EFFICIENCY, GRAMMATICALIZATION, AND THE TYPOLOGY OF FUNCTIONAL EXPRESSIONS

EFFICIENCY IN GRAMMAR:
PATTERNS AND EXPLANATIONS
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OUTLINE

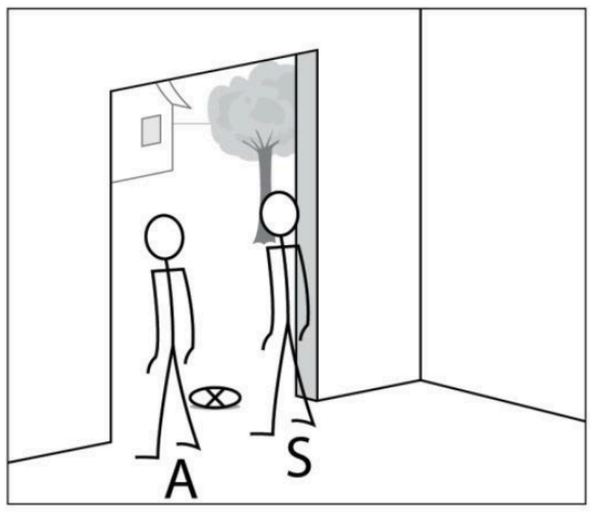
- A typological puzzle
- A theory of functional expressions
- Some data
- An evolutionary model of grammaticalization
- Supporting evidence: the ecology of definiteness marking
- Summary
- Appendices

A TYPOLOGICAL PUZZLE

- taking a page from Sapir (1921: 86-126)
  - though no fowl shall be harmed in the present version
- all of the following utterances

are responses to Scene 20 of Wilkins (2016 [1999])

20.



Spkr and Addr are inside a house looking out of (open) door. They are near the doorway. The referent is just outside of door (near it). The referent is easily reached by both Addr and speaker (and equidistant from both).
"I like _____ book/radio."
"Who's book/radio is ___?"
• Does it make a difference if the Spkr points or not? Must Spkr point?
• Does it make a difference if object has been mentioned before?
• Does it make a difference if Addr already has attention on object vs. attention being drawn?
• Does term change with change in closeness of Spkr/Addr to door? Closeness of object to door?

Figure 1.1. *Scene 20 of Wilkins (2016)*

(1.1) Hijazi Arabic (Saudi Arabia)

Li-man **ði:h** **el-**kita:b?
to-who this(SG) DEF-book
'Whose is this book?' (Ali M. Alshehri, p.c.)

(1.2) German

We-m gehör-**t** **dies-es** Buch?
who-DAT.SG belong-3SG.PRS this-SG.N.NOM book
'To whom does this book belong?'

(1.3) Japanese (colloquial)

Kono hon **dare=no**?
this book who=GEN
'Whose book is this?' (Mitsuaki Shimojo, p.c.)

(1.4) Japanese (formal)

Kono hon(**=wa**) **dare=no** **desu** **ka**?
this book=TOP who=GEN COP Q
'Whose is this book?' (Mitsuaki Shimojo, p.c.)

(1.5) Saliba-Logea (Oceanic, Papuan Tip)

Kaiteya **yo-na** tobwa **ina**?
who CL1-3SG.POSS bag this
'Whose bag is this?' (Margetts 2016: 261)

(1.6) Yucatec Maya (Mexico)

Máax ti'a'l **le=**lìibro **he'l=o'**?
who property(B3SG) DEF=book PRSV=D2
'Whose property is that book over there?'

Table 1.1. *Summary of functional meanings expressed in (1.1)-(1.6)*

Expressed in all examples	Expressed only in particular languages
• Interrogative pro-form • Demonstrative (or complex expression of spatial deixis) • (Complex expression of) possession • Interrogative speech act (mostly coded via sentence type construction)	• Definiteness (Arabic, Yucatec) • Case (German, Japanese) • Gender/noun class (German, Saliba) • Number (Arabic, German, Saliba, Yucatec) • Person (German, Saliba, Yucatec) • Topic (Japanese)

- what accounts for this differential distribution?
- my answer in a nutshell
  - the functional meanings that are expressed in all languages are part of the speaker's intended message
  - the typologically variable functional expressions serve to facilitate comprehension

Table 1.2. *Communicative functions of constituents of (1.1)-(1.6)*

Speaker's intended message	Redundant facilitative categorizations
• Draw ADDR's attention to x • Lexically categorize x • Relate x to possessor y • Ask about identity of y	• Topic time includes utterance time • Uniqueness of x in speech situation • x is inanimate; $\|x\| = 1$ • Possessed: x; possessor: y • Topic: x; focus: y

- but what mechanism causes non-redundant functional expressions to be distributed near-universally
  - and redundant ones to be distributed much more variably?
- to account for this, we need to upgrade **grammaticalization theory** (**GT**)
- with a mechanism for **functional selection**
  - that boosts the grammaticalization of expressions adapted for **communicative fitness**

Figure 1.2. *Grammaticalization and functional selection*

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A THEORY OF FUNCTIONAL EXPRESSIONS

- so what are functional expressions?
  - morphemes that are part of the grammar of the language *as individual expressions* (but types, not tokens)
    - rather than as members of lexical/syntactic categories
- that is, there are construction templates/rules that reference the individual functional expressions
  - e.g., in English
    - the preposition *of* in possessive constructions
    - the verb *be* in nonverbal predication and progressive aspect constructions

- so what are functional expressions? (cont.)
  - this then spells out the usual suspects
    - function words
    - inflections
    - highly productive and transparent derivations

A THEORY OF FUNCTIONAL EXPRESSIONS (CONT.)

- so what are functional expressions? (cont.)
  - this is not a new insight

"Roughly, then, the total stock of elementary forms of a language can be split into two unequal portions: *tea*, *write*, and all other grammatically 'unimportant' forms go into one portion (by far the larger), while *he*, *she*, and all other grammatically 'important' forms go into the other. The deletion of anyone or two forms from the first portion would leave the grammatical system of the language essentially unchanged; the deletion of even a single item of the second kind would have drastic consequences. Equally drastic consequences could not be achieved by tinkering with the first portion unless we deleted all the members of some large form-class" (Hockett 1958: 261-262).

- on this view, most, but not all, functional expressions are
  - closed-class items
  - grammaticalized
    - e.g., *gehören* in (2.1) is an ordinary verb and *ti'a'l* in (2.2) an ordinary noun

(2.1) German

We-m	gehör-**t**	**dies-es**	Buch?
who-DAT.SG	belong-3SG.PRS	this-SG.N.NOM	book

'To whom does this book belong?'

(2.2) Yucatec Maya (Mexico)

Máax	ti'a'l	**le=**lìibro	**he'l=o'**?
who	property(B3SG)	DEF=book	PRSV=D2

'Whose property is that book over there?'

- variables that form the basis
  of the classification of functional expressions
  - combinatorial and semiotic properties
  - communicative function:
    discourse-prominent vs. inherently backgrounded

A THEORY OF FUNCTIONAL EXPRESSIONS (CONT.)

- communicative function/discourse prominence
  - inspired by Boye & Harder (2012)
  - classifies functional expressions into those that may express **at-issue content** and those that may not
    - the latter are said to be **inherently backgrounded**

- communicative function/discourse prominence (cont.)
  - **at-issue content**: provides a (partial) answer to the context's **question under discussion** (QuD)
    - by reducing the number of live alternatives that are consistent with the discourse
      - Carlson (1982), Klein & von Stutterheim (1987, 2002), van Kuppevelt (1995, 1996), Roberts (1996, 2012), Büring (1997, 2003)

- communicative function/discourse prominence (cont.)
  - the QuD of an utterance's context determines the utterance's information perspective
    - provided the utterance is felicitous and the discourse coherent

(2.3) a. [Q: Who ate the cake? – A:] FLOYD (did/ate the cake).

b. [Q: What did Floyd eat? – A:] (He ate) the CAKE.

c. [Q: What did Floyd do to the cake? – A:] EAT it / He ATE it.

d. [Q: What happened next? – A:] FLOYD ATE THE CAKE.

- communicative function/discourse prominence (cont.)
  - inherent backgrounding of functional expressions means they cannot express at-issue content
    - and thus cannot be focalized
      - e.g., the past tense in (2.4) cannot be focalized
        - stress on the auxiliary expresses ‘verum focus’
      - but the negation can

(2.4) Q: DID Floyd eat the cake? – A: NO.

- communicative function/discourse prominence (cont.)
  - Boye & Harder (2012) treat discourse-primary expressions as not grammaticalized and not part of the grammar
    - including demonstratives, pronouns, modals, etc.
  - in contrast, the present approach allows for discourse-prominent functional expressions
    - by treating discourse prominence as one of *two* (give or take) properties
      - that govern the classification of functional expressions

A THEORY OF FUNCTIONAL EXPRESSIONS (CONT.)

- how communicative and combinatorial properties come together
  - some discourse-prominent expressions are lexical, others are part of the grammar
    - due to their semiotic and combinatorial properties
  - what unites them is that they are needed to express the speaker's intended message
  - in contrast, inherently backgrounded functional expressions are redundant wrt. the intended message
    - but instead serve to boost the odds that the hearer will infer the intended message

- the classification: let's have it!

Informative functional expressions typically express part of the speaker's intended message

Redundant functional expressions serve to facilitate processing

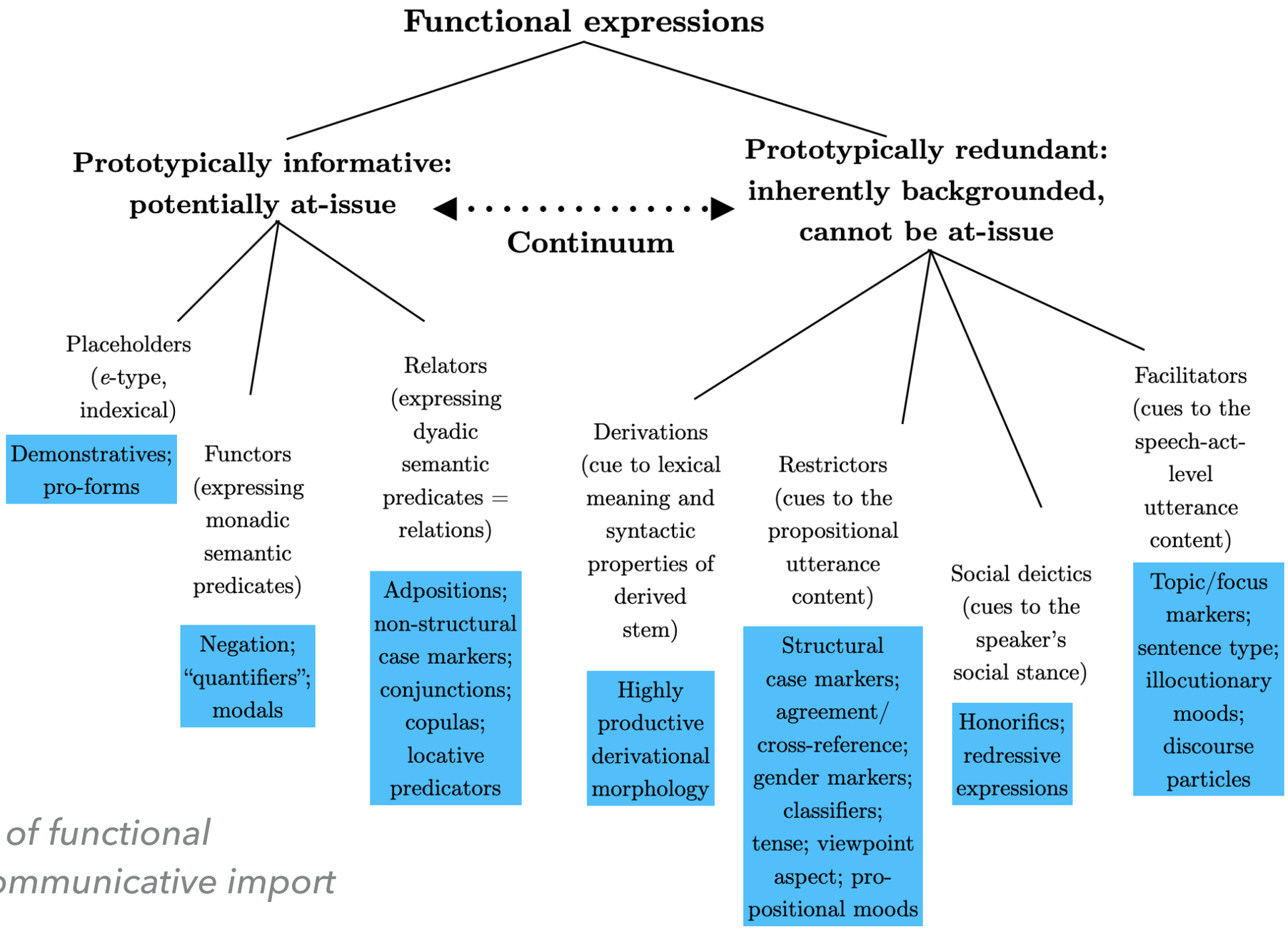
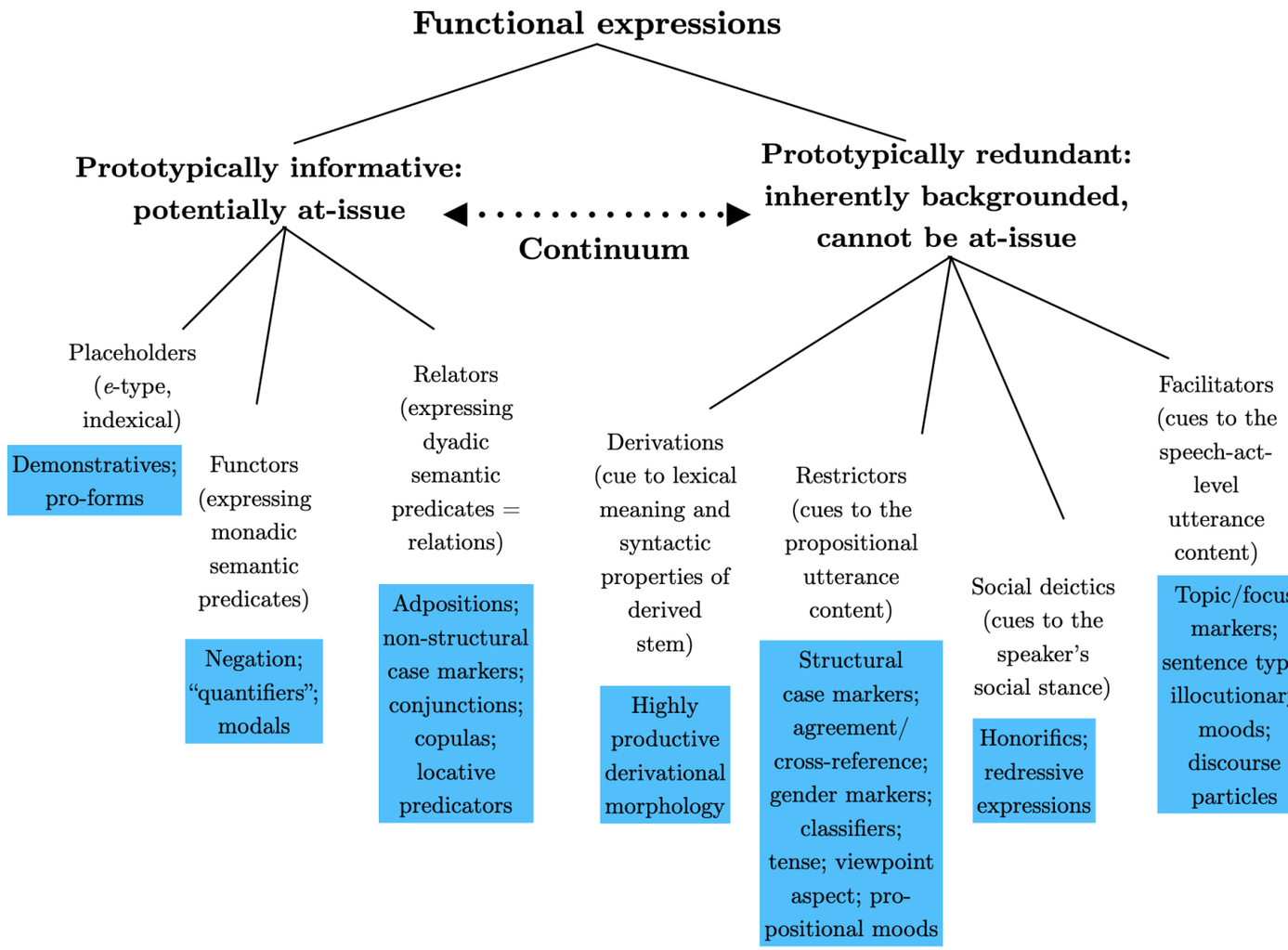


Figure 2.2. *Classification of functional expressions in terms of communicative import and semantic type*

- predictions

Average informativeness/ redundancy predicts typological variability and degree of grammaticalization

Cf. Boye & Harder (2012) on the role of focalizability in grammati-calization



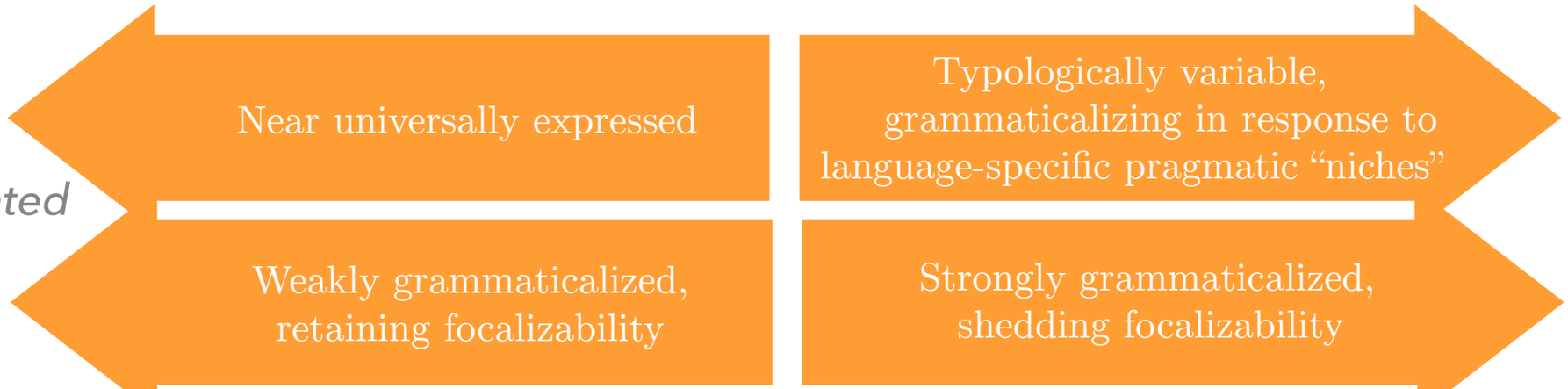


Figure 2.3. *Predictions generated by the proposed theory of functional expressions*

- this distinction between communicatively primary and secondary functional expressions is not a new idea
  - and neither is the observation that the latter are typologically more variable than the former

> “We are thus once more reminded of the distinction between essential or unavoidable relational concepts and the dispensable type. The former are universally expressed, the latter are but sparsely developed in some languages, elaborated with a bewildering exuberance in others.” (Sapir 1921: 99).

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SOME DATA

- discourse-prominent expressions
  - demonstratives have been argued to be present in all languages (Diessel 1999; Dixon 2003)
    - exceptions arise in languages that use compositional expressions for exophoric reference
      - such as French and Yucatec

(3.1) Yucatec Maya (Mexico)

Máax ti'a'l **le=**lìibro (he'l)**=o'**?
who property(B3SG) DEF=book PRSV=D2
'Whose property is that book over there?'

Table 3.1. *French demonstrative paradigms (Diessel 1999: 37)*

	DEM PROS		DEM DETS	
	PROXIMAL	DISTAL	PROXIMAL	DISTAL
SG.M	*celui-ci*	*celui-là*	*ce livre-ci*	*ce livre-là*
SG.F	*celle-ci*	*celle-là*	*cette maison-ci*	*cette maison-là*
PL.M	*ceux-ci*	*ceux-là*	*ces livres-ci*	*ces livres-là*
PL.F	*celles-ci*	*celles-là*	*ces maisons-ci*	*ces maisons-là*

- similarly, independent pronouns are present universally
  - though some languages have compositional pronoun stems

(3.1) Mundari (Mundar, India; Daniels 2013)

a-ñ ‘I’	a-liŋ ‘we.DU’	a-le ‘we.PL’;
a-m ‘you.SG’	a-ben ‘you.DU’	a-pe ‘you.PL

- Everett (2005) argues that Pirahã had no independent pronouns before borrowing some from Tupian languages
- Evans & Levinson (2009: 431) claim that

“Sign languages like ASL (American Sign Language) also lack pronouns, using pointing instead.”

- Cormier et al. (2013) dispute this

SOME DATA (CONT.)

- data from the Atlas of Pidgin and Creole Language Structures (Michaelis et al. 2013)
  - all sample languages have expressions equivalent to
    - demonstratives
      - complex circumnominal forms often but not always involve augmentation with adverbs (‘the/that N there’)
    - independent pronouns
    - interrogative pro-forms
    - negations
    - frequency adverbs
    - cardinal numerals
    - adpositions (defined purely syntactically)
    - verbal and NP conjunctions (defined purely syntactically)

- person and number distinctions are restrictors on pronouns
  - so it is not surprising that there are counterexamples to Greenberg's Universal 42

> "All languages have pronominal categories involving at least three persons and two numbers" (Greenberg 1966: 96).

- e.g., Everett (2005) reports that Pirahã does not express number either in nouns or in pronouns
- there are eight languages in the APiCS sample w/ 1/2 or 2/3 syncretism (Haspelmath 2013)
  - Cysouw (2009: 39-65) discusses additional examples
- similarly, 14 of 75 sample languages lack distance distinctions in demonstratives

- restrictors: APiCS and WALS

Table 3.1. *Some restrictor types in the APiCS and WALS databases*

Type of functional expression	APiCS Sample languages	APiCS Number of sample languages the type is attested in	WALS Sample genera	WALS Number of sample genera the type is attested in
Case	76	15 (19.7%)	171	65 (38%)
Subject agreement	75	45 (60%)	173	123 (71.1%)
Nominal gender	No data		170	76 (44.7%)
Nominal number	76	71 (93.4%)	378	351 (95.9%)
Past tense	75	59 (78.7%)	156	92 (59%)
Definite article	76	57 (75%)	262	180 (68.7%)

SOME DATA (CONT.)

- "*ex-nihilo*" innovations
  - innovation of functional expressions not inherited from the genealogical ancestor in the absence of a contact model
    - in practice, absence of the type of functional expression in question in the other members of the genus
      - usually has to serve as a stand-in for evidence of absence of genealogical transmission
- prediction: innovations of discourse-prominent functional expressions are limited to transitions
    - between compositional and non-compositional expressions
  - in contrast, *ex-nihilo* innovation of inherently backgrounded functional expressions ought to be more common

- *"ex-nihilo"* innovations (cont.)
  - evidence of *ex-nihilo* innovations of functional expressions is key proof of concept for any evolutionary theory
    - *ex-nihilo* innovations directly attest to the evolvability of the particular type of expression

- a few attested examples of *ex-nihilo* innovations of functional expressions
  - Wälchli (2018) discusses the emergence of gender in Nalca (Mek, Tanah Papua)
  - Egyptian likely innovated articles and structural case (Levin 1992; Eitan Grossman, p. c.)
- Gullah (creole, Carolinas and Georgia) has numeral classifiers (Mufwene 1986)
  - but neither the lexifier nor any of the likely substrate languages does
- Matthew Dryer (p. c.) reports the innovation of an imperative mood out of an irrealis mood
  - and a diminutive out of a neuter gender in Walman (Torricelli, PNG)

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AN EVOLUTIONARY MODEL OF GRAMMATICALIZATION

- traditional mainstream grammaticalization theory (TMGT)
  - grammar is the result of grammaticalization
  - grammaticalization involves unidirectional change along loosely correlated scales
    - of metaphoric extension, semantic bleaching, and morphophonological reduction
      - Lehmann 1982; Heine & Reh 1984; Hopper 1981; *inter alia*

Table 4.1. *Grammaticalization processes (Croft 2000: 157)*

Phonological	
Paradigmatic:	*attrition*: reduction/erosion > phonological loss
Syntagmatic:	*coalescence*: free morpheme > cliticization, compounding > affixation > loss
	adaptation (including assimilation)
Morphosyntactic	
Paradigmatic:	obligatorification > fossilization > morphological loss
	paradigmaticization: open class > closed class > invariant element
Syntagmatic:	*rigidification* [word order]
	loss of independent syntactic status > morphological fusion > loss
Functional	
Paradigmatic:	extension of semantic range > loss of function
Syntagmatic:	*idiomaticization*: compositional & analyzable > noncompositional & analyzable > unanalyzable

- TMGT takes a “blind"or “ballistic” view of grammaticalization
  - the output of grammaticalization processes is seen as constrained only by the input
    - and by **mutational constraints** (Haspelmath 2019)
      - i.e., by the available pathways of grammaticalization and the unidirectionality of grammaticalization

- the case against TMGT: Argument I
  - mutational constraints alone cannot account for the differential typological distribution of functional expressions
    - the sources of the grammaticalization of inherently backgrounded expressions are lexical expressions
      - and discourse-prominent functional expressions
  - since both of these are universally available, why would backgrounded functional expressions not also be?

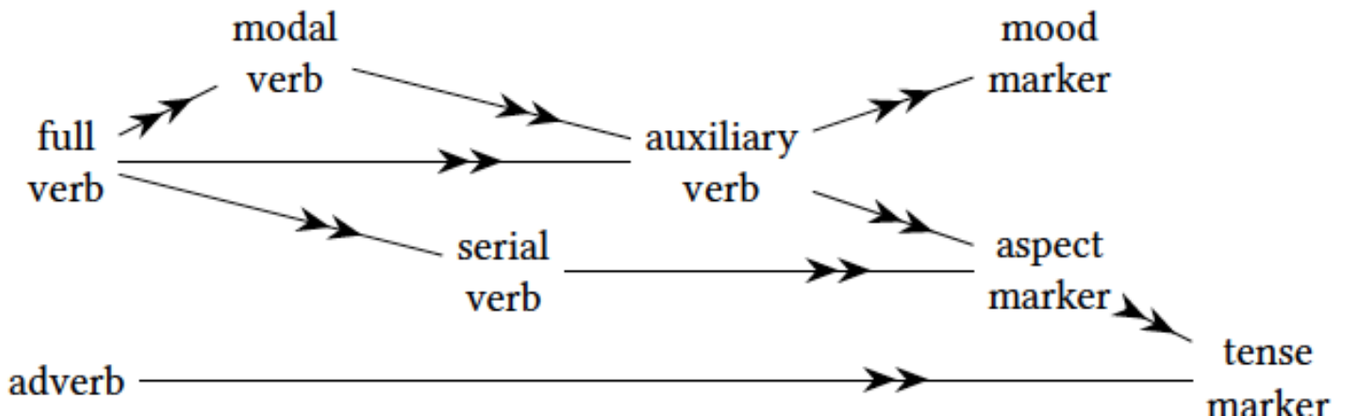

Figure 4.1. *Some grammaticalization pathways in the verbal domain (Lehmann 2015: 39)*

- the case against TMGT: Argument II
  - TMGT predicts
    - that given enough time, all languages will eventually grammaticalize all possible functional expressions
  - in reality, there is no evidence
    - that contemporary languages are overall richer in functional expressions
      - than any historically attested languages

- the case against TMGT: Argument III
  - among pragmatically overlapping functional categories
    - languages tend to grammaticalize
      some more strongly and richly than others
      - suggesting a pragmatic division-of-labor ecology
      - e.g., Bhat (1999) on tense, aspect, and mood
- TMGT cannot explain this
  other than by appealing to accidents of history

- the alternative: to account for the observable typological distribution of functional expressions
  - GT must be retrofitted with **functional-adaptive constraints** (Haspelmath 2019)
    - i.e., constraints that boost the grammaticalization of expressions that are optimized for communicative fitness

- Hawkins (2014: 86) identifies three elements of functional-adaptive mechanisms in language change
  - based on Haspelmath (1999a)
  - speakers have a choice from among competing structural alternatives for communicating the same message
  - selection among these is biased in terms of 'user optimality', i.e., communicative fitness
  - this boosts the usage frequency of the fitter options, causing regularization and obligatorization
    - and potentially eventually the loss of the competitors

- sketching an explicit causal model

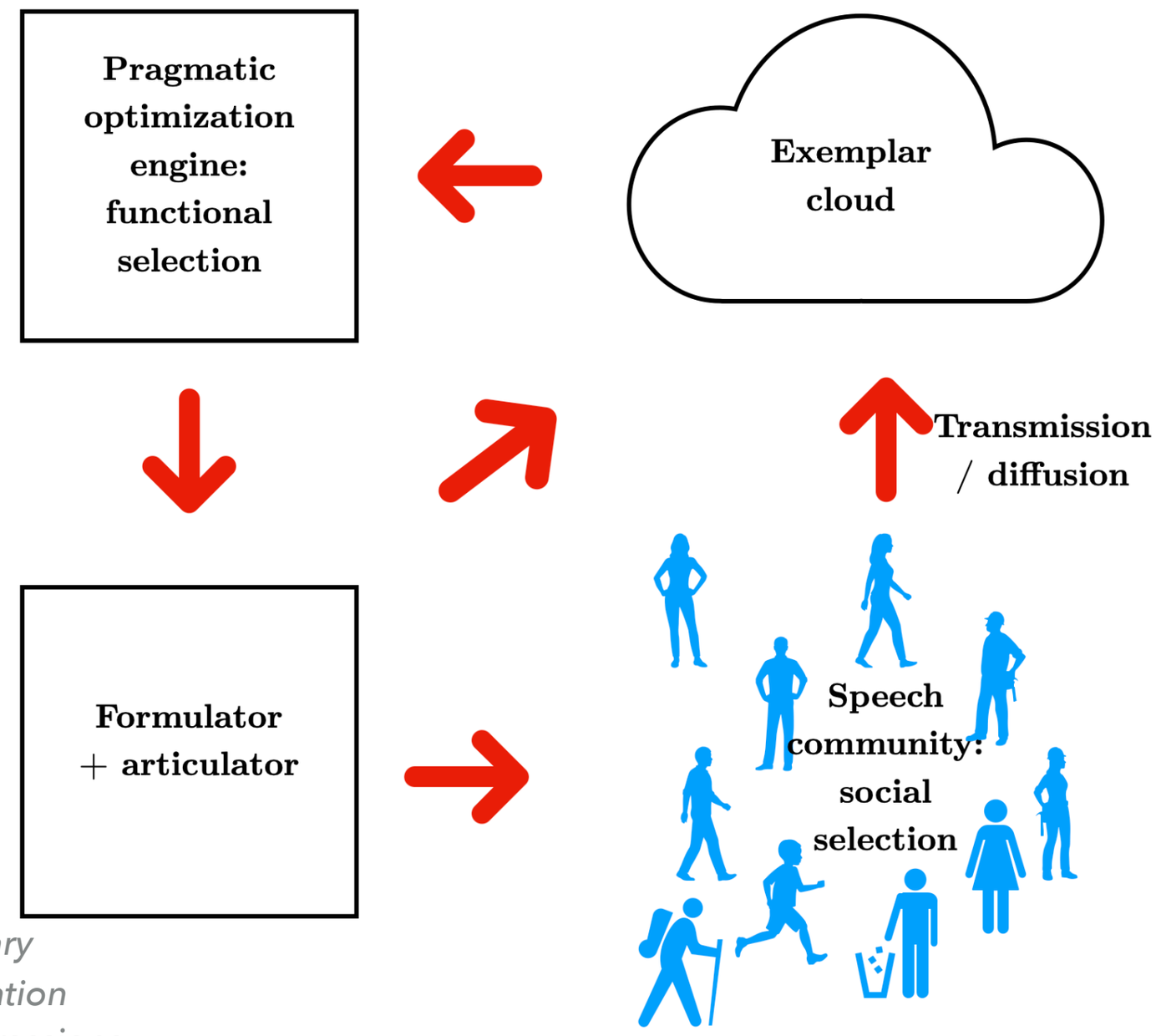

Figure 4.2. *An evolutionary model of the grammaticalization of redundant functional expressions (short version)*

- sketching an explicit causal model (cont.)

Assume a contrast between two expressions C_1 and $C_2 = C_1 + x$, both of which could be used to express the speaker's communicative intent. The addition of x to C_1 is licensed by an existing construction of the language. Its use in C_2 is redundant wrt. the speaker's communicative intent, but increases the probability p of the hearer inferring the intended meaning I ($p(I|C_2) > p(I|C_1)$). E.g., x could be a demonstrative added to indicate definiteness, a perfective aspect marker to indicate past time reference, or an allative case marker to indicate a syntactic object relation.

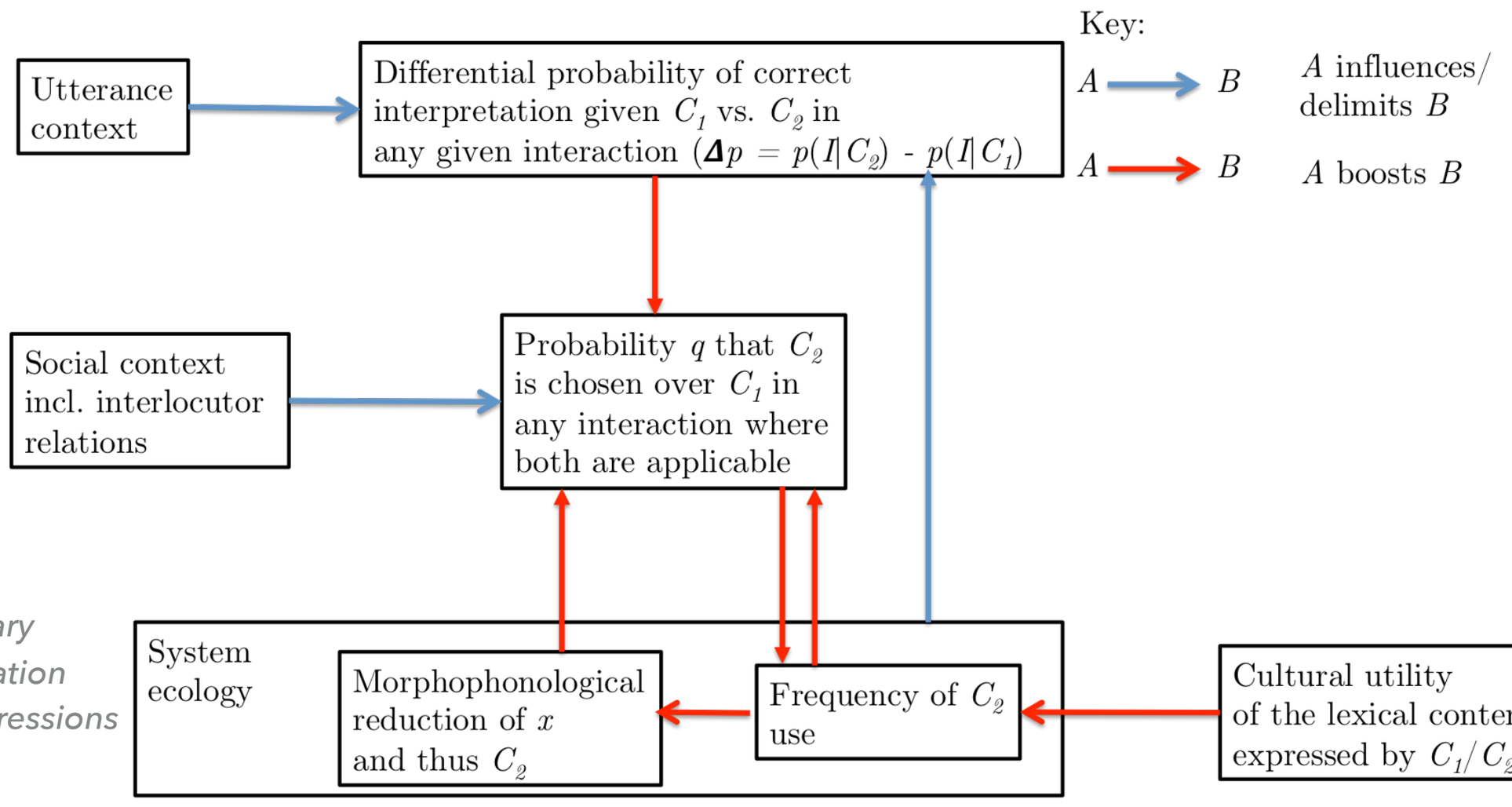

Figure 4.3. *An evolutionary model of the grammaticalization of redundant functional expressions (long version)*

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SUPPORTING EVIDENCE: THE ECOLOGY OF DEFINITENESS MARKING

- Evers (2020): rationale
  - if the grammaticalization of inherently backgrounded functional expressions is a functional adaption
    - it should occur where there are functional “niches” for it
      - and not elsewhere
- so it should be possible to predict which languages grammaticalize e.g. definite articles and which don’t
  - on the basis of the presence/absence of alternative morphosyntactic definiteness cues

- grammar sampling study: generating the sample
  - a sample of 100 languages were randomly selected by an algorithm introduced in Dryer (2018)
    - based on two criteria
      - availability of a recent extensive description
      - at least 30 languages spoken geographically in between each pair of adjacent languages

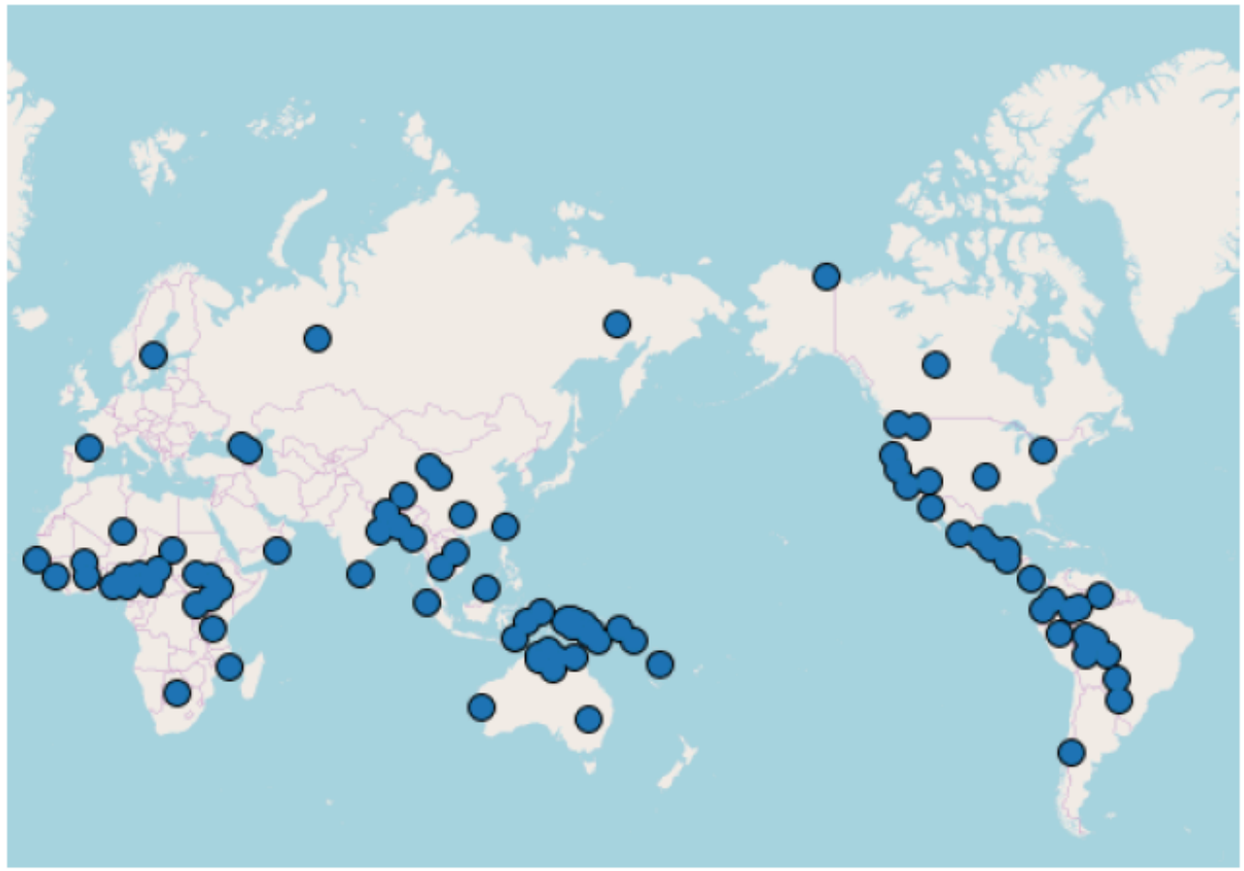

Figure 5.1. *Map of the language sample of Evers (2020: 125)*

- grammar sampling study: procedure
  - manually coding the sample languages for 8 variables selected from an original 16 after a pilot study
    - on a sample of 32 languages
      at a distance of 50 languages in between
- run machine learning models to identify
  the strongest predictors of absence of definite articles

Case	Differential Object Marking
Gender	Noun Classifiers
Perfective Aspect Marking	Switch Reference
Prodrop	Verb Agreement
Isolating	Ergativity
Focus Marking	Topic Marking
Flexible Subject Order	VO Word Order
Affixation Order	Indefinite Article

Alignment	Case Marking
Morphological Complexity	Object Agreement
Order of Object and Verb	Subject Order Flexibility
Switch Reference	Topic Marking

Figure 5.2. *Pilot (left) and final set of independent variables (Evers 2020: 88, 126)*

- grammar sampling study: findings

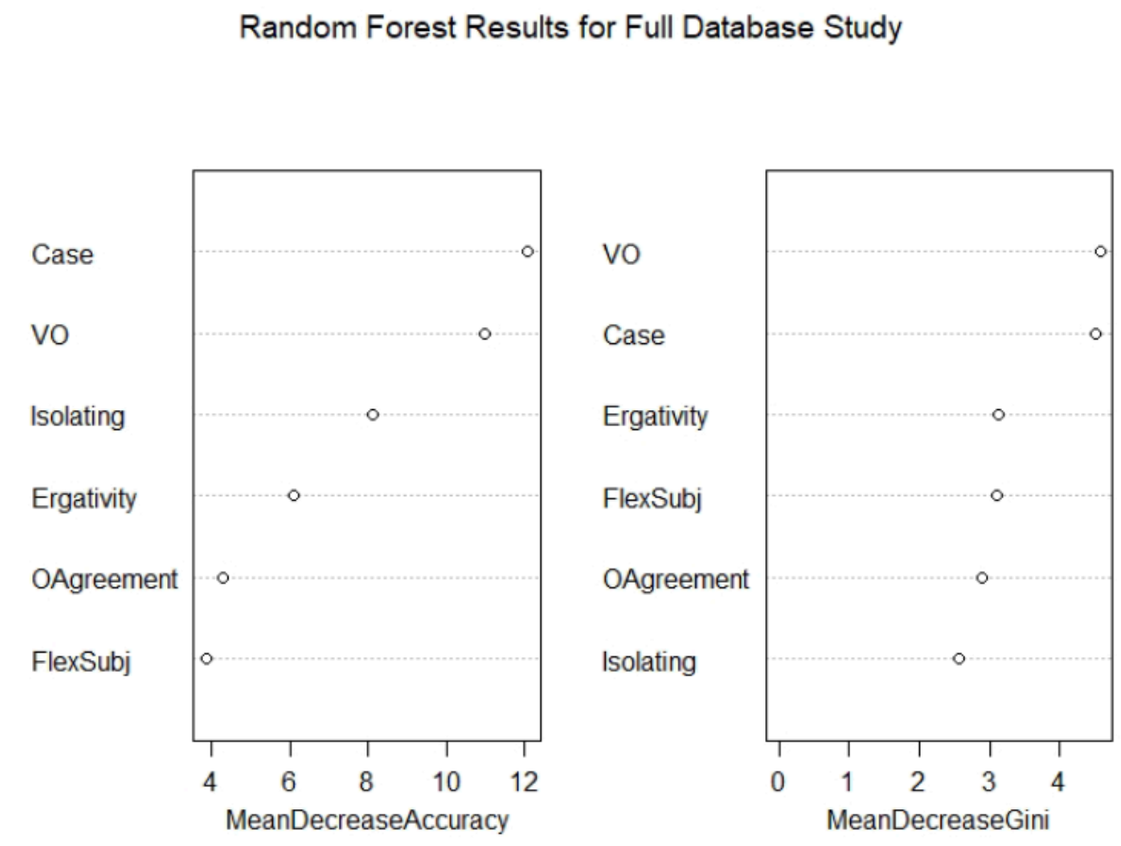

Figure 5.3. *Random forest models of the main sample predicting* ***absence*** *of definite articles (Evers 2020: 135)*

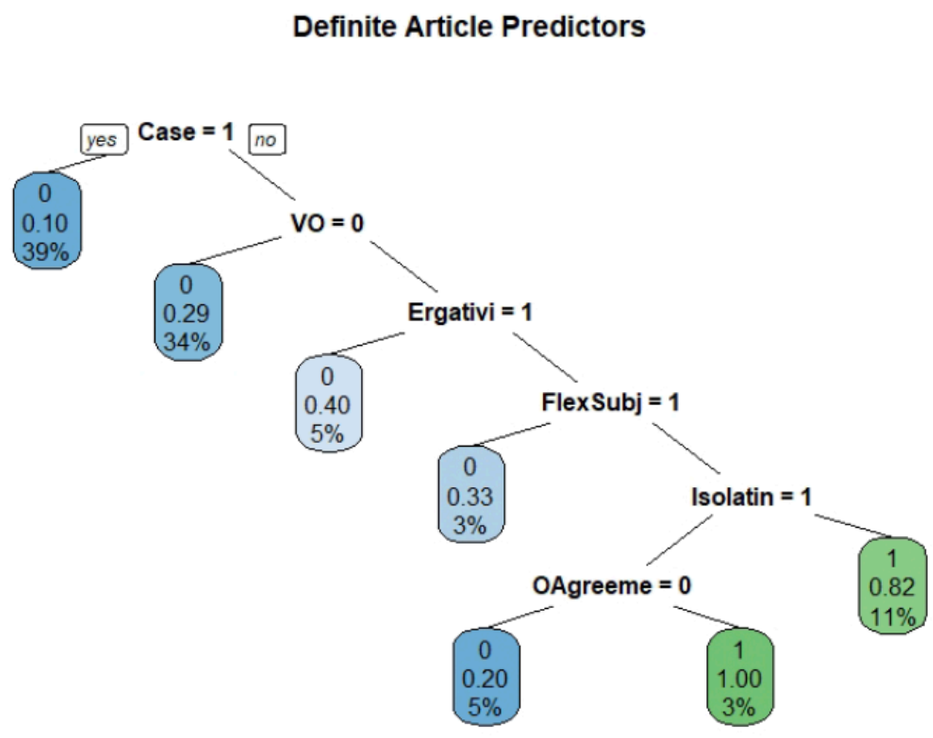

Figure 5.4. *Conditional inference tree of the main sample predicting* ***absence*** *of definite articles (Evers 2020: 136)*

SUPPORTING EVIDENCE: THE ECOLOGY OF DEFINITENESS MARKING (CONT.)

- Evers followed this analysis up with two corpus studies
  - on Kalaallisut (Eskaleut, Greenland) and Colloquial Jakarta Indonesian (CJI)
    - both of which lack definite articles
  - she manually coded discourses in both languages
    - and ran classifiers predicting definiteness
  - she found that models accurately predicted definiteness in
    - 78% of arguments in CJI
    - 90% of arguments in Kalaallisut

SUPPORTING EVIDENCE: THE ECOLOGY OF DEFINITENESS MARKING (CONT.)

- additional evidence: event order in discourse (Bohnemeyer 1998, 2000, 2002, 2009)
  - Yucatec Maya lacks both tense marking
    - and specific temporal connectives with meanings such as ‘after’ and ‘before’
- speakers are able to infer the order of events in discourse on the basis of aspect-mood marking
  - and conversational implicatures

- additional evidence: event order in discourse (cont.)
  - in a referential communication task, Yucatec speakers were as successful in communicating contrastive event orders
    - as were the German-speaking control group
      - German having tense and specific temporal connectives, but only rudimentary aspect marking

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SUMMARY

- there are two types of functional expressions in the languages of the world
  - discourse-prominent expressions are capable of expressing at-issue content
    - i.e., part of the speaker's intended message
- they share this property with lexical expressions
  - but differ from them in terms of their combinatorial properties and abstract, syncategorematic semantics

- in contrast, inherently backgrounded functional expressions are communicatively redundant to varying degrees
  - their primary purpose is to boost the odds that the hearer will infer the intended meaning
  - their function is thus primarily metalinguistic and they tend to be more strongly grammaticalized

- discourse-prominent functional expressions are distributed near-universally across the languages of the world
  - every "all-purpose" language expresses the relevant meanings either compositionally or non-compositionally
- in contrast, inherently backgrounded functional expressions display considerable typological variation
  - and it appears that the extent of this variation correlates with the extent of their backgrounding/redundancy
  - evidence from *ex-nihilo* innovations further supports this conclusion
    - and represents direct evidence of the evolvability of functional expressions

- theories of grammaticalization that take into account only sources and mutational constraints
  - cannot explain the typological distribution of functional expressions
  - to do this, grammaticalization theory requires an upgrade with an evolutionary module of functional selection

- evidence in support of the idea that inherently backgrounded functional expressions evolve where they fill functional niches
  - comes from a typological study using machine learning models to predict the absence of definite articles
    - on the basic of competing alternative definiteness cues

OUTLINE

- Emotions
- Heider on interpersonal emotions
- Force dynamics of emotion
- Semiotics of emotion in language
- Emotion across cultures

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  - the people who attended my presentations of this material to the Linguistic Circle of Copenhagen and the University of Rochester audience design group
- None but me should be presumed to agree with, or be responsible for, any of the material

THANKS!

APPENDICES

- the bigger picture: typology and evolutionary linguistics
  - cf. Greenberg (1978, 1992)

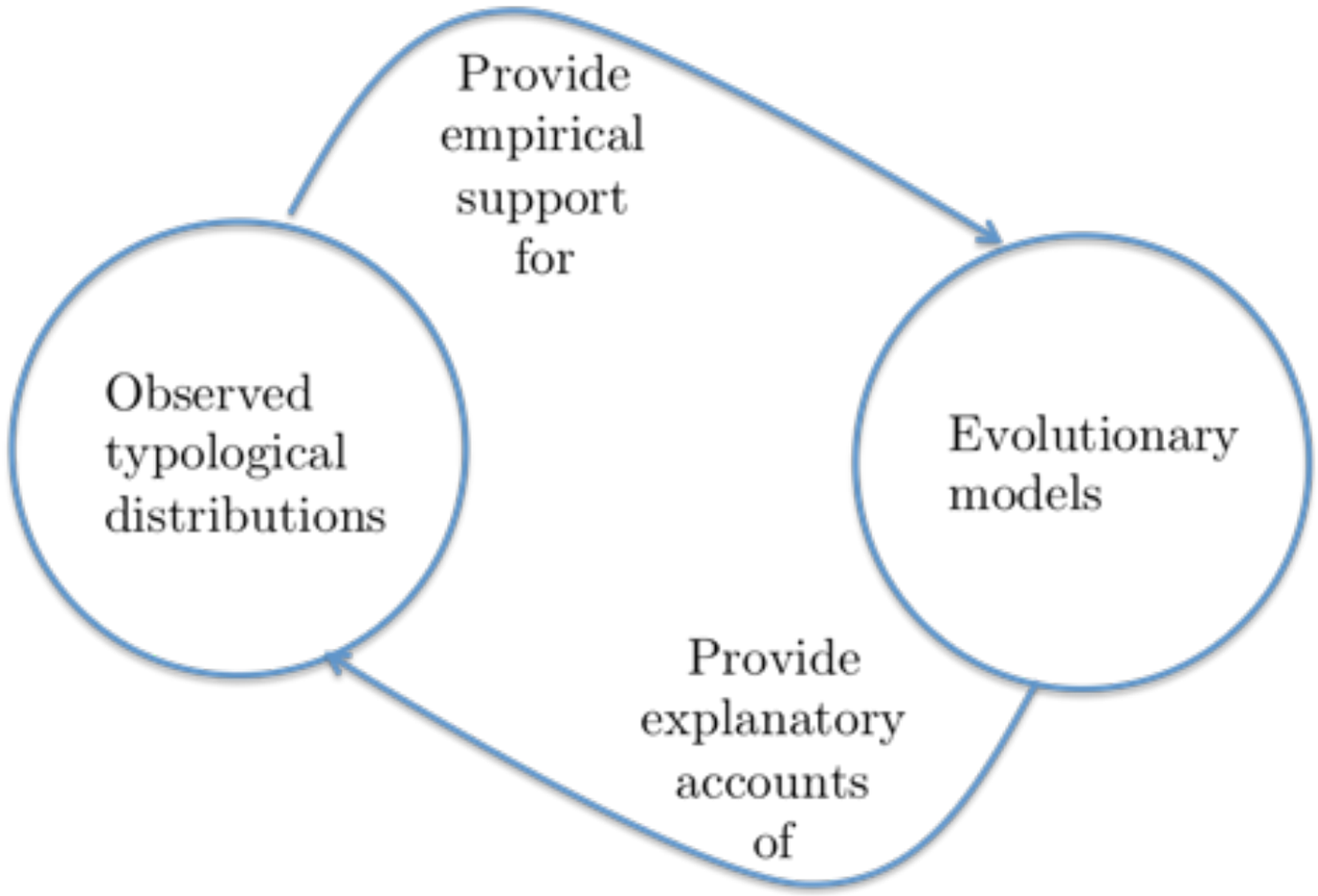


Figure 1.3. *The interaction between typology and evolutionary linguistics*

- the organization of the book I'm working on

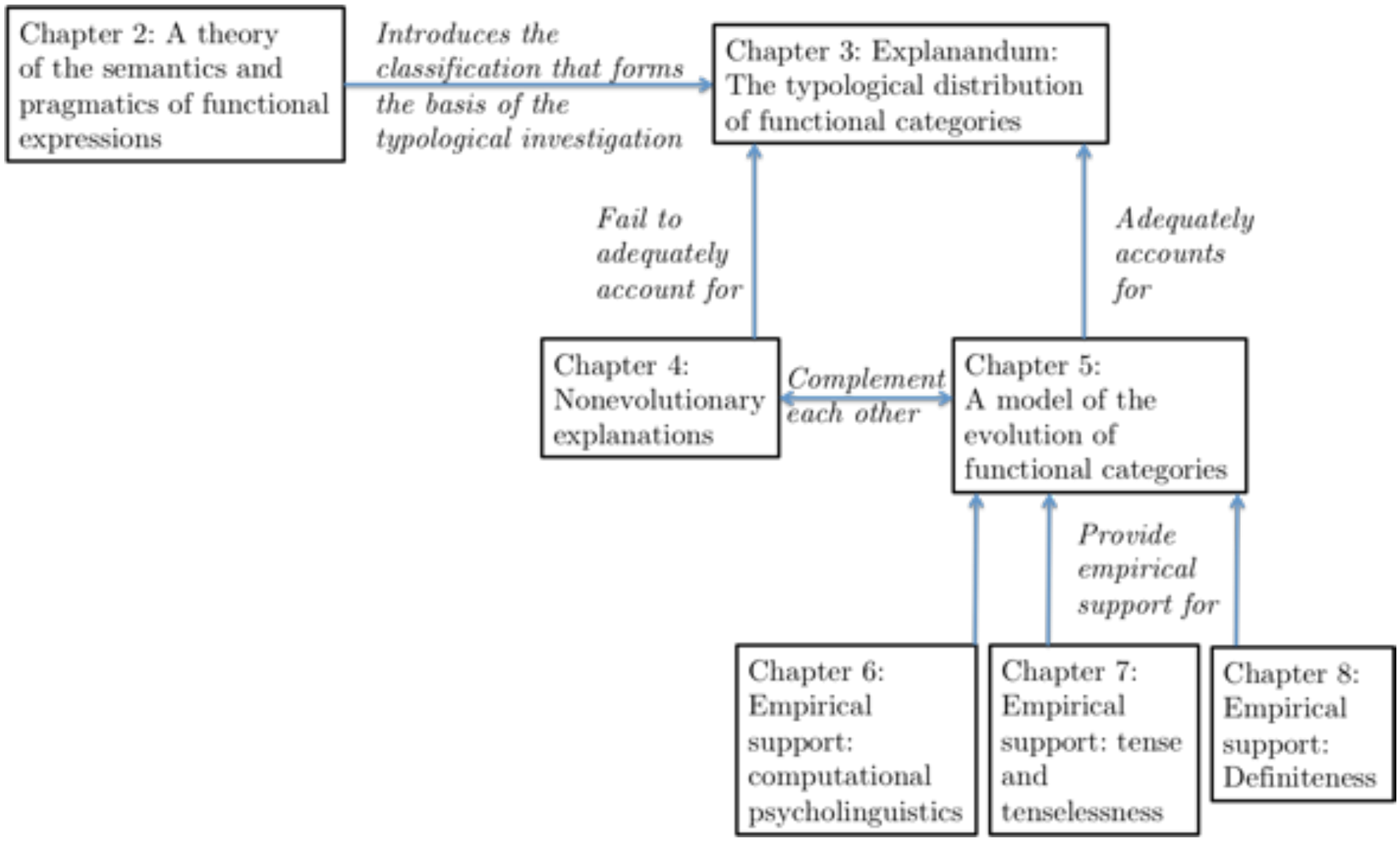


Figure 1.4. *Organization of the book as a flowchart*

APPENDICES

- commitments
  - **evolutionary functionalism** - only evolutionary models can explain how semantic/pragmatic functions shape language
    - as long as teleological explanations are rejected
    - cf. Keller (1994); Hawkins (1994, 2004, 2014); Croft (1996, 2000); Haspelmath (1999a,b), *inter alia*
  - **constructionism** - constructions are simple or templatic signs with conventionalized iconic and symbolic meanings
    - with morphophonological, morphosyntactic, semantic, and pragmatic properties that continuously evolve
    - cf. Langacker (1987); Goldberg (1995); Croft (2001); Boas & Sag (2012); *inter alia*

APPENDICES

- commitments (cont.)
  - **probabilistic pragmatics** — comprehension is based on (often non-monotonic) inferences, not on decoding
    - cf. Grice (1975, 1989); Sperber & Wilson (1987); Clark (1996); Levinson (2000); Goodman & Frank (2016); *inter alia*
  - **categorical particularism** — constructions and functional expressions are strictly language-specific = *emic*
    - the *etic* 'comparative concepts' we use to compare them have no explanatory value
    - cf. Dryer (1997); Haspelmath (2007, 2010); *inter alia*

- the role of functional expressions in language

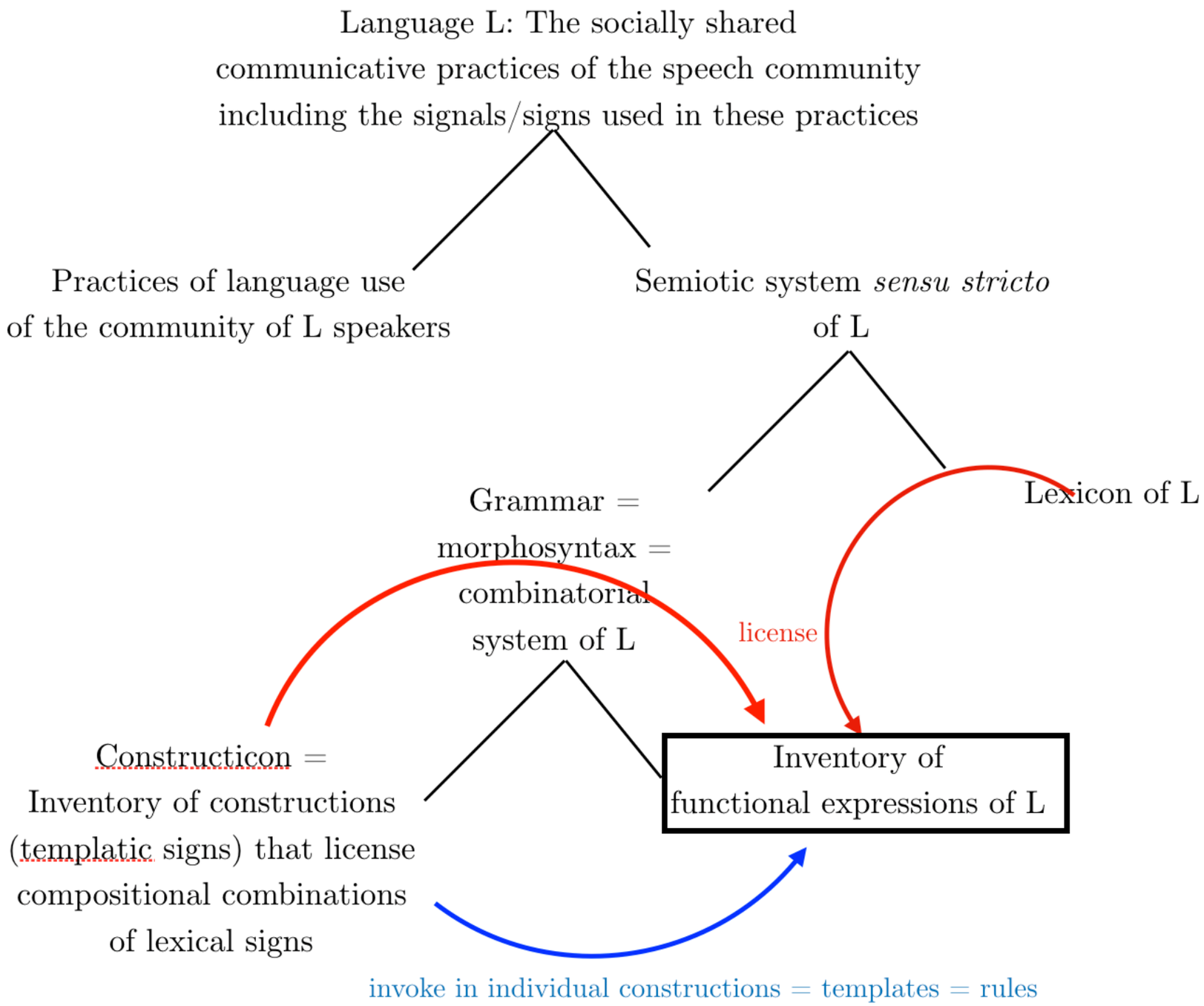


Figure 2.1. *The place of functional expressions in the grammar of language L*

APPENDICES

- combinatorial and semiotic properties
  - Cann (2000): functional categories can be defined in terms of language-specific distributional classes
    - vis-à-vis the major lexical categories V, N, A

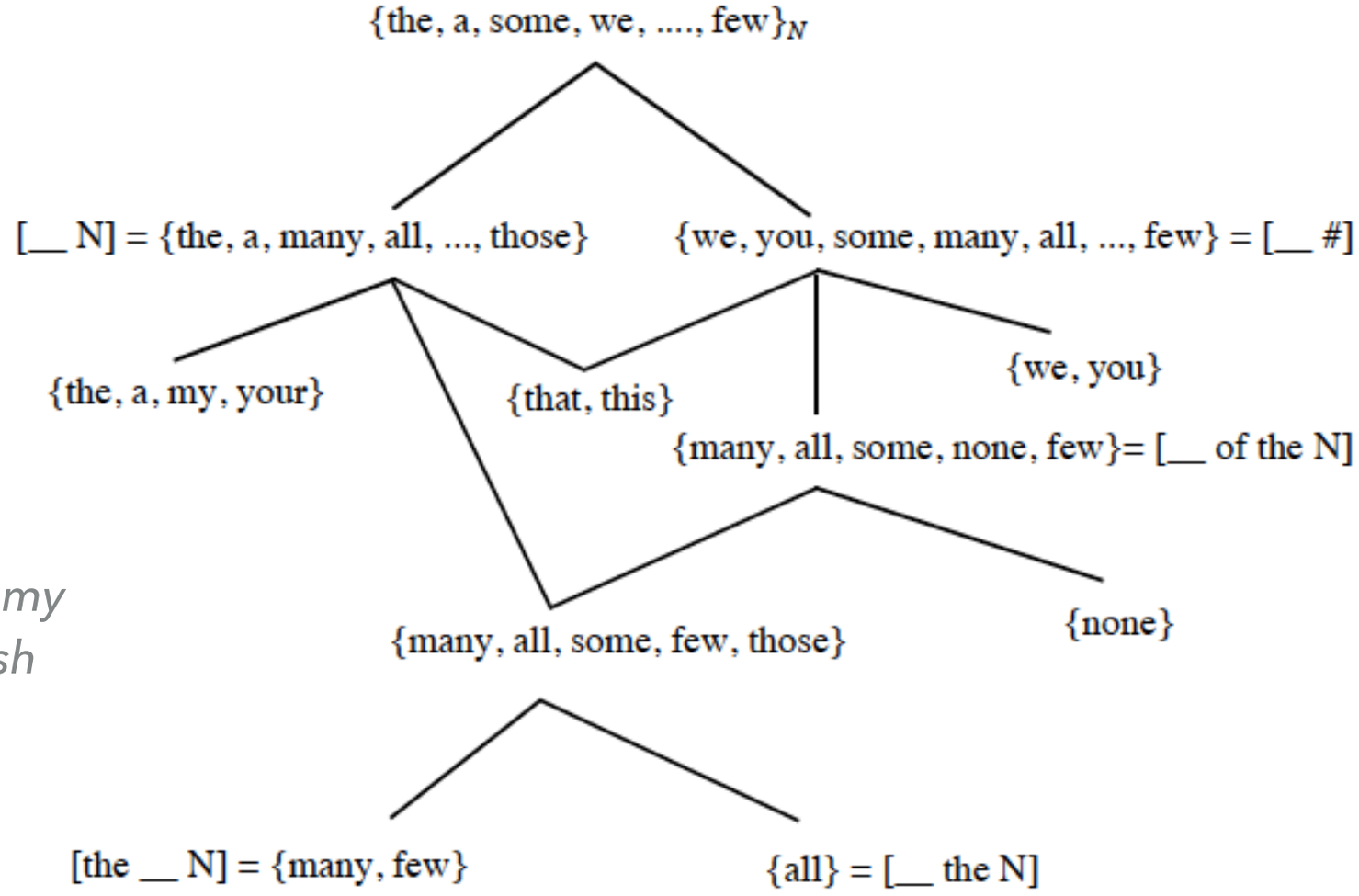


Figure 2.2. *Lattice representing a taxonomy of nominal functional categories of English defined in terms of distributional classes (Cann 2000: 18)*

APPENDICES

- combinatorial and semiotic properties (cont.)
  - one way to visualize the semantic effect of combinatorial properties: **semantic type**

Lexical and phrasal categories		Functional expressions	
Proper nouns, pronouns	e	Numerals, mensuratives	$\langle\langle e,t\rangle,\langle e,t\rangle\rangle$
Non-relational common nouns, standard-form predicative adjectives, intransitive verbs, VPs	$\langle e,t\rangle$	Lexical adpositions	$\langle\langle\langle e,t\rangle,t\rangle,\langle e,t\rangle\rangle$
NPs headed by common nouns	$\langle\langle e,t\rangle,\ t\rangle$	Determiners	$\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle$
Relational common nouns, comparative-form predicative adjectives, transitive verbs	$\langle e,\ \langle e,t\rangle\rangle$	Modals, VP negation	$\langle\langle e,t\rangle,$ $\langle\langle\langle e,t\rangle,\ t\rangle,\ t\rangle\rangle$
Ditransitive verbs	$\langle e,\ \langle e,\ \langle e,t\rangle\rangle\rangle$	Sentential negation	$\langle t,t\rangle$
Attributive adjectives, relative clauses	$\langle\langle e,t\rangle,\langle e,t\rangle\rangle$	Coordinative conjunctions	$\langle t,\ \langle t,t\rangle\rangle$
Clauses, sentences	t		

Table 2.1. *Standard-issue extensional Montegovian type system for English sans events/situations*

APPENDICES

- combinatorial and semiotic properties (cont.)
  - the point: functional expressions differ from lexical expressions in that they are **syncategoremata** and more abstract and relational in their meanings

Lexical and phrasal categories		Functional expressions	
Proper nouns, pronouns	e	Numerals, mensuratives	$\langle\langle e,t\rangle,\langle e,t\rangle\rangle$
Non-relational common nouns, standard-form predicative adjectives, intransitive verbs, VPs	$\langle e,t\rangle$	Lexical adpositions	$\langle\langle\langle e,t\rangle,t\rangle,\langle e,t\rangle\rangle$
NPs headed by common nouns	$\langle\langle e,t\rangle,\ t\rangle$	Determiners	$\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle$
Relational common nouns, comparative-form predicative adjectives, transitive verbs	$\langle e,\ \langle e,t\rangle\rangle$	Modals, VP negation	$\langle\langle e,t\rangle,$ $\langle\langle\langle e,t\rangle,\ t\rangle,\ t\rangle\rangle$
Ditransitive verbs	$\langle e,\ \langle e,\ \langle e,t\rangle\rangle\rangle$	Sentential negation	$\langle t,t\rangle$
Attributive adjectives, relative clauses	$\langle\langle e,t\rangle,\langle e,t\rangle\rangle$	Coordinative conjunctions	$\langle t,\ \langle t,t\rangle\rangle$
Clauses, sentences	t		

Table 2.1. *Standard-issue extensional Montegovian type system for English sans events/situations*

APPENDICES

- combinatorial and semiotic properties (cont.)
  - consider also Sapir's (1921: 68-128) classification of linguistic meanings

I. CONCRETE CONCEPTS:
1. First subject of discourse: *farmer*
2. Second subject of discourse: *duckling*
3. Activity: *kill*
——analyzable into:
4. RADICAL CONCEPTS:
   1. Verb: (*to*) *farm*
   2. Noun: *duck*
   3. Verb: *kill*
5. DERIVATIONAL CONCEPTS:
   1. Agentive: expressed by suffix *-er*
   2. Diminutive: expressed by suffix *-ling*

II. RELATIONAL CONCEPTS:
Reference:
1. Definiteness of reference to first subject of discourse: expressed by first *the,* which has preposed position
2. Definiteness of reference to second subject of discourse: expressed by second *the,* which has preposed position

Modality:
3. Declarative: expressed by sequence of "subject" plus verb; and implied by suffixed *-s*

Personal relations:
4. Subjectivity of *farmer:* expressed by position of *farmer* before kills; and by suffixed *-s*
5. Objectivity of *duckling:* expressed by position of *duckling* after *kills*

Number:
6. Singularity of first subject of discourse: expressed by lack of plural suffix in *farmer;* and by suffix *-s* in following verb
7. Singularity of second subject of discourse: expressed by lack of plural suffix in *duckling*

Time:
8. Present: expressed by lack of preterit suffix in verb; and by suffixed *-s*

Table 2.2. *Sapir's (1921: 92-93) classification of concepts expressed in* The farmer killed the duckling

APPENDICES

- combinatorial and semiotic properties (cont.)
  - beyond semantic type, combinatorial properties in a broad sense also extend to
    - indexicality
    - the component of the meaning of the utterance that the functional expression operates on

Table 2.3. *Hengeveld's (1989: 131-132) classification of operators in Functional Grammar*

Semantic domain	Grammatical category
Predicate operators	
Internal temporal constituency	Imperfective/Perfective, Phasal Aspect
Presence or absence of property or relation expressed by predicate	Predicate negation
Predication operators	
Time of occurrence	Tense
Frequency of occurrence	Quantificational Aspect
Actuality of occurrence	Objective mood/Polarity
Proposition operators	
Source of proposition	Evidential mood
Commitment to proposition	Subjective mood
Illocution operators	
Weakening strategy	Mitigating mode
Strengthening strategy	Reinforcing mode

Table 2.4. *Operators in the layered structure of the clause (Van Valin 2005: 9)*

Nuclear operators:
- Aspect
- Negation
- Directionals (only those modifying orientation of action or event without reference to participants)

Core operators:
- Directionals (only those expressing the orientation or motion of one participant with reference to another participant or to the speaker)
- Event quantification
- Modality (root modals, e.g. ability, permission, obligation)
- Internal (narrow scope) negation

Clausal operators:
- Status (epistemic modals, external negation)
- Tense
- Evidentials
- Illocutionary force

APPENDICES

- the classification: hybrids
  - there are quite a few pervasive expressions in natural languages that instantiate multiple types at ones
  - e.g., morphologically unbound personal pronouns are placeholders (discourse-prominent)
  - but the co-expressed categories of person, number, gender are restrictors on them (inherently backgrounded)
  - similarly for the distance distinctions in demonstratives

APPENDICES

- the classification: limits
  - the proposed theory contains no principles from which to derive an exhaustive classification of functional expressions
    - beyond the level of the seven super-types
  - I'm skeptical that an exhaustive classification is possible

APPENDICES

- the classification: limits (cont.)
  - it's part of the "logic" of evolution
    - that the possibility space for the emergence of new species depends on the set of existing species
      - e.g., birds could not have evolved before dinosaurs
- thus the possibility space continues to evolve itself
- the languages that existed beyond the time horizon of the comparative method
  - probably actually were substantially different from today's

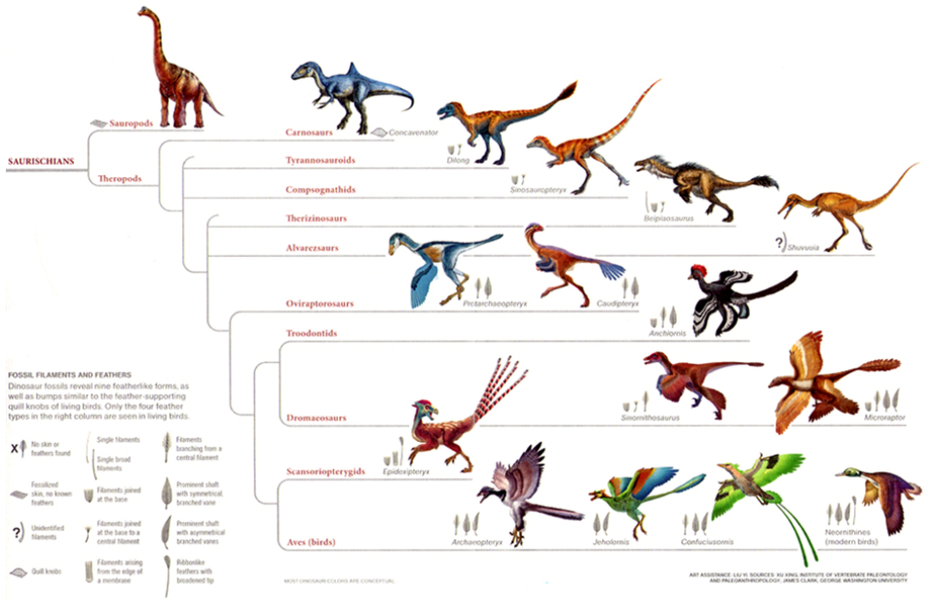


Figure 2.4. *Birds and reptile (image credit: https://reptiland.com/how-birds-and-reptiles-are-related/)*

- predictions

Table 2.5. *Predictions generated by the proposed theory of functional expressions*

Type of functional expression	Discourse-prominent	Inherently backgrounded
Degree of grammaticalization	Weaker	Stronger
Typological distribution	Near-universal: expressed in any all-purpose language, either by a functional expression or compositionally	Variable to a degree that depends on just how redundant the type of expression is
Ex nihilo type innovation (type emergence in a genus without contact model)	Limited to transitions b/w compositional and non-compositional expressions	Unlimited

APPENDICES

- the pragmatic optimization engine (POE)
  - when we "speak" (i.e., use language)
    - we ***aim*** to optimize the utterances we produce for
      - informativeness, frequency, length, and complexity
        - of the expressions involved
- we know this because the computation of **generalized conversational implicatures** (GCIs) relies on this ability
  - cf. Grice (1975, 1989); Sperber & Wilson (1987); Clark (1996); Levinson (2000); Goodman & Frank (2016); *inter alia*

APPENDICES

- disclaimer
  - I'm not suggesting
    - that grammaticalization or evolutionary language change are driven by implicatures

- what I am suggesting
  - the computation of GCIs relies on the ability to optimize (*in an atelic sense*) utterances for communicative efficiency
    - in terms of informativeness, frequency, length, and complexity
    - and that same ability also drives evolutionary language change, including grammaticalization

APPENDICES

- GCIs: POE in action - a crash course
  - informativeness: **scalar** implicatures
    - when a speaker selects an expression over a more informative alternative
      - the hearer is licensed to infer that the alternative doesn't apply
        - this is a defeasible default interpretation - a GCI

(6.1) *Sally ate **some** of the cookies*
+> She didn't eat all of them

(6.2) *Floyd owns **two** laptops*
+> He doesn't own more than two

(6.3) *Joe **broke** the vase*
+> Nobody made him do it

APPENDICES

- GCIs: POE in action - a crash course (cont.)
  - frequency:
    stereotype vs. **manner** implicatures
    - when a speaker selects a high-frequency expression over a low-frequency alternative
      - the hearer is licensed to infer that the most stereotypical situation compatible with the expression applies

(6.4) *Sally **went** into the library*

+> she walked, in a stereotypical manner

(6.5) *The vase **was** on the table*

+> the vase was directly fully supported by the table

(6.6) *Floyd **stopped** the car*

+> direct causation: F. hit the brakes

APPENDICES

- GCIs: POE in action - a crash course (cont.)
  - frequency:
    stereotype vs. **manner** implicatures (cont.)
    - when a speaker selects a low-frequency expression over a high-frequency alternative
      - the hearer is licensed to infer that the most stereotypical situation compatible with the expression does *not* apply

(6.7) *Sally **walked/dashed/danced/rolled/careened** into the library*
manner specified – manner at issue or atypical

(6.8) *The vase **was balanced** on the table*
+> the vase was not directly fully supported by the table

(6.9) *Floyd **caused** the car **to stop***
+> indirect causation; e.g., F. stepped in front of the car

APPENDICES

- GCIs: POE in action - a crash course (cont.)
  - length and complexity:
    stereotype vs. **manner** implicatures (yes, again!)
    - when a speaker selects a simple, short expression over a complex, longer/heavier alternative
      - the hearer is licensed to infer that the most stereotypical situation compatible with the expression applies

(6.4) *Sally **went** into the library*
+> she used a stereotypical entryway

(6.5) *The vase **was** on the table*
+> the vase was directly fully supported by the table

(6.6) *Floyd **stopped** the car*
+> direct causation: F. the brakes

APPENDICES

- GCIs: POE in action - a crash course (cont.)
  - length and complexity:
    stereotype vs. **manner** implicatures (yes, again!) (cont.)
    - when a speaker selects a long, complex expression over a shorter, simpler alternative
      - the hearer is licensed to infer that the most stereotypical situation compatible with the expression doesn't apply

(6.7) *Sally* ***entered*** *to the library* ***through the window***
entryway specified because it is atypical or at issue

(6.8) *The vase* ***was balanced*** *on the table*
+> the vase was not directly fully supported by the table

(6.9) *Floyd* ***caused*** *the car* ***to stop***
+> indirect causation; e.g., F. stepped in front of the car

APPENDICES

- so: the POE effectively **compares** alternative expressions in terms of
  - informativeness
  - frequency = predictability
  - length/weight and complexity
    - both speaker and hearer rely on these comparisons
      - i.e., they inform both production and comprehension
- however: it is not clear how/where exactly these comparisons happen during production/comprehension
  - and to what extent these comparisons happen “online”
    - more below!

APPENDICES

- have psycholinguists studied this ability?
  - not anywhere nearly enough!
  - but, there is a small but burgeoning field called (by some) *experimental pragmatics*
    - cf., e.g., Gibbs (2017), Noveck (2018), Schwartz (2017)
    - for recent synopses

APPENDICES

- what role does the POE play in grammaticalization according to the theory proposed here?
  - actually, two roles!
  - first role: the POE compares expressions to variants that have been augmented by incipient grammaticalization
    - example: it compares bare nominals to nominals augmented by a demonstrative
      - for optional definiteness marking in languages without definite articles

Russian

Zatem	s	solidny-m	dokument-om
afterward	with	substantial-INST.SG	document-INST.SG
ot	redakci-i	on	po-echa-l
from	editorial.office-GEN.SG	he.NOM	TEL-go-PAST.SGM
na	sever (...).	Dokument	**etot**
to	north(ACC.SG.M)	Document(NOM.SG.M)	this(NOM.SG.M)
by-l	neobchodi-m		
be-PAST.SG.M	necessary-SG.M		

'Afterwards he went up north with a substantial document from the editors. He needed **this/the** document (...)' (Birkenmaier 1979:90)

APPENDICES

- the **first** role of the POE in grammaticalization (cont.)
  - compare the bare expression to the augmented variant in terms of
    - the relative odds of the hearer inferring the intended message given their selection
    - the relative effort in producing the two

"The Principle of Communicative Efficiency
Communicate in such a way as to maximize the benefit-to-cost ratio." (Levshina 2018: 4)

Russian

Zatem	s	solidny-m	dokument-om
afterward	with	substantial-INST.SG	document-INST.SG

ot	redakci-i	on	po-echa-l
from	editorial.office-GEN.SG	he.NOM	TEL-go-PAST.SGM

na	sever (...).	Dokument	**etot**
to	north(ACC.SG.M)	Document(NOM.SG.M)	this(NOM.SG.M)

by-l	neobchodi-m ... .
be-PAST.SG.M	necessary-SG.M

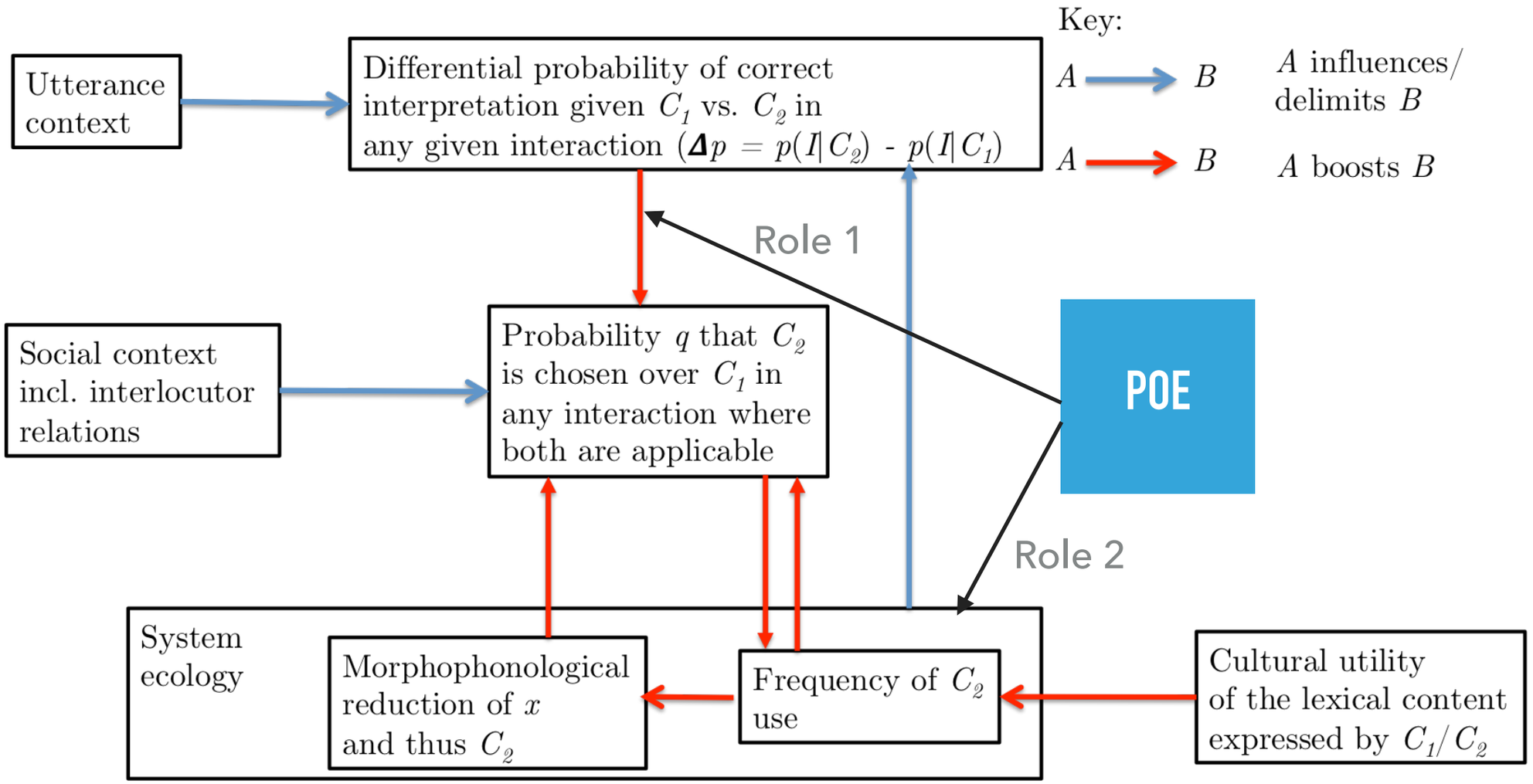
'Afterwards he went up north with a substantial document from the editors. He needed **this/the** document (...)' (Birkenmaier 1979:90)

APPENDICES

- the **second** role of the POE in grammaticalization
  - compare the augmented variant
    to shorter versions of itself
    - the relative effort in producing the two
      biases POE in selecting the shorter versions
      - as long as the odds of the hearer inferring the intended message is not significantly affected
- this leads to Zipfian effects
  - which themselves play a crucial role in grammaticalization
    - by further reducing the effort involved in the production of the grammaticalizing variant

- putting the two roles of the POE into the picture

Assume a contrast between two expressions C_1 and $C_2 = C_1 + x$, both of which could be used to express the speaker's communicative intent. The addition of x to C_1 is licensed by an existing construction of the language. Its use in C_2 is redundant wrt. the speaker's communicative intent, but increases the probability p of the hearer inferring the intended meaning I ($p(I|C_2) > p(I|C_1)$). E.g., x could be a demonstrative added to indicate definiteness, a perfective aspect marker to indicate past time reference, or an allative case marker to indicate a syntactic object relation.



APPENDICES

- so where is the POE located
  relative to the production and comprehension processes?
  - unclear
  - the question is precisely to what extent the comparison of alternatives involves actual individual expressions
    - and thus access to the mental lexicon and grammar
- and to what extent it can be farmed out to the preverbal message (during production)
  - e.g., part of the computation of the preverbal message might involve an assessment
    - that a SoA to be talked about is atypical and thus requires a more complex, low-frequency expression

APPENDICES

- a variety of different evolutionary models of language change have been proposed recently

Table 4.2. *A typology of evolutionary models of language change*

Assumed primary "agents" of language change Specificity of the model	(Primarily L1) Learners	(Primarily adult) speakers	Both learners and speakers
Narrow analogy to biological evolution (causal model)	Deacon (1997)	Croft (2000)	Christiansen & Chater (2008, 2016)
Broad – language as a 'complex adaptive system'	Kirby (1999); Reali & Christiansen (2009); Fedzechkina et al. (2012)	Haspelmath (1999); Hawkins (2014); Pierrehumbert (2001)	Beckner et al. (2009)