PART I: FUNDAMENTALS

Chapter 1 – The Human Brain

- Introduction

- Neurons: The basic signalling units of the brain
  - Anatomy
  - Physiology
  - Representation

- Navigating the neural landscape

- Building the brain from the bottom up
  - Brainstem and thalamus
  - Hippocampus and amygdala
  - Basal ganglia and cerebellum

- The cerebral cortex
  - The major lobes—visible and hidden
  - Gyral-sulcal organization
  - Cytoarchitectonic organization
  - Connectional organization
  - Sensory, motor, and higher-order systems
  - Box: Born for phonetics?
  - Language-related regions: Broca’s area, Wernicke’s area, and beyond

- Summary and key points

- Recommended further reading

Chapter 2 – Brain Mapping Methods

- Introduction

- Neuropsychology
  - Single and double dissociations
  - Groups and individuals
  - Visualizing the brain: The basic mechanics of magnetic resonance imaging
  - Types of brain damage
    - Stroke
    - Traumatic brain injury
    - Neurodegenerative and infectious diseases
    - Tumors
  - Relationships between behavioral data and lesion data
    - Lesion overlap and subtraction analysis
- Voxel-based lesion-symptom mapping
- A few caveats about neuropsychological research on brain-behavior relationships

- Functional neuroimaging
  - Two techniques
    - Positron emission tomography
    - Functional magnetic resonance imaging
  - Standardized three-dimensional coordinates for defining stereotaxic brain space
  - Box: What’s in a voxel?
  - Blocked versus event-related designs
  - Some basic experimental paradigms
    - Subtraction
    - Correlation
    - Multivariate pattern analysis

- Electrophysiology
  - Stimulation
  - Recording
    - Intracranial
    - Extracranial

- Transcranial magnetic stimulation
  - How it works
  - Applications to language

- Major strengths and weaknesses of the different methods

- Summary and key points

- Recommended further reading

**PART II: APHASIA**

**Chapter 3 – Classic Aphasia Syndromes**

- Introduction

- Historical background
  - Box: Handedness and language lateralization

- How should different types of aphasia be classified?

- Broca’s aphasia
  - Production
  - Comprehension
Chapter 4 – Primary Progressive Aphasia Syndromes

- Introduction

- Historical background

- Progressive nonfluent aphasia
  - Production
  - Comprehension
  - Repetition
- Lesion correlates and other biomarkers
- Associated neurological deficits
  - Box: Creativity in art and music: The positive side of PPA?

- Semantic dementia
  - Production
  - Comprehension
  - Repetition
- Lesion correlates and other biomarkers
- Associated neurological deficits

- Logopenic progressive aphasia
  - Production
  - Comprehension
  - Repetition
- Lesion correlates and other biomarkers
- Associated neurological deficits

- PPA as a window on the neurobiology of language

- Summary and key points

- Recommended further reading

PART III: THE PERCEPTION AND PRODUCTION OF SPEECH

Chapter 5 – Speech Perception

- Introduction
  - Box: Some basic aspects of speech sounds

- Early cortical stages of speech processing
  - Box: From cochlea to cortex
  - Hierarchical organization
  - Bilateral organization
    - Both hemispheres contribute to speech perception
    - The two hemispheres have partially different temporal windows for speech perception
  - Box: The neural substrates of audiovisual integration during speech perception: A combined fMRI and TMS study of the McGurk effect
- Summary

- A double dissociation between comprehension and repetition: Initial evidence for separate streams of speech processing
- The ventral “what” stream: From sound to meaning
  - The lexical interface
  - The combinatorial network
  - Summary

- The dorsal “how” stream: From sound to action
  - The sensorimotor interface
  - The articulatory network
  - Box: *Might articulatory activation during speech perception facilitate turn-taking?*
  - Summary

- Summary and key points

- Recommended further reading

**Chapter 6 – Speech Production**

- Introduction

- The Lemma Model of lexical selection and form encoding
  - Box: “*Close to scientific paradise*”
  - Box: “*Where wings take dream*”
  - The architecture of the model
    - Conceptual focusing and perspective-taking
    - Lemma selection
    - Retrieving morphemic and phonological codes
    - Prosodification and syllabification
    - Phonetic encoding and articulation
    - Self-monitoring
  - Neurobiological evidence for the model
    - A meta-analysis of 82 brain mapping experiments involving word production
    - Conceptual focusing and perspective-taking
    - Lemma selection
    - Box: *Happy faces are named faster than neutral faces*
    - Retrieving morphemic and phonological codes
    - Prosodification and syllabification
    - Phonetic encoding and articulation
    - Self-monitoring
  - Some challenges facing the model
    - The lemma dilemma
    - Discrete versus interactive processing

- The DIVA Model of speech motor control
  - How do you say “good doggie”?*
  - Feedforward control
  - Box: *A brain-machine interface restores rudimentary speech in a patient with locked-in syndrome*
- **Box: What the brain does before the tongue slips**
- **Box: When the will is gone**
- A quick look at the roles of forward and inverse models in motor control
- Auditory feedback control
- **Box: Using the DIVA Model to simulate stuttering**
- Somatosensory feedback control
- Some challenges facing the model
  - The island of Reil
  - Are the auditory and somatosensory feedback circuits integrated in the planum temporale?

- Peripheral mechanisms of speech production

- Summary and key points

- Recommended further reading

**Chapter 7 – Prosody**

- Introduction

- Emotional prosody
  - Perception
    - The right mid to anterior superior temporal cortex: Auditory integration
    - The amygdala: Relevance detection
    - The right ventral frontoparietal cortex: Emotion simulation
    - The basal ganglia: Emotion simulation, sequence decoding, and response triggering
    - The bilateral orbitofrontal and inferior frontal cortices: Cognitive evaluation
  - **Box: Sex differences in the perception of emotional prosody**
  - Summary

- Production

- Linguistic prosody
  - Perception
    - The syntactic domain
    - The lexical domain
    - The tonal domain
  - **Box: Correlations between the geographic distributions of tone languages and genes for brain development**
  - Summary

- Production

- Summary and key points

- Recommended further reading
PART IV: OTHER MODALITIES OF LANGUAGE USE

Chapter 8 – Reading and Writing

- Introduction

- Reading
  - Hierarchical coding of letter strings in the ventral occipitotemporal cortex
  - The visual word form area (VWFA)
    - Normal response properties
    - Box: Reading printed letters activates the motor region for writing the same letters
    - Effects of damage
    - Developmental origins: The Neuronal Recycling Hypothesis
  - From print to sound and meaning
    - A cognitive model
    - Evidence from acquired dyslexia
    - Neural substrates
  - Summary

- Writing
  - From sound and meaning to print
    - A cognitive model
    - Evidence from acquired dysgraphia
    - Neural substrates
  - Summary

- Summary and key points

- Recommended further reading

Chapter 9 – Sign Language

- Introduction

- Structural aspects of sign language
  - Phonology
  - Morphology
  - Syntax
  - Nonmanual signs
  - Summary

- Left-hemisphere dominance
  - Wada testing
  - Dissociations between sign language and visuospatial cognition
  - Dissociations between sign language and symbolic gesture
  - Summary
- Functional-anatomical organization within the left hemisphere
  - Different sign language aphasias associated with anterior and posterior lesions
  - The production of signs
  - The perception of signs
  - Box: The plasticity of left-hemisphere "auditory" areas in congenitally deaf brains reflects sign language rather than sensory deprivation
  - Summary

- Right-hemisphere contributions
  - Activation during sentence comprehension: A mysterious and controversial phenomenon
  - Involvement in classifier constructions
  - Summary

- Summary and key points

- Recommended further reading

PART V: THE MEANINGS OF WORDS

Chapter 10 – Object Nouns

- Introduction

- Perceptual and motor features of object concepts
  - Theoretical background
  - Box: What is a violin?
  - Color features
  - Shape features
  - Motion features
  - Motor features
  - Auditory features
  - Gustatory and olfactory features
  - Summary

- A semantic hub for object concepts
  - Box: The concept of a nest in the brain of a mouse
  - Evidence from semantic dementia
  - Evidence from fMRI and TMS
  - Summary

- Domains of object concepts
  - Three major domains of selective semantic impairment
    - Animal concepts
      - Box: The influences of gender and culture on concepts for animals and fruits/vegetables
Chapter 11 – Action Verbs

- Introduction

- Perceptual and motor features of action concepts
  - Visual features
  - Motor features
  - Box: Hockey players do it better
  - Summary

- A semantic hub for action concepts

- Domains of action concepts
  - Transitive and intransitive verbs
  - Involvement of the temporal and parietal regions
  - Box: Do action concepts have a default directionality?
  - Involvement of Broca's area
  - Summary

- Summary and key points

- Recommended further reading

Chapter 12 – Abstract Words

- Introduction

- Cognitive and neural distinctions between concrete and abstract concepts
  - Theoretical background
  - Box: Do abstract concepts have metaphorical foundations?
  - Evidence from PET and fMRI
  - Evidence from neuropsychology and rTMS
  - Summary

- A semantic hub for abstract concepts
  - Evidence from semantic dementia
  - Evidence from rTMS
PART VI: MORPHOLOGY, SYNTAX, AND DISCOURSE

Chapter 13 – Morphology

- Introduction
- Box: How to build a noun in Tabasaran

- Morphosyntactic and morphophonological aspects of inflection
  - Sahin et al.’s (2006) fMRI study
  - Sahin et al.’s (2009) electrophysiological study
  - Summary

- Noun and verb inflection: A closer look at morphosyntax
  - A common pathway in Broca’s area
  - A neuropsychological double dissociation
  - Neural correlates of noun-specific and verb-specific morphosyntactic processing
  - What about comprehension?
  - Summary

- Regular and irregular inflection: A closer look at morphophonology
  - Theoretical background
  - Box: Connectionist computer simulations of the regular/irregular distinction
  - The perspective from neuropsychology
  - Box: Do the basal ganglia contribute to regular inflection?
  - The perspective from functional neuroimaging
  - What about comprehension?
  - Summary

- Summary and key points

- Recommended further reading
Chapter 14 – Sentence Production

- Introduction

- Syntax: A short tutorial
  - Devices for indicating participant roles
  - Hierarchical structure
  - Argument structure
  - Closed-class elements
  - Complex sentences

- Syntactic encoding: A rudimentary model

- Insights from neuropsychology
  - Agrammatism: A complex syndrome steeped in controversy
  - Box: Similar symptoms, different causes
  - Sentence production deficits in vascular aphasia
    - Deficits involving the functional level
    - Deficits involving the positional level
  - Sentence production deficits in primary progressive aphasia
  - Box: Selection for position: A possible contribution of Broca’s area to syntactic encoding
  - Summary

- Insights from PET and fMRI
  - Indefrey et al.’s (2001, 2004) PET studies
  - Haller et al.’s (2005) fMRI study
  - Summary

- Summary and key points

- Recommended further reading

Chapter 15 – Sentence Comprehension

- Introduction

- A large-scale neural network for sentence comprehension: Anatomical organization
  - Lesion and connectivity studies by Dronkers et al. (2004) and Turken & Dronkers (2011)
    - Dronkers et al.’s (2004) lesion study
    - Turken & Dronkers’s (2011) connectivity study
  - Convergent results from other studies
  - Summary

- A large-scale neural network for sentence comprehension: Functional organization
  - Possible contributions of the pMTG
    - Snijders et al. (2009) investigation
- Tyler et al.’s (2011) and Papoutsi et al.’s (2011) investigations
- Summary
- Possible contributions of the aSTG and some adjacent regions
  - Syntactic analysis
  - A combinatorial syntactic-semantic network
  - Some challenging data from neuropsychology
  - Summary
- Possible contributions of the pSTS/BA39 and some adjacent regions
  - Associations between auditory-verbal STM and sentence comprehension
  - Dissociations between auditory-verbal STM and sentence comprehension
  - Summary
- Possible contributions of Broca’s area and some adjacent regions
  - Is Broca’s area necessary for sentence comprehension?
  - Box: Shared syntax for producing and comprehending syntax in Broca’s area
  - Hypotheses that emphasize sequential and hierarchical processing
  - Hypotheses that emphasize auditory-verbal STM and cognitive control
  - Summary
- Summary
- Box: Subcortical contributions to sentence comprehension

- Major ERP components associated with sentence comprehension
  - The N400
  - The P600
  - Early and sustained negativities
  - Summary

- Summary and key points

- Recommended further reading

**Chapter 16 – Discourse**

- Introduction

- Story production
  - Frog stories: A window onto the neural substrates of narrative coherence
  - Box: A normal frog story
  - Ash et al.’s (2006) neuropsychological study
  - Troiani et al.'s (2008) fMRI study

- Story comprehension
  - Electrophysiological evidence for the rapid integration of words into the discourse context
  - A meta-analysis of 12 PET and fMRI studies of the comprehension of coherent versus incoherent narratives
    - The anterior temporal lobes: Integrating semantic information
    - The medial parietal cortex: Establishing and updating situation models
- The dorsomedial prefrontal cortex: Drawing inferences
- The temporoparietal junction: Attributing thought to protagonists
- Summary

- Summary and key points

- Recommended further reading