

# Table of contents

List of Figures	viii
List of Tables	ix
Preface	x
1. INTRODUCTION	1
2. WHAT IS LANGUAGE?	5
3. THE THEORY OF EVOLUTION	13
3.1 Natural selection as an abstract process	14
3.2 Variation, randomness, and mutation	15
3.3 Limitations and misunderstandings of evolution	16
3.4 Cultural evolution	20
3.4.1 Evolutionary epistemology	22
3.4.2 The three worlds of Karl Popper	24
3.4.3 Memetics	25
3.4.4 The interaction of cultural and biological evolution	29
3.5 Evolutionary theory as applied to language	31
3.5.1 Evolution of language <i>per se</i>	32
3.5.2 Co-evolution of linguistic and biological organisms	35
3.6 The time scale of evolution	39
3.7 Summary	40
4. HUMAN ORIGINS AND EVOLUTION	41
4.1 Mammals	42
4.2 Primates	44
4.2.1 Who is our closest living relative?	48
4.3 Hominids	51
4.3.1 Bipedal apes	52
4.3.2 Growing brains	60
4.3.3 Ourselves and other humans	66
4.4 Summary	75
5. ANATOMICAL AND NEUROLOGICAL PREREQUISITES	77
5.1 Sound production	77
5.1.1 Vocal tract differences	78

5.1.2	The neural wiring of the vocal apparatus	81
5.1.3	Control of rapid sequencing	83
5.1.4	When did we start to speak?	85
5.2	Sound perception	86
5.3	Brain anatomy, modularity, and lateralization	88
5.3.1	Why did large brains evolve?	94
5.3.2	Lateralization	98
5.3.3	Modularity	100
5.3.4	Brain and language in other species, fossil and extant	112
5.4	Summary	116
6.	ANIMAL COMMUNICATION IN THE WILD	119
6.1	Do animal calls mean anything?	120
6.2	Mental states of communicating animals?	122
6.3	The evolution of animal communication	125
6.4	Animal syntax?	127
6.5	Summary	127
7.	CAN NON-HUMANS BE TAUGHT LANGUAGE?	129
7.1	Apes	130
7.2	Dolphins	136
7.3	Parrots	137
7.4	Patterns of non-human language acquisition	138
7.5	Summary	141
8.	LANGUAGE, MIND, AND SELF	143
8.1	What is Mind — the ‘hard problem’	145
8.2	What is mind — the ‘easy problem’ — and do animals have it?	147
8.2.1	Theory of mind	148
8.2.2	Self-awareness	152
8.3	Summary	155
9.	HYPOTHESES OF LANGUAGE ORIGINS	157
9.1	Historical background	158
9.2	Dimensions of language evolution hypotheses	162
9.3	Adaptation vs. spandrel	163

---

9.4	Early vs. late	167
9.4.1	Art and technology as proxies for language?	168
9.5	Gradual vs. sudden	170
9.6	Speech first vs. gestures first	173
9.6.1	Mimesis	175
9.6.2	Mirror neurons	176
9.6.3	Why switch to speech?	177
9.7	Innate vs. learned	178
9.8	Summary	190
10.	WHY DID LANGUAGE EVOLVE?	193
10.1	Hunting	195
10.2	Tool making	198
10.3	Sexual selection	202
10.4	Child care and teaching	206
10.5	Social relations in groups and tribes	208
10.6	Miscellaneous ideas	214
10.7	Why us and not the other apes?	216
10.8	Summary	217
11.	PROTO-LANGUAGE	219
11.1	Proto-speech	219
11.2	Proto-gestures	222
11.3	Proto-semantics	223
11.4	Proto-syntax	230
11.5	How can all the protos be combined?	240
11.6	Summary	242
12.	CONCLUSIONS	243
	References	248
	Index	331