

CONTENTS

| | |
|---|-------------------|
| <i>List of figures</i> | <i>page</i> xviii |
| <i>List of tables</i> | xxiii |
| <i>Preface</i> | xxv |
| <i>Acknowledgements</i> | xxvi |
| Introduction | 1 |
| PART I General concepts | |
| 1 The semiotic framework | 13 |
| 1.1 Semiotics as the general theory of signs | 13 |
| 1.2 Semantic, evidential and regulative information in speech | 14 |
| 1.3 Vocal and non-vocal behaviour | 15 |
| 1.4 Verbal and non-verbal behaviour | 16 |
| 1.5 Signs and symbols | 17 |
| 1.6 Dual-level structure in the linguistic code | 18 |
| 1.7 Form and substance | 19 |
| 1.8 Code and medium | 20 |
| 1.9 Communicative and informative behaviour | 21 |
| 1.10 Linguistic, paralinguistic and extralinguistic behaviour | 21 |
| 1.11 The domain of phonetics | 23 |
| Further reading | 23 |
| 2 The relationship between phonetics and phonology | 26 |
| 2.1 The acoustic level | 26 |
| 2.2 The perceptual level | 26 |
| 2.3 The organic level | 27 |
| 2.4 The phonetic level | 28 |
| 2.5 The phonological level | 30 |
| 2.6 Language-system and language-behaviour | 48 |
| Further reading | 53 |
| | xi |

| | | |
|----------------|--|------------|
| 3 | Accent, dialect and language | 55 |
| 3.1 | The Standard English dialect, and non-regional and regional accents | 56 |
| 3.2 | Differences of dialect between speakers | 60 |
| 3.3 | Differences of accent between speakers | 62 |
| 3.4 | Differences of style and free variation within the accent of a single speaker | 66 |
| 3.5 | Accent as a marker of the speaker's group-membership and individuality | 69 |
| 3.6 | Dialectology and dialect geography | 71 |
| 3.7 | Language differences between speakers | 77 |
| 3.8 | The genetic relationship between languages | 84 |
| | Further reading | 89 |
| | | |
| PART II | The analytic framework | |
| 4 | The phonetic analysis of speech | 95 |
| 4.1 | General phonetic theory and general phonological theory | 95 |
| 4.2 | The phonetic analysis of speech | 98 |
| 4.3 | The biological basis for speech | 99 |
| 4.4 | Parametric and linear approaches to segmentation of the stream of speech | 101 |
| 4.5 | Linear units of phonetic organization: feature, segment, syllable, setting, utterance, speaking turn | 110 |
| 4.6 | Elements of speech production: initiation, phonation, articulation, temporal, prosodic and metrical organization | 116 |
| | Further reading | 118 |
| 5 | The architecture of phonetic classification | 119 |
| 5.1 | A frame of reference for the production of speech | 119 |
| 5.2 | The traditional design of the classificatory model for segmental description | 129 |
| 5.3 | Classification of segments by initiation, phonation, articulation and co-ordination | 130 |
| 5.4 | Degree of stricture and phases of articulation | 133 |
| 5.5 | Place of articulation | 135 |
| 5.6 | Aspect of articulation | 140 |
| 5.7 | Major aspects of articulation | 143 |
| 5.8 | Contoid, approximant and vocoid segments | 147 |
| 5.9 | Articulatory co-ordination | 149 |
| 5.10 | The duration of segments | 151 |

| | | |
|--|--|------------|
| 5.11 | The suprasegmental analysis of speech | 152 |
| | Further reading | 158 |
| PART III Initiation and phonation | | |
| 6 | Airstream mechanisms | 161 |
| 6.1 | The pulmonic airstream mechanism | 162 |
| 6.2 | The glottalic airstream mechanism | 171 |
| 6.3 | The velaric airstream mechanism | 173 |
| 6.4 | Combined glottalic and pulmonic airstream mechanisms | 179 |
| 6.5 | Phonological use of non-pulmonic airstreams | 181 |
| 6.6 | Symbols for segments made on various airstream mechanisms | 183 |
| | Further reading | 183 |
| 7 | Phonation | 184 |
| 7.1 | Voicelessness: nil phonation | 187 |
| 7.2 | Voicelessness: breath phonation | 189 |
| 7.3 | Whisper phonation | 190 |
| 7.4 | Voiced phonation | 191 |
| 7.5 | Creak phonation | 194 |
| 7.6 | Falsetto phonation | 197 |
| 7.7 | Compound phonation types | 198 |
| 7.8 | Symbols for phonation types | 200 |
| | Further reading | 200 |
| PART IV Linear segmental analysis | | |
| 8 | Stop articulations | 205 |
| 8.1 | Place-neutral stop articulations | 206 |
| 8.2 | Oral versus nasal aspects of stop articulations | 209 |
| 8.3 | Displaced stop articulations | 214 |
| 8.4 | Topographical aspects of stop articulations | 215 |
| 8.5 | Transitional aspects of stop articulation: tapped, flapped and trilled stops | 218 |
| 8.6 | Complex oral/nasal stop articulations | 227 |
| 8.7 | Stop segments and phonation types | 235 |
| 8.8 | Stop articulations and non-pulmonic airstreams | 237 |
| 8.9 | Syllabic stop segments | 239 |
| 8.10 | Symbols for stop articulations | 242 |
| | Further reading | 243 |

| | | |
|-----------|--|------------|
| 9 | Fricative articulations | 244 |
| 9.1 | Place-neutral fricative articulations | 245 |
| 9.2 | Displaced fricative articulations | 248 |
| 9.3 | Examples of fricative segments in languages | 253 |
| 9.4 | Conformational aspects of fricative articulations | 255 |
| 9.5 | Topographical aspects of the shape of the tongue in fricative articulations | 258 |
| 9.6 | Auditory characteristics of fricatives | 260 |
| 9.7 | Transitional aspects: flapped, tapped and trilled fricatives | 263 |
| 9.8 | Syllabic fricatives | 264 |
| 9.9 | Fricative articulations and phonation types | 265 |
| 9.10 | Fricative articulations and non-pulmonic airstreams | 266 |
| 9.11 | Symbols for fricative articulations | 266 |
| | Further reading | 266 |
| 10 | Resonant articulations | 269 |
| 10.1 | Syllabic vocoids | 270 |
| 10.2 | Charts of the vocoid space | 272 |
| 10.3 | Phonetic symbols for vocoids | 277 |
| 10.4 | Labial elements of vocoid segments | 278 |
| 10.5 | Intermediate vocoids | 280 |
| 10.6 | Exemplification of vocoid symbols | 281 |
| 10.7 | Transitional aspects of vocoid production: monophthong, diphthong and triphthong | 282 |
| 10.8 | Tongue-root position in vocoid articulations | 289 |
| 10.9 | Nasal vocoid articulations | 291 |
| 10.10 | Voiceless and whispered vocoids | 295 |
| 10.11 | Non-syllabic approximant articulations | 297 |
| 10.12 | Nasal approximants | 305 |
| 10.13 | Lateral resonants | 306 |
| 10.14 | Symbols for resonant articulations | 313 |
| | Further reading | 313 |
| 11 | Multiple articulations | 314 |
| 11.1 | Double stop articulations | 314 |
| 11.2 | Double fricative articulations | 316 |
| 11.3 | Resonant articulations with multiple strictures | 318 |
| 11.4 | Secondary articulations | 320 |
| 11.5 | The phonological patterns of secondary articulations | 333 |
| 11.6 | The ambiguous use of '-ization' labels | 334 |

