Concept Checklist – Lecture 1 + Literature

- Gazzaniga, Ivry, Mangun: The Biology of Mind, 4th edition
    - Ch 2. Structure and Function of the Nervous System (pages 37-60)
        - Overview of Nervous system structure
        - A guided tour of the brain
        - The cerebral cortex

Concepts

- Nervous system (NS)
    - Central NS
    - Peripheral NS
        - Somatic
        - Autonomic
- Neuroanatomy
    - Planes, Sections
        - Saggital
        - Coronal
        - Transverse/Axial/Horizontal
    - Sides, Directions
        - Superior/Dorsal
        - Inferior/Ventral
        - Anterior/Rostral
        - Posterior/Caudal
        - Medial
        - Lateral
    - White matter
    - Grey matter
    - Nuclei
    - Hemispheres
    - Ventricles
    - Brainstem
        - Hindbrain
            - Medulla, Cerebellum, Pons
        - Midbrain
    - Diencephalon
        - Thalamus
        - Hypothalamus
    - Telencephalon
        - Limbic system
        - Basal ganglia
        - Cerebral cortex

- Gyri & sulci ⟶ Literature *bumps and grooves*

  gyri ↑   *surcos* ↑
- Cortical layers ⟶ Literature
- Brodmann's areas
- Lobes & basic functions
  - Occipital
  - Temporal
  - Parietal
  - Frontal

Concept Checklist – Lecture 2 + Literature

- Gazzaniga, Ivry, Mangun: The Biology of Mind, 4th edition

    – Ch 2. Structure and Function of the Nervous System (pages 22-37)

        - The Structure of Neurons

        - Neuronal signaling

        - Synaptic transmission

        - The Role of Glial cells

        - The Bigger picture

Concepts

- Scales of analysis in the brain
    o Macroscale:
        ▪ Lobes
        ▪ (Brodmann) areas
    o Mesoscale:
        ▪ Circuits
        ▪ Cortical columns
        ▪ Cortical layers
    o Microscale:
        ▪ neurons
            • Dendrites
            • Dendritic spines
            • Axons
            • Axon hillock
            • Terminal boutons
        ▪ glia
            • Astrocytes
            • Oligodendrocytes
            • Schwann cells
            • Microglia
    o Nanoscale:
        ▪ Synapses
        ▪ Neurotransmitters
- Neuron resting potential
    o Cell membrane
    o Intracellular & Extracellular
    o Membrane potential: about -70mV
    o Ion concentrations at rest (intra & extra-cellular)
        ▪ Sodium (Na^+)
        ▪ Chloride (Cl^-)
        ▪ Potassium (K^+)
        ▪ Negatively charged proteins (A^-)

- - o Concentration pressure
    - o Electrostatic pressure
    - o Ion channels
      - Non-gated
      - Voltage-gated
    - o Na/K pump
- Graded post-synaptic potentials
  - o EPSP: depolarize
  - o IPSP: hyperpolarize
  - o Temporal summation
  - o Spatial summation
- Action potential
  - o Threshold potential
  - o Order of ion channels opening and closing
    - Na+
    - K+
  - o Direction and times of ion flow
  - o Refractory period
    - Absolute
    - Relative
  - o Propagation
    - Myelination
    - Nodes of Ranvier
    - Saltatory conduction
- Synapses
  - o Electrical (sometimes) & Chemical (mostly)
  - o Pre-synaptic
  - o Post-synaptic
  - o Ca+
  - o Synaptic vesicles
  - o Exocytosis
  - o Synaptic cleft
  - o Receptors
  - o Neurotransmitters
    - Acetycholine: brain, neuromuscular junction
    - Monoamines
      - Dopamine: pleasure, addiction
      - Norepinephrine: arousal, wakefullness
      - Epinephrine: periphery
      - Serotonin: sleep, eating
    - Amino acid
      - Glutamate
        - o Main brain excitatory
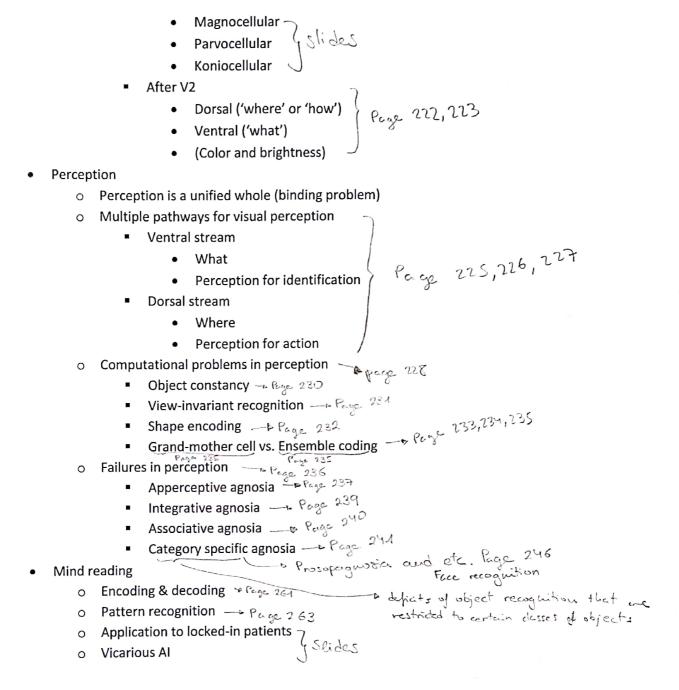   - GABA
        - o Main brain inhibitory

Concept Checklist – Lecture 3 + Literature

- Gazzaniga

  - Ch 5: Sensation and Perception *→ page 184*

    - Only general intro and vision

  - Ch 6. Object Recognition

    - Parts on vision

Concepts

- Visible light spectrum ✓
  - Longer wavelengths (red) *⎫ page 165*
  - Shorter wavelengths (blue) *⎭*
- Eye ← *page 185*
  - Iris, pupil, cornea, lens, retina
  - Optic nerve *—. Page 185, 186*
  - Inverted projection on retina
- Retina
  - Blind spot *—→ Page 185*
  - Fovea *—→ Page 186*
  - Receptors
    - Rods
    - Cones
      - Short wavelength *—→ Page 185*
      - Medium wavelength
      - Long wavelength
  - Ganglion cells *→ Page 185, 186*
  - Bipolar cell, horizontal cells, Amacrine cells
    - Lateral inhibition & contrast enhancement
- Visual system
  - Eye
  - Optic chiasm *—→ Page 186,'*
  - LGN *—→ Page 186, 187*
  - Visual cortex *——→ Page 187*
    - V1
      - Simple cells
      - Complex cells
      - End-stopped cells
      - Orientation columns
    - Contralateral and upside-down projection
    - Receptive fields
      - Center-surround
    - Retinotopy
  - Visual pathways
    - Eye to V1, V2 *⎫ slides*

- Magnocellular ⎫
- Parvocellular ⎬ slides
- Koniocellular ⎭
  - After V2 ⎫
    - Dorsal ('where' or 'how') ⎬ Page 222, 223
    - Ventral ('what') ⎪
    - (Color and brightness) ⎭
- Perception
  - Perception is a unified whole (binding problem)
  - Multiple pathways for visual perception ⎫
    - Ventral stream ⎪
      - What ⎪
      - Perception for identification ⎬ Page 225, 226, 227
    - Dorsal stream ⎪
      - Where ⎪
      - Perception for action ⎭
  - Computational problems in perception → page 228
    - Object constancy → Page 230
    - View-invariant recognition → Page 231
    - Shape encoding → Page 232
    - Grand-mother cell vs. Ensemble coding → Page 233, 234, 235
  - Failures in perception → Page 236
    Page 235   Page 235
    - Apperceptive agnosia → Page 237
    - Integrative agnosia → Page 239
    - Associative agnosia → Page 240
    - Category specific agnosia → Page 241
      → Prosopagnosia and etc. Page 246
      Face recognition
- Mind reading
  - Encoding & decoding → Page 261
  - Pattern recognition → Page 263
  - Application to locked-in patients ⎫
  - Vicarious AI ⎬ Slides

→ deficits of object recognition that are restricted to certain classes of objects

Concept Checklist – Lecture 4 + Literature

- Gazzaniga

  – Chapter 7: Attention

Concepts

- Functions of Attention ⎫
    o Vigilance ⎪
    o Search ⎬ *Slides*
    o Selective attention ⎪
    o Divided attention ⎭
- Signal detection theory ⎫ *Slides*
    o Sensitivity, specificity ⎬
    o Hit, Miss, False alarm, Correct rejection ⎭
- Search ⎫
    o Targets and distracters ⎪
    o Array size effect ⎪
    o Feature (pop-out) search, conjunction search ⎬ *Slides*
    o Feature integration theory ⎪
    o Similarity theory ⎪
    o Guided search theory ⎭
- Selective Attention
    o Cocktail party problem → *Page 281*
    o Dichotic listening task → *Page 281*
    o Posner cuing task → *Page 284, 285*
    o Early filtering, late filtering, attenuation theory → *Page 283 slides*
    o Voluntary attention, reflexive attention, overt /covert attention → *Page 280*
- Anatomy of attention
    o Cortex: Posterior parietal, superior prefrontal, temporo-parietal, ventral prefrontal ⎫ *SLIDES*
    o Dorsal and ventral Frontoparietal attention networks ⎭
- Attention deficits
    o ADHD ⎫ *SLIDES*
    o Change blindness ⎭
    o Neglect → *Page 276.*
- Automatic and controlled processes → *SLIDES*
    o Automatization → *SLIDES*
    o Practice effects
    o Stroop effect → *Demonstration of interference in the reaction time of a task (when the name of a color is printed in a color that it's not denoted by the name)*
- Attentive robots ⎫ *SLIDES*
- Social robots ⎭

Concept Checklist – Lecture 5 + Literature

- Gazzaniga

  - Chapter 9: Memory

    - Anatomy of memory

    - Memory deficits

    - Mechanisms of memory

Concepts

- Learning } SLIDE 4
- Memory
  - Ecoding
    - Acquisition } SLIDE 5
    - Consolidation
  - Storage
  - Retrieval
- Types of Memory ——→ SLIDE 8
  - Long term memory
    - Declarative (explicit) memory —→ SLIDE 15
      - Episodic memory
      - Semantic memory —→ SLIDE 15
    - Nondeclarative (implicit) memory
      - Procedural memory } SLIDE 20
      - Priming —→ SLIDE 21
  - Short term memory ——→ SLIDE 14
    - Sensory memory } SLIDE 10
      - Iconic memory
      - Echoic memory
    - Working memory
- Atkinson & Shiffrin's modal (or multi-store) model —→ SLIDE 17
  - Attention & Rehearsal
- Baddeley's working memory model —→ SLIDE 18, 19
  - Phonological loop —→ encodes information acoustically in working memory
  - Visuospatial sketchpad —→ encodes information visually in working memory
- Consolidation by studying/rehearsal
  - Elaborative or maintenance rehearsal } SLIDE 29
  - Distributed or massed practice
  - Mnemonics
- Free recall experiments
  - Primacy effect } SLIