnulth according to the existing literature. It would be interesting to see whether they do in fact pattern in similar ways.

Examining a range of languages like this also allows for the investigation of any correlations between flexibility and morphological type, potentially answering such questions as, "Are isolating languages more flexible than synthetic ones?". (Vonen (1994) argues, for example, that typological similarities between English and Tokelau account for the fact that both languages are fairly flexible.)

Another way that, in retrospect, I wish I had extended the empirical coverage for this study is to include adverbial (predicate modifying) uses of stems as well. I suspect that the overall flexibility rating of English may have been significantly lower had predicate modifiers been included in the analysis. I recommend that any future researchers include this category in their analysis as well. This does not affect the calculation of the flexibility rating for each stem in any meaningful way: the number of levels will simply be 4 instead of 3. Shannon's H should still be an accurate representation of the functional diversity of each stem when applied in this way.

Other research desiderata would require additional coding than what was done here. For example, a more thorough investigation of the semantics of lexical flexibility would require tagging each stem for its semantic class(es) and/or features. One could also investigate the effect of blocking (the existence of an overtly-derived form which preempts the use of a stem in that discourse function) by annotating each stem for whether an overtly-derived counterpart exists. I suspect that the flexibility ratings for blocked forms will be very low but not necessarily zero (as evidenced by the fact that one can use *know* as a referent in English despite the existence of the potential blocker *knowledge*).

I also believe that one of the most important areas in need of investigation is the diachrony of lexical flexibility. Since competing diachronic forces can change the overall flexibility of a language in either direction, it is important to understand exactly how these changes take place. Studies that examine the trajectory of individual lexemes and how their flexibility evolved over time would be especially valuable. The long history of written documentation for English and other European languages also makes it possible to determine whether languages change significantly in their overall flexibility over time. One could study this by comparing the flexibility of corpora of Old English with Modern English, or Old French with Modern French. Some work has already been done in this area (Cannon 1985: 414; Kastovsky 1996), suggesting that English has become more flexible over time, starting with the paradigm leveling that took place in Middle English. Within English, one could also compare the flexibility of words of Germanic origin with words of Romance origin, to see if there are notable flexibility effects based on source language.

The number of research questions this project spawned is vastly greater than the ones addressed in this dissertation itself. However, I hope I have shown that it is possible to answer these questions in an empirically adequate way, using the methodological foundations set forth here.

5.5 Conclusion

This dissertation makes three primary contributions, one methodological, one theoretical, and one empirical. The methodological contribution is the creation of a metric for measuring the lexical flexibility of individual lexemes in a language, using the Shannon diversity index. This metric nicely captures the intuition behind lexical flexibility in a way that can be consistently applied across lexemes and languages. Theoretically, I have argued for a reversal of the canonical position on parts of speech. Rather than viewing lexical flexibility as something exotic, and as a problem for theories of lexical categories, I argue that lexical flexibility is a fundamental design feature of language. Lexical flexibility exists in all cases where a language has yet to develop dedicated morphosyntactic constructions for different discourse functions, or where diachronic changes in the language have leveled such distinctions over time. Finally, the empirical contribution of this thesis is a first comprehensive understanding of just how lexical flexibility operates in English and Nuuchahnulth.

Appendices

Appendix A

Early grammatical descriptions

The table below contains publication information on some of the first grammatical descriptions of languages other than Latin and Greek.

Table A.1: Some first grammatical descriptions of European vs. American languages

Language	Year	Title	Author
Irish	600s	*Auraicept na n-Éces* 'The scholars' primer'	Longarad
Occitan	1327	*Leys d'amors* 'Laws of love'	Guilhèm Molinièr
Welsh	1382–1410	*Llyfr Coch Hergest* 'Red book of Hergest'	unknown
Tuscan	1437–1441	*Grammatica della lingua toscana* 'Grammar of the Tuscan language'	Leon Battista Alberti
Castilian	1492	*Gramática de la lengua castellana* 'Grammar of the Castilian language'	Antonio de Nebrija
French	1530	*L'Éclaircissement de la langue francoyse* 'Explication of the French language'	John Palsgrave
German	1534	*Ein Teutsche Grammatica* 'A German grammar'	Valentin Ickelsamer
Basque	1545	*Linguæ Vasconum Primitiæ* 'First fruits of the Basque language'	Bernard Etxepare

Table A.1: Some first grammatical descriptions of European vs. American languages

Language	Year	Title	Author
Totonac	1539–1554	*Arte de la lengua totonaca* 'Grammar of the Totonac language'	Andrés de Olmos
Nahuatl	1547	*Arte para aprender la lengua mexicana* 'Grammar for learning the Mexican language'	Andrés de Olmos
Tarascan	1558	*Arte de la lengua tarasca de Michoacán* 'Grammar of the Tarascan language of Michoacán'	Maturino Gilberti
Dutch	1559	*Den schat der Duytsscher Talen* 'The treasure of the Dutch language'	John III van de Werve
Quechua	1560	*Grammatica o arte de la lengua general de los Indios de los Reynos del Peru* 'Grammar or Art of the General Language of the Indians of the Royalty of Peru'	Domingo de Santo Tomás
Tzeltal Maya	1571	*Ars Tzeldaica* 'Tzeltal Grammar'	Fray Domingo de Hara
Zapotec	1578	*Arte en lengua Zapoteca* 'Grammar in the Zapotec language'	Juan de Córdova
English	1586	*Pamphlet for Grammar*	William Bullokar
Mixtec	1593	*Arte de lengua Mixteca* 'Grammar of the Mixtec language'	Antonio de los Reyes
Timucua	1614	*Gramatica de la lengua Timuquana de Florida* 'Grammar of the Timucua language of Florida'	Francisco Pareja
Narragansett	1643	*A key into the language of America*	Roger Williams

Appendix B

100-item samples

Table B.1 and Table B.2 list various statistics for each lexical item in the 100-item samples of English and Nuuchahnulth, respectively. See Chapter 3 for how these samples were selected and their accompanying statistics calculated.

B.1 English

Table B.1: Corpus statistics for the 100-item English sample

Stem	Frequencies		Flexibility	Dispersion	Frequencies			Dispersions (DP)		
	Raw	Relative	(Shannon's H)	(DP)	Reference	Predication	Modification	Reference	Predication	Modification
able	1207	0.371	0.000	0.650	0	0	5	—	—	0.998
anything	2458	0.755	0.000	0.449	2081	0	0	0.488	—	—
area	1544	0.474	0.027	0.652	1526	0	7	0.656	—	0.997
away	1208	0.371	0.000	0.636	5	0	0	0.997	—	—
back	3757	1.154	0.844	0.411	272	54	143	0.886	0.974	0.941
believe	1014	0.312	0.014	0.709	0	953	2	—	0.723	0.999
best	777	0.239	0.537	0.742	201	0	526	0.915	—	0.807
big	2701	0.830	0.046	0.474	21	0	2381	0.991	—	0.489
bill	328	0.101	0.127	0.920	310	10	0	0.923	0.997	—
business	629	0.193	0.517	0.818	460	0	158	0.852	—	0.945

Table B.1: Corpus statistics for the 100-item English sample

Stem	Frequencies		Flexibility	Dispersion	Frequencies			Dispersions (DP)		
	Raw	Relative	(Shannon's H)	(DP)	Reference	Predication	Modification	Reference	Predication	Modification
central	53	0.016	0.091	0.977	1	0	48	0.999	—	0.978
certain	733	0.225	0.018	0.767	2	0	706	0.999	—	0.775
child	2551	0.784	0.326	0.677	2165	0	283	0.682	—	0.954
come	5446	1.673	0.255	0.330	64	4528	263	0.969	0.351	0.881
consider	474	0.146	0.058	0.834	0	336	4	—	0.874	0.998
day	3082	0.947	0.329	0.478	2577	0	343	0.491	—	0.945
decide	789	0.242	0.097	0.752	3	652	10	0.999	0.780	0.996
different	2130	0.654	0.012	0.524	3	0	1705	0.999	—	0.580
difficult	380	0.117	0.000	0.868	0	0	54	—	—	0.978
door	430	0.132	0.093	0.866	420	0	9	0.868	—	0.996
down	3369	1.035	0.277	0.457	1	0	10	0.999	—	0.995
end	1368	0.420	0.721	0.614	604	693	34	0.781	0.766	0.987
enjoy	1565	0.481	0.005	0.677	0	1485	1	—	0.686	0.999
everybody	1228	0.377	0.302	0.635	1044	120	0	0.671	0.939	—
everything	1971	0.606	0.000	0.518	1960	0	0	0.520	—	—
fan	217	0.067	0.067	0.942	211	0	3	0.942	—	0.998
father	447	0.137	0.040	0.867	401	0	3	0.875	—	0.999
feel	2707	0.832	0.135	0.529	73	2382	5	0.971	0.549	0.997
figure	577	0.177	0.378	0.788	50	384	5	0.977	0.840	0.998
first	2130	0.654	0.328	0.498	178	0	1345	0.924	—	0.609
five	2222	0.683	0.302	0.512	141	0	1226	0.938	—	0.631
four	1757	0.540	0.301	0.578	140	0	1223	0.939	—	0.660
friend	1270	0.390	0.012	0.653	1237	1	1	0.658	0.999	1.000
fun	913	0.280	0.594	0.761	267	0	149	0.895	—	0.943
good	6868	2.110	0.175	0.355	196	0	3888	0.925	—	0.410
grow	1227	0.377	0.310	0.701	3	885	96	0.999	0.757	0.950
hard	1583	0.486	0.000	0.587	0	0	380	—	—	0.868
hate	455	0.140	0.026	0.840	0	442	2	—	0.845	0.999
here	4859	1.493	0.055	0.425	451	5	0	0.841	0.997	—
house	2159	0.663	0.182	0.668	1994	3	98	0.682	0.998	0.964
husband	1381	0.424	0.011	0.668	1281	0	2	0.679	—	0.999
idea	826	0.254	0.009	0.736	823	0	1	0.737	—	1.000
important	590	0.181	0.063	0.839	2	0	151	0.999	—	0.942

Table B.1: Corpus statistics for the 100-item English sample

Stem	Frequencies		Flexibility	Dispersion	Frequencies			Dispersions (DP)		
	Raw	Relative	(Shannon's H)	(DP)	Reference	Predication	Modification	Reference	Predication	Modification
job	1283	0.394	0.239	0.693	1185	0	94	0.701	—	0.971
know	44687	13.729	0.030	0.214	7	11496	51	0.998	0.265	0.977
large	509	0.156	0.042	0.845	2	1	428	0.999	0.999	0.868
like	3768	1.158	0.003	0.447	1	3105	0	0.999	0.505	—
little	5657	1.738	0.511	0.362	1345	0	4062	0.610	—	0.409
live	3399	1.044	0.349	0.480	132	2626	148	0.946	0.529	0.938
look	3614	1.110	0.263	0.432	89	2713	103	0.965	0.470	0.945
make	5712	1.755	0.129	0.352	25	4029	91	0.991	0.387	0.960
man	933	0.287	0.101	0.765	752	1	16	0.805	0.999	0.994
manage	150	0.046	0.195	0.943	1	119	5	0.999	0.953	0.997
money	2293	0.704	0.066	0.622	2220	1	29	0.625	1.000	0.988
more	6191	1.902	0.545	0.355	1294	12	3500	0.606	0.994	0.429
move	1267	0.389	0.236	0.678	41	948	18	0.982	0.738	0.994
much	5470	1.680	0.429	0.330	3240	15	640	0.406	0.993	0.765
name	922	0.283	0.485	0.755	755	66	70	0.781	0.971	0.969
need	2711	0.833	0.220	0.501	164	2475	3	0.943	0.517	0.999
never	3024	0.929	0.725	0.441	2	10	2	0.999	0.995	0.999
old	1977	0.607	0.054	0.565	5	3	838	0.998	0.998	0.749
one	13052	4.010	0.571	0.245	8384	1	3944	0.310	1.000	0.368
order	300	0.092	0.691	0.893	92	65	3	0.969	0.973	0.999
other	4845	1.488	0.441	0.338	895	0	3841	0.683	—	0.370
paint	490	0.151	0.919	0.954	131	139	47	0.981	0.976	0.986
pay	2979	0.915	0.322	0.648	89	1789	80	0.971	0.701	0.975
person	1171	0.360	0.013	0.690	1111	1	1	0.698	1.000	1.000
pretty	3808	1.170	0.170	0.440	1	1	51	1.000	1.000	0.978
problem	2429	0.746	0.016	0.548	2422	0	6	0.549	—	0.997
put	3571	1.097	0.109	0.458	16	2288	36	0.994	0.522	0.980
real	3500	1.075	0.010	0.434	0	1	655	—	0.999	0.765
right	9104	2.797	0.680	0.308	312	7	305	0.918	0.997	0.880
run	1662	0.511	0.509	0.608	97	1038	106	0.964	0.702	0.955
say	8784	2.699	0.095	0.303	45	7385	96	0.981	0.324	0.956
see	8267	2.540	0.056	0.343	46	5563	11	0.991	0.395	0.994
seven	695	0.214	0.361	0.767	54	0	344	0.976	—	0.868

Table B.1: Corpus statistics for the 100-item English sample

Stem	Frequencies		Flexibility	Dispersion	Frequencies			Dispersions (DP)		
	Raw	Relative	(Shannon's H)	(DP)	Reference	Predication	Modification	Reference	Predication	Modification
six	1185	0.364	0.288	0.648	81	0	760	0.960	—	0.733
something	5418	1.665	0.000	0.341	5092	0	0	0.347	—	—
sound	1150	0.353	0.268	0.679	54	1048	24	0.974	0.702	0.992
stick	377	0.116	0.670	0.853	33	182	28	0.985	0.922	0.987
take	6186	1.900	0.066	0.341	21	4570	34	0.991	0.374	0.985
talk	3308	1.016	0.247	0.420	58	1974	70	0.975	0.528	0.969
thing	10666	3.277	0.003	0.267	10649	4	0	0.267	0.998	—
think	21082	6.477	0.060	0.262	162	20089	58	0.930	0.267	0.970
three	2560	0.786	0.338	0.477	269	1	1964	0.897	0.999	0.524
time	7523	2.311	0.071	0.309	7310	11	93	0.313	0.996	0.957
transfer	80	0.025	0.662	0.968	7	49	9	0.996	0.978	0.997
try	3814	1.172	0.195	0.407	28	2764	109	0.986	0.454	0.951
two	4232	1.300	0.419	0.383	648	0	3106	0.764	—	0.424
understand	896	0.275	0.053	0.724	4	752	3	0.998	0.756	0.999
want	5053	1.552	0.037	0.374	7	4899	23	0.997	0.379	0.989
watch	2134	0.656	0.226	0.730	36	1329	40	0.986	0.793	0.980
way	3962	1.217	0.004	0.376	3730	1	1	0.388	1.000	0.999
week	1493	0.459	0.013	0.627	1476	0	3	0.629	—	0.999
whole	1753	0.539	0.102	0.546	41	0	1682	0.980	—	0.551
woman	1112	0.342	0.146	0.827	969	0	38	0.837	—	0.993
wonder	669	0.206	0.194	0.793	26	589	4	0.988	0.814	0.998
work	6368	1.956	0.707	0.423	1381	3698	323	0.645	0.475	0.905
worst	152	0.047	0.484	0.937	32	0	111	0.986	—	0.955
year	6773	2.081	0.006	0.355	6728	2	3	0.355	0.999	0.999

B.2 Nuuchahnulth

Table B.2: Corpus statistics for the 100-item Nuuchahnulth sample

Stem	Gloss	Frequencies		Flexibility	Dispersion	Frequencies			Dispersions (DP)		
		Raw	Relative	(Shannon's H)	(DP)	Reference	Predication	Modification	Reference	Predication	Modification
ƛ̓aːq	fat	7	0.837	0.000	0.830	7	0	0	0.830	—	—
ƛ̓aẏix	swift	6	0.717	0.000	0.773	0	6	0	—	0.773	—
ƛaʔuː	another	19	2.271	0.835	0.322	11	6	2	0.505	0.614	0.784
ƛaqmis	oil	5	0.598	0.000	0.843	5	0	0	0.843	—	—
ƛatẇa	paddling.steadily	4	0.478	0.000	0.710	0	4	0	—	0.710	—
ƛawa	hear	7	0.837	0.000	0.909	0	7	0	—	0.909	—
ƛuɬ	nice	7	0.837	0.545	0.631	2	5	0	0.895	0.736	—
ɬuːcsaːmiːḥ	women	5	0.598	0.000	0.613	5	0	0	0.613	—	—
ʔaḥkuˑ	right.here	6	0.717	0.631	0.688	3	3	0	0.881	0.807	—
ʔac	go.out.hunting	6	0.717	0.000	0.614	0	6	0	—	0.614	—
ʔac-yuˑ	go.out.hunting-done	14	1.673	0.000	0.693	0	14	0	—	0.693	—
ʔana	only	12	1.434	0.410	0.462	0	10	2	—	0.482	0.863
ʔana-ʾiˑc	only-eat	4	0.478	0.000	0.640	0	4	0	—	0.640	—
ʔatḥ	night	4	0.478	0.000	0.678	0	4	0	—	0.678	—
ʔaya	many	34	4.064	0.652	0.424	2	23	6	0.801	0.496	0.669
ʔiːqḥ	telling	19	2.271	0.000	0.494	0	19	0	—	0.494	—
ʔu-(w)aƛ	it-find	4	0.478	0.000	0.788	0	4	0	—	0.788	—
ʔu-ḥtaˑ	it-doing.to	7	0.837	0.000	0.776	0	7	0	—	0.776	—
ʔu-ca-ḥta	it-go.to-apart	11	1.315	0.000	0.659	0	11	0	—	0.659	—
ʔu-kɬaˑ	it-having.as.name	21	2.510	0.000	0.542	0	21	0	—	0.542	—
ʔu-naˑk	it-having	28	3.347	0.140	0.448	1	27	0	0.887	0.478	—
ʔu-ẏiˑḥa	it-because.of	7	0.837	0.000	0.589	0	7	0	—	0.589	—
ʔuːš	some	20	2.391	0.920	0.556	9	8	3	0.647	0.603	0.857
ʔuːš-ckʷiˑ	some-remains.of	5	0.598	0.000	0.634	0	5	0	—	0.634	—
ʔuḥ	being.it	28	3.347	0.000	0.312	0	28	0	—	0.312	—
ʔucq	foggy	4	0.478	0.000	0.957	0	4	0	—	0.957	—
ʔunic	how.much.time.spent	9	1.076	0.625	0.601	4	5	0	0.794	0.693	—
ʔunẇiːƛ	there.is.a.reason	13	1.554	0.000	0.620	0	13	0	—	0.620	—
ʕaʔuk	lake	4	0.478	0.512	0.755	3	1	0	0.887	0.868	—

Table B.2: Corpus statistics for the 100-item Nuuchahnulth sample

Stem	Gloss	Frequencies		Flexibility	Dispersion	Frequencies			Dispersions (DP)		
		Raw	Relative	(Shannon's H)	(DP)	Reference	Predication	Modification	Reference	Predication	Modification
ḥaːɬ	there	21	2.510	0.761	0.506	5	14	2	0.803	0.559	0.759
ḥaːḥuːp	instructing	8	0.956	0.000	0.827	0	8	0	—	0.827	—
ḥaːkʷaːƛ	girl	6	0.717	0.000	0.721	6	0	0	0.721	—	—
ḥacẘaḥs	bowl	5	0.598	0.000	0.978	5	0	0	0.978	—	—
ḥamip	knowing	7	0.837	0.000	0.650	0	7	0	—	0.650	—
ḥaẘiɬ	chief	35	4.184	0.417	0.549	29	6	0	0.594	0.649	—
ḥuː	over.there	25	2.988	0.400	0.489	4	21	0	0.778	0.477	—
ḥuːɬ	over.there	15	1.793	0.455	0.385	3	12	0	0.887	0.398	—
ḥumiːs	red.cedar	7	0.837	0.373	0.859	6	1	0	0.859	0.891	—
c̓aʔak	water	4	0.478	0.000	0.759	4	0	0	0.759	—	—
c̓aḥ	adze	4	0.478	0.000	0.891	0	3	0	—	0.891	—
c̓apac	canoe	38	4.542	0.113	0.579	36	1	0	0.576	0.891	—
c̓iːq	sing	11	1.315	0.277	0.728	1	10	0	0.990	0.728	—
c̓u	move	5	0.598	0.000	0.920	0	5	0	—	0.920	—
camaqƛ	take.time	4	0.478	0.000	0.891	0	4	0	—	0.891	—
ciq	speak	16	1.913	0.213	0.467	1	15	0	0.957	0.499	—
haʔukʷ	eat	4	0.478	0.000	0.842	0	4	0	—	0.842	—
hapt	hide	12	1.434	0.261	0.597	1	11	0	0.957	0.597	—
hiɬ	there	52	6.216	0.606	0.393	20	32	0	0.512	0.374	—
hiɬ-ʾaˑʔa	here-on.the.rock	6	0.717	0.579	0.628	2	4	0	0.954	0.651	—
hiʔiːs	there.on.the.ground	10	1.195	0.296	0.514	1	9	0	0.868	0.503	—
hiːhiːq-šaḥap	various-doing	4	0.478	0.000	0.912	0	4	0	—	0.912	—
hiːnip	obtain	4	0.478	0.000	0.967	0	4	0	—	0.967	—
hiːtkin	strange	6	0.717	0.790	0.773	1	4	1	0.920	0.853	0.887
hicnup	couple	5	0.598	0.613	0.699	3	2	0	0.863	0.836	—
hin-ʔaɬ	there-aware.of	5	0.598	0.000	0.867	0	5	0	—	0.867	—
hin-in	there-come	9	1.076	0.000	0.577	0	9	0	—	0.577	—
hiniːp	take.long	6	0.717	0.000	0.821	0	6	0	—	0.821	—
his	beat	8	0.956	0.000	0.643	0	8	0	—	0.643	—
his-iˑk	there-going.along	9	1.076	0.625	0.743	4	5	0	0.755	0.743	—
his-taq	there-come.from	19	2.271	0.188	0.432	1	18	0	0.886	0.470	—
hiš-umɬ	all-in.a.bunch	4	0.478	0.000	0.960	0	4	0	—	0.960	—
huːʔak	long.ago	29	3.466	0.137	0.421	0	28	1	—	0.449	0.868

Table B.2: Corpus statistics for the 100-item Nuuchahnulth sample

Stem	Gloss	Frequencies		Flexibility	Dispersion	Frequencies			Dispersions (DP)		
		Raw	Relative	(Shannon's H)	(DP)	Reference	Predication	Modification	Reference	Predication	Modification
huḥtak	know	32	3.825	0.000	0.356	0	32	0	—	0.356	—
kʷis	different	10	1.195	0.296	0.627	1	9	0	0.920	0.605	—
kʷis-tu·p	different-thing	8	0.956	0.000	0.899	0	8	0	—	0.899	—
k̓ʷac	hit.the.right.spot	6	0.717	0.000	0.561	0	6	0	—	0.561	—
k̓aḥ-kʷa	split-in.pieces	5	0.598	0.000	0.886	0	5	0	—	0.886	—
kamatq	running	23	2.749	0.000	0.792	0	23	0	—	0.792	—
kuːciɬ	filleting.fish	4	0.478	0.000	0.809	0	4	0	—	0.809	—
kuːkuḥʷ'isa	hair.seal	15	1.793	0.223	0.831	14	1	0	0.826	0.977	—
ṁuksy̓i	stone	11	1.315	0.000	0.763	11	0	0	0.763	—	—
ma-maɬ-ṁi·	dwell-move-come	6	0.717	0.000	0.664	6	0	0	0.664	—	—
maːʔak	gray.whale	12	1.434	0.000	0.852	12	0	0	0.852	—	—
maːmaːti	bird	6	0.717	0.410	0.708	5	1	0	0.708	0.977	—
mamaɬṁi	white.man	16	1.913	0.213	0.476	15	1	0	0.465	0.886	—
muː-ci·ɬ	four-days.long	9	1.076	0.602	0.721	3	5	0	0.755	0.853	—
muː-qʔicḥ	four-year	6	0.717	0.613	0.875	2	3	0	0.988	0.886	—
ṁaːs	day	7	0.837	0.000	0.511	7	0	0	0.511	—	—
ṁup-ci·ɬ	one-days.long	10	1.195	0.613	0.610	2	3	0	0.759	0.744	—
naʔaː	hear	21	2.510	0.000	0.532	0	21	0	—	0.532	—
nani·qsu	grandparent	10	1.195	0.556	0.873	7	3	0	0.873	0.907	—
nas	try.in.vain	6	0.717	0.000	0.793	0	6	0	—	0.793	—
nunuːk	singing	13	1.554	0.562	0.824	4	9	0	0.944	0.790	—
piḥ	observe	9	1.076	0.000	0.734	0	9	0	—	0.734	—
qʷayačːk-štaqumɬ	wolf-groups	13	1.554	0.000	0.901	13	0	0	0.901	—	—
qʷis	do.so	60	7.172	0.476	0.294	13	47	0	0.517	0.372	—
qaɬaːtik	younger.brother	5	0.598	0.000	0.671	4	0	0	0.671	—	—
qaḥ	dead	29	3.466	0.228	0.491	2	27	0	0.834	0.512	—
qiː-sasa	for.a.long.time-precisely	5	0.598	0.000	0.566	0	5	0	—	0.566	—
quːʔas	person	81	9.682	0.106	0.341	78	2	0	0.355	0.834	—
quṁaː	amount	8	0.956	0.602	0.481	5	3	0	0.565	0.704	—
siːḥ-iɬ	you.all-to	4	0.478	0.000	0.943	0	4	0	—	0.943	—
sukʷiƛ	take	8	0.956	0.000	0.785	0	8	0	—	0.785	—
sut-(c)iɬ	you-doing.to	13	1.554	0.000	0.469	0	13	0	—	0.469	—
ƫaːtṁa	children	9	1.076	0.318	0.653	8	1	0	0.764	0.868	—

Table B.2: Corpus statistics for the 100-item Nuuchahnulth sample

Stem	Gloss	Frequencies		Flexibility	Dispersion	Frequencies			Dispersions (DP)		
		Raw	Relative	(Shannon's H)	(DP)	Reference	Predication	Modification	Reference	Predication	Modification
ƭaṅa	child	9	1.076	0.000	0.659	9	0	0	0.659	—	—
tuṗaɬ	sea	4	0.478	0.000	0.750	4	0	0	0.750	—	—
wa·	say	273	32.632	0.120	0.261	6	199	0	0.844	0.306	—
wa·ɬ-’aqstuƛ	word-inside	4	0.478	0.000	0.929	0	4	0	—	0.929	—
wik	not	139	16.615	0.039	0.190	1	138	0	0.920	0.188	—

Appendix C

Sample annotations

This appendix contains small sample annotations from the English and Nuuchahnulth corpora. Each token that was included in this study is given an annotation indicating its discourse function—REF, PRED, or MOD for reference, predication, or modification, respectively. Lexical items that are excluded from this study for one of the reasons discussed in Section 3.3 are not given an annotation. Recall from Chapter 3 that for English, predicate adjectives and non-finite verbs are *not* included. For English, the annotation is given as a subscript after the word. For Nuuchahnulth, the discourse function is indicated as a 5th line in the interlinear gloss.

C.1 English

Well life$_{\text{REF}}$ there in the country$_{\text{REF}}$ is nice and tranquil. I lived$_{\text{PRED}}$ working$_{\text{MOD}}$ all of my life$_{\text{REF}}$ with livestock$_{\text{REF}}$. I always had to get$_{\text{PRED}}$ up early milk$_{\text{PRED}}$ the cows$_{\text{REF}}$ and uh run$_{\text{PRED}}$ run$_{\text{PRED}}$ them as we say$_{\text{PRED}}$ because it's a— to the pastures$_{\text{REF}}$ until times$_{\text{REF}}$ got$_{\text{PRED}}$ pretty bad and one$_{\text{MOD}}$ day$_{\text{REF}}$ I sent$_{\text{PRED}}$ my daughter$_{\text{REF}}$ to to the pasture$_{\text{REF}}$ to bring in the cows$_{\text{REF}}$. We brought$_{\text{PRED}}$ them back in the afternoon$_{\text{REF}}$ when I saw$_{\text{PRED}}$ that behind her there came$_{\text{PRED}}$ a big$_{\text{MOD}}$ group$_{\text{REF}}$ of they looked$_{\text{PRED}}$ like soldiers$_{\text{REF}}$ but in street$_{\text{MOD}}$ clothes$_{\text{REF}}$. Then she came$_{\text{PRED}}$ my daughter$_{\text{REF}}$ came$_{\text{PRED}}$ almost green pale and she said$_{\text{PRED}}$ to me "Mama" she said$_{\text{PRED}}$ to me "Those are guerillas$_{\text{REF}}$!" That was the first$_{\text{MOD}}$ time$_{\text{REF}}$ I saw$_{\text{PRED}}$ them the gue— the guerillas$_{\text{REF}}$. (Ide & Suderman 2005: ArguetaBertila-ENG)

C.2 Nuuchahnulth

qiiʔaƛ	qiiɬaƞaƛ	qʷiyuckʷiʔitq	qʷis	ʔaḥ
qiː-ʾaƛ	qiː-ɬaƞa-ʾaƛ	qʷiyu-ckʷi··ʔi·tq	qʷis	ʔaḥ
for.a.long.time-FIN	for.a.long.time-slightly-FIN	time-done-REL.3	happen.thus	this
happened.long.ago	quite.a.while.ago	when.it.occurred	happen.thus	this
PRED	PRED	REF	PRED	REF

‘This happened a long time ago.’

siikc̓inƛ	siikaa	hitac̓inƛ	maaqtusiis
siːk-c̓inƛ	siːk-(y)a·	hita-c̓inƛ	maːqtusiːs
sailing-into.a.bay	sailing-CONT	there.MOM-into.a.bay	NAME
sail.into.a.bay	sailing	entered.into.a.bay	NAME
PRED	PRED	PRED	REF

‘They sailed into the bay of Maaqtusiis.’

yuupickʷimatak	yuupi	yuksaaʔa
yuːpi-ckʷi··matak	yuːpi	yu-ksa·ʔa
breeze-done-probably	breeze	blowing-come.to.land
probably.there.was.a.breeze	breeze	breeze.along.the.shoreline
PRED	REF	PRED

‘There probably was a little wind, blowing towards the land.’

qʷiyimtii	n̓aas	hitac̓inƛ
qʷiyu-imt-(y)iː	n̓aːs	hita-c̓inƛ
when-PAST-INDEF.3	day	there.MOM-in.a.bay
whenever.it.was	day	entered.a.bay
PRED	REF	PRED

‘They came into the bay one day.’

hitac̓u	ʔukɬaakʔakna	y̓uuqʷaa
hitac̓u	ʔu-kɬa··ak-ʔa·k-na·	y̓uːqʷaː
NAME	it-called-DUR-POSS-1PL	also
NAME	we.also.call.it	also
	PRED	PRED

‘We also call it (the bay) “*hitac̓u*”.’

wałyuu	maaqtusiis	wiiḥaaqsusiis
wał-yu·	maːqtusiːs	wiːḥaːqsusiːs
go.home-done	NAME	NAME
gone.home	NAME	NAME
PRED	REF	

‘They went to Maaqtusiis — [to be exact,] *Wiiḥaaqsusiis*.’

ʔuʔiiyačištckʷi	wiiḥaaqsusiis	ƛayuukʷiƛ	kuunaa
ʔu-ʔi·ya-ačišt-ckʷi·	wi:ḥa:qsusi:s	ƛayu:-kʷi(ƛ)	ku:na:
it-reach-on.the.sea-done	NAME	anchored-MOM	schooner
reached	NAME	anchored	schooner
PRED	REF	PRED	REF

‘The schooner reached *Wiiḥaaqsusiis* and dropped anchor.’

wik	ʔiiḥ	wikckʷii	ʔiiḥ
wik	ʔi:ḥ	wik-ckʷi·	ʔi:ḥ
not	large	not-done	large
not	large	was.not	large
PRED	PRED	PRED	PRED

‘It (the schooner) was not so big.’

ʔaƛa	ʔaƛista	qacċistamitquu
ʔaƛa	ʔaƛa-ista	qacċa-ista-mit-qu:
two	two-people.on.board	three-people.on.board-PAST-COND.3
two	two.people.on.board	there.could.have.been.three.people.on.board
PRED	REF	PRED

‘There were two crewmen, or there could have been three, on the ship.’

hinaačiƛ̓aɬ	yaqitii
hin-a·či(ƛ)-ʔa·ɬ	yaq-it-(y)i:
there.MOM-go.out.to.meet-PL	who-PAST-INDEF.3
they.go.out.to.meet	whoever.it.was
PRED	REF

‘Some people went out to meet them (the people on the schooner).’

ʔin	ʔutwiickʷiʔaaɬ	hinaačiƛ	wiʔakʔi
ʔin	ʔutwi:-ckʷi·-ʔa:ɬ	hin-a·či(ƛ)	wiʔak-ʔi·
since	first-done-always	there.MOM-go.out.to.meet	brave-DEF
since	they.were.the.first.one	go.out.to.meet	the.brave.one
	PRED	PRED	REF

wiiʔaksaʔi	ḥaaʔaƛ̓atʔi	ɬiṁaqsti
wiʔak-sa-ʔi·	ḥa:ʔak-’at-ʔi·	ɬiṁaqsti
brave-real-DEF	strong-POSS-DEF	mind
the.bravest.one	the.one.with.strong.one	mind
REF	REF	REF

‘The first ones to go out were the bravest ones, the ones with strong minds.’

ʔin	naʔaackʷaƛ	ʔaya	mamaɬṅi	hisiickʷiʔitqʔaɬ	hiistiƛ
ʔin	naʔaːckʷi··ʾaƛ	ʔaya	mamaɬṅi	hisiː-ckʷi··ʔi·tq-ʔa·ɬ	hiːstiƛ
??	hear-done-FIN	many	white.man	??-done-REL.3-PL	from
??	understood	many	white.man	the.way.they.spoke	from
	PRED	MOD	REF	REF	PRED

ciqy̓ak	čiinuukʔatḥ
ciq-y̓akʷ	čiːnuːk-ʾatḥ
speak-instrument	Chinook-belonging.to
language	Chinook
REF	PRED

‘Many white men could understand Chinook Jargon.’

čiičiinukʷackʷaƛ	ʔuuš
DUP-čiːnu·k-(y)a-ckʷi··ʾaƛ	ʔuːš
DISTR-speak.Chinook-REP-done-FIN	some
spoke.Chinook.Jargon	some
PRED	REF

‘Some of them spoke Chinook Jargon.’

histʔatḥckʷaƛukʔaɬ	ʔaḥ	[Hudson	Bay]
hist-ʾatḥ-ckʷi··ʾaƛ-uk-ʔa·ɬ	ʔaḥ		
there-belonging.to-done-FIN-POSS-PL	this		
they.got.theirs.from.there	they		
PRED	REF		

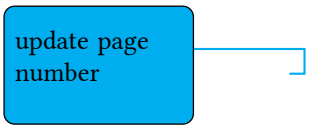
‘They got theirs (= their knowledge of Chinook Jargon) from Hudson Bay Company.’

yaqʷiiyii	naʔaaʔaƛ	Captainmitquu	yaqʷacʔitq
yaqʷ-wi··(y)iː	naʔaːʾaƛ	Captain-mit-quː	yaqʷ-ac-ʔi·tq
who-first-INDEF.3	hear-FIN	captain-PAST-COND.3	who-belonging.to-REL.3
the.ones.who.were.first	understood	one.who.was.Captain	owner.of
REF	PRED	PRED	REF

šipʔii
šip-ʔi·
ship-DEF
the.ship
REF

‘Among the first ones that [learned to] understand the language might have been the Captain who was taking command of the ship.’

(Louie 2003: Kingfisher)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