| | | |
|--|--|------------|
| 11.7 | Symbols for double articulations and secondary articulations | 335 |
| | Further reading | 335 |
| PART V Articulatory co-ordination and phonetic settings | | |
| 12 | Intersegmental co-ordination | 339 |
| 12.1 | The devoicing process | 339 |
| 12.2 | Aspiration | 348 |
| 12.3 | Pre-aspiration | 356 |
| 12.4 | Co-ordination of the marginal phases of stop segments | 358 |
| 12.5 | Articulatory feature sharing | 376 |
| | Further reading | 389 |
| 13 | Phonetic similarity and multisegmental settings | 391 |
| 13.1 | Phonetic similarity and segments | 391 |
| 13.2 | Phonetic similarity and settings | 394 |
| 13.3 | The phonetic description of settings | 399 |
| 13.4 | Neutral reference settings | 402 |
| 13.5 | Articulatory settings | 406 |
| 13.6 | Phonatory settings | 414 |
| 13.7 | Settings of articulatory range | 415 |
| 13.8 | Settings of overall muscular tension | 416 |
| 13.9 | Summary transcription conventions | 420 |
| 13.10 | Applications of setting-analysis | 423 |
| | Further reading | 427 |
| PART VI Temporal, prosodic and metrical analysis | | |
| 14 | The temporal organization of speech: segmental duration | 431 |
| 14.1 | The perception of duration | 431 |
| 14.2 | Intrinsic versus conditioned factors of duration | 432 |
| 14.3 | Intrinsic durations of contoids | 434 |
| 14.4 | Intrinsic durations of vocoids | 435 |
| 14.5 | Phonetic duration and phonological length | 436 |
| 14.6 | Allophonic adaptations of duration | 445 |
| | Further reading | 448 |
| 15 | The prosodic organization of speech: pitch and loudness | 450 |
| 15.1 | The perception of pitch | 450 |
| 15.2 | Inherent and overlaid features | 452 |

| | | |
|------------------|--|------------|
| 15.3 | Perturbations of pitch and loudness due to segmental performance | 452 |
| 15.4 | The prosodic analysis of pitch | 456 |
| 15.5 | The analysis of melody in language | 462 |
| 15.6 | The analysis of pitch-patterns in tone systems | 462 |
| 15.7 | The analysis of pitch-patterns in intonation systems | 483 |
| 15.8 | The analysis of loudness | 500 |
| 15.9 | Prosodic settings of pitch and loudness | 506 |
| | Further reading | 508 |
| 16 | The metrical organization of speech: stress, syllable weight, prominence and rhythm | 511 |
| 16.1 | Prominence achieved through syllable stress | 512 |
| 16.2 | Prominence achieved through syllable weight | 517 |
| 16.3 | The typology of lexical stress | 518 |
| 16.4 | Rhythm in speech | 523 |
| 16.5 | The constructive perception of rhythm | 524 |
| 16.6 | The typology of speech rhythm | 527 |
| 16.7 | Utterance-marginal lengthening | 532 |
| | Further reading | 533 |
| 17 | The temporal organization of speech: continuity and rate | 534 |
| 17.1 | Continuity of speech | 535 |
| 17.2 | Articulation rate and speaking rate | 539 |
| | Further reading | 546 |
| PART VII | Principles of transcription | |
| 18 | Types of transcription | 549 |
| 18.1 | Phonological and phonetic transcriptions | 549 |
| 18.2 | Systematic phonemic and allophonic transcriptions | 550 |
| 18.3 | Allophonic and phonetic transcriptions | 556 |
| 18.4 | General phonetic transcription and the IPA | 561 |
| | Further reading | 562 |
| PART VIII | Conclusion | |
| 19 | Evaluating general phonetic theory | 565 |
| 19.1 | General phonetic theory and the segment | 566 |
| 19.2 | The role of convenient fictions in theory-building | 568 |
| 19.3 | Linear and non-linear characteristics of speech units | 569 |
| 19.4 | Default assumptions and language statistics | 570 |

| | |
|---|------------|
| Further reading | 591 |
| Envoi | 592 |
| <i>Appendix I</i> The phonetic alphabet of the International Phonetic Association | 593 |
| <i>Appendix II</i> Index of languages | 596 |
| <i>References</i> | 622 |
| <i>Index of names</i> | 685 |
| <i>Subject index</i> | 694 |

FIGURES

| | <i>page</i> | |
|------|---|-----|
| 3.1 | Consonant and vowel systems of three accents of English | 63 |
| 3.2 | The words for 'splinter' in dialects of Scotland and Northern Ireland | 74 |
| 3.3 | An isogloss boundary | 75 |
| 3.4 | An isogloss map of a transitional accent zone | 76 |
| 4.1 | Parametric articulatory analysis | 102 |
| 4.2 | Parametric acoustic analysis | 104 |
| 4.3 | Parametric articulatory analysis from cinefluorography | 105 |
| 4.4a | Target configuration for the articulation of [f] in <i>fish</i> | 109 |
| 4.4b | Target configuration for the articulation of [ɸ] in <i>fish</i> | 109 |
| 4.4c | Target configuration for the articulation of [ʃ] in <i>fish</i> | 109 |
| 5.1 | Sagittal view of the vocal organs | 120 |
| 5.2 | Schematic view of the roof of the mouth from below | 121 |
| 5.3 | Schematic view of the surface of the tongue from above | 123 |
| 5.4 | Frontal view of the back of the mouth | 125 |
| 5.5 | Sagittal view of the articulation of [s] | 127 |
| 5.6 | Sagittal view of the articulation of [m] | 127 |
| 5.7 | Four major descriptive elements of speech production | 131 |
| 5.8 | Initiation of speech production and associated segment-types | 132 |
| 5.9 | Phases of segmental performance | 133 |
| 5.10 | Classification of segment-types by degree of stricture | 134 |
| 5.11 | Labels for the zones of articulation | 135 |
| 5.12 | The neutral configuration of the vocal tract | 137 |
| 5.13 | Labels for place-neutral, displaced, double and secondary articulations | 139 |
| 5.14 | Aspects of articulation and associated types of segments | 143 |
| 5.15 | Configuration for the articulation of [d] | 145 |
| 5.16 | Configuration for the articulation of [n] | 145 |
| 5.17 | Contoids, non-contoids, approximants and vocoids | 147 |

| | | |
|------|---|-----|
| 5.18 | Syllabic and non-syllabic contoids and vocoids | 148 |
| 5.19 | Vocal profile protocol | 154 |
| 6.1 | Lung volumes and capacities | 164 |
| 6.2 | The balance between expiratory and inspiratory forces and relaxation pressure | 166 |
| 6.3a | Configuration for the first stage of articulating a click | 176 |
| 6.3b | Configuration for the second stage of articulating a click | 176 |
| 6.3c | Configuration for the third stage of articulating a click | 176 |
| 7.1 | The cartilaginous framework of the larynx | 184 |
| 7.2 | Some of the muscles of the larynx | 185 |
| 7.3 | Views of the larynx from behind and from above | 186 |
| 7.4 | Telelaryngoscopic views of the glottis in action | 188 |
| 7.5 | Glottal configurations for breath and whisper phonation | 191 |
| 7.6 | Vertical phase differences of the vocal folds in vibration | 193 |
| 7.7 | Constraints on the combinability of different modes of phonation | 199 |
| 7.8 | Diacritic symbols for phonation types | 200 |
| 8.1a | Configuration for the articulation of [p] | 208 |
| 8.1b | Configuration for the articulation of [t̚] | 208 |
| 8.1c | Configuration for the articulation of [t] | 208 |
| 8.1d | Configuration for the articulation of [c] | 208 |
| 8.1e | Configuration for the articulation of [k] | 208 |
| 8.1f | Configuration for the articulation of [q] | 208 |
| 8.2a | Configuration for the articulation of [m] | 210 |
| 8.2b | Configuration for the articulation of [ɱ] | 210 |
| 8.2c | Configuration for the articulation of [n] | 210 |
| 8.2d | Configuration for the articulation of [ɲ] | 210 |
| 8.2e | Configuration for the articulation of [ŋ] | 210 |
| 8.2f | Configuration for the articulation of [ɳ] | 210 |
| 8.3a | Configuration for the articulation of [t̪] | 217 |
| 8.3b | Configuration for the articulation of [ɲ] | 217 |
| 8.4a | Configuration for the first stage of the articulation of [ɾ] | 223 |
| 8.4b | Configuration for the second stage of the articulation of [ɾ] | 223 |
| 8.4c | Configuration for the third stage of the articulation of [ɾ] | 223 |
| 8.5 | Articulatory relationships between simplex and complex oral and nasal stops | 228 |
| 8.6 | Symbols for place-neutral and displaced pulmonic stops | 242 |
| 9.1a | Configuration for the articulation of [ϕ] | 246 |
| 9.1b | Configuration for the articulation of [θ] | 246 |
| 9.1c | Configuration for the articulation of [s] | 246 |

| | | |
|--------|---|-----|
| 9.1d | Configuration for the articulation of [ʃ] | 246 |
| 9.1e | Configuration for the articulation of [ç] | 246 |
| 9.1f | Configuration for the articulation of [ç] | 246 |
| 9.1g | Configuration for the articulation of [x] | 247 |
| 9.1h | Configuration for the articulation of [χ] | 247 |
| 9.1i | Configuration for the articulation of [h] | 247 |
| 9.1j | Configuration for the articulation of [H] | 247 |
| 9.2a | Configuration for the articulation of [f] | 249 |
| 9.2b | Configuration for the articulation of [ɸ] | 249 |
| 9.2c | Configuration for the articulation of [ʃ, ʃ] | 249 |
| 9.2d | Configuration for the articulation of [ʂ] | 249 |
| 9.3 | Symbols for place-neutral and displaced pulmonic fricatives | 267 |
| 10.1 | Contoids, non-contoids, approximants and vocoids | 269 |
| 10.2 | Articulation of a retroflex vocoid | 271 |
| 10.3 | The shape of the vocoid space | 272 |
| 10.4 | Stylized chart of the vocoid space | 273 |
| 10.5 | Cardinal Vowel diagram | 274 |
| 10.6 | Polar chart of the vocoid space | 276 |
| 10.7 | IPA vocoid chart and symbols | 277 |
| 10.8 | Vocoid chart of non-rounded vocoids, with associated symbols | 278 |
| 10.9 | Lip positions | 279 |
| 10.10 | Vocoid chart of rounded vocoids with symbols | 280 |
| 10.11 | Vocoid chart of intermediate vocoids with symbols | 281 |
| 10.12 | Lip-rounding in Tamil | 283 |
| 10.13 | Vocoid chart of English monophthongs | 285 |
| 10.14 | Transition duration against acoustic distance in diphthongs | 287 |
| 10.15a | Vocoid chart of English diphthongs | 288 |
| 10.15b | Vocoid chart of English triphthongs | 288 |
| 10.16 | Vocoid charts of Brazilian Portuguese triphthongs | 290 |
| 10.17 | Advanced tongue root in Igbo | 291 |
| 10.18 | Configurations for /r/: bunched [ʁ] versus retroflex [ɻ] | 301 |
| 10.19 | Cineradiographic film of a speaker performing bunched [ʁ] versus retroflex [ɻ] | 303 |
| 10.20 | Cineradiographic films of lateral resonants | 308 |
| 10.21 | Symbols for vocoids and approximants | 312 |
| 11.1 | Configuration for the articulation of [k̟p̟] | 315 |
| 11.2 | Configuration for the articulation of [d̟] | 323 |
| 11.3 | Configuration for the articulation of [d̟ʲ] | 326 |

| | | |
|--------|---|-----|
| 11.4 | Cineradiographic film of 'emphasis' in Arabic | 329 |
| 12.1 | Schematic diagrams of devoicing | 340 |
| 12.2 | Voice onset in French, English and Thai | 352 |
| 12.3a | Configuration for the articulation of [k̤] | 377 |
| 12.3b | Configuration for the articulation of [k̚] | 377 |
| 12.3c | Configuration for the articulation of [k] | 377 |
| 12.4 | Lip protrusion in English, French and Spanish | 380 |
| 13.1 | Auditory distances between segment-types | 392 |
| 13.2 | Acoustic distances between segment-types | 395 |
| 13.3a | Vocoid chart of English vocoids with a neutral setting | 401 |
| 13.3b | Vocoid chart of English vocoids with a palatalized setting | 401 |
| 13.4 | The neutral configuration of the vocal tract | 403 |
| 13.5 | Protocol for longitudinal, cross-sectional and velopharyngeal settings | 405 |
| 13.6 | Protocol for phonatory settings | 414 |
| 13.7 | Combinability of different modes of phonation | 415 |
| 13.8 | Protocol for ranges of labial, mandibular and lingual settings | 417 |
| 13.9 | Protocol for supralaryngeal and laryngeal muscular tension settings | 419 |
| 13.10 | Summary vocal profile protocol | 422 |
| 13.11 | Summary of symbols for settings | 423 |
| 14.1 | Vocoid chart of Fula vocoids | 441 |
| 15.1 | Stave for annotating pitch-patterns | 459 |
| 15.2 | Pitch-span, baseline and plateau | 460 |
| 15.3 | Parenthetic intonation | 460 |
| 15.4 | Pitch and amplitude characteristics in Swedish word-accents | 464 |
| 15.5 | Ten tonal patterns in Tlapanec | 466 |
| 15.6 | Contour tone system in Texmelucan Zapotec | 466 |
| 15.7 | Mixed register/contour tone system in Copala Trique | 466 |
| 15.8 | Tonal differences in Yoruba | 468 |
| 15.9 | Acoustic analysis of tone in Thai | 469 |
| 15.10 | Acoustic analysis of tone in Beijing Mandarin | 470 |
| 15.11 | Downstepped high tones in Coatzospan Mixtec | 471 |
| 15.12 | Upstepped high tones in Coatzospan Mixtec | 472 |
| 15.13 | Y.R. Chao's 'tone letters' | 475 |
| 15.14 | Six tunes of French intonation | 486 |
| 15.15a | Falling tune in French intonation | 487 |
| 15.15b | Rising tune in French intonation | 487 |

| | | |
|-------|---|-----|
| 15.16 | French declarative intonation | 487 |
| 15.17 | Two tunes of Spanish intonation | 488 |
| 15.18 | Neutral intonation in English, French and Italian | 489 |
| 15.19 | Intonation signalling 'contradiction' | 489 |
| 15.20 | Five 'Yes/No' question intonations in English | 490 |
| 15.21 | Fall versus step-down intonation in English | 493 |
| 15.22 | Protocol for prosodic settings | 508 |
| 16.1 | Metrical structure of syllables | 518 |
| 17.1 | Rate variation in American English | 543 |

TABLES

| | <i>page</i> |
|--|-------------|
| 3.1 Sound-correspondences between Latin, French, Italian and Spanish | 87 |
| 3.2 Sound-correspondences in words in four Algonquian languages | 88 |
| 6.1 Lung volumes and capacities | 165 |
| 6.2 Old and new IPA symbols for clicks | 175 |
| 6.3 Pulmonic and glottalic airstreams in Quichean languages | 182 |
| 12.1 Unreleased stops in English versus released stops in French | 360 |
| 12.2 Co-ordinatory phenomena in contrasting clicks in Nama | 376 |
| 12.3 A Firthian view of vowel harmony in Turkish | 387 |
| 12.4 Consonant harmony in Etsako | 389 |
| 15.1 Some pitch-patterns and their labels | 461 |
| 15.2 Tonal sandhi in Szechuanese | 476 |
| 15.3 Interaction of tone and intonation in Thai | 478 |
| 15.4 Pitch-patterns on tonic syllables in English | 495 |
| 15.5 Choices of tonality on an English phrase | 496 |
| 16.1 Word-pairs in English differentiated by word-stress | 517 |
| 17.1 Different speech styles and tempos in Hungarian | 545 |
| 19.1 Frequent and infrequent consonant-types in languages with large and small consonant-systems | 573 |
| 19.2a Voiceless oral stops in 317 languages | 580 |
| 19.2b Voiced oral stops in 317 languages | 580 |
| 19.2c Aspirated voiceless oral stops in 317 languages | 581 |
| 19.2d Affricated voiceless oral stops in 317 languages | 581 |
| 19.2e Affricated voiced oral stops in 317 languages | 581 |
| 19.2f Voiceless ejective stops in 317 languages | 582 |
| 19.2g Voiced implosive stops in 317 languages | 582 |
| 19.2h Voiceless implosive stops in 317 languages | 582 |
| 19.2i Voiced nasal stops in 317 languages | 583 |
| 19.2j Voiceless nasal stops in 317 languages | 583 |

| | | |
|-------|---|-----|
| 19.2k | Voiced pre-nasal oral stops in 317 languages | 583 |
| 19.2l | Voiced post-nasal oral stops in 317 languages | 584 |
| 19.2m | Voiceless fricatives in 317 languages | 584 |
| 19.2n | Voiced fricatives in 317 languages | 584 |
| 19.2o | Lateral segments in 317 languages | 585 |
| 19.2p | Rhotic segments in 317 languages | 585 |
| 19.3 | Totals of segment-types in 317 languages | 586 |
| 19.4 | Proportions of languages using one or more segment-types within a manner category for contrastive purposes | 587 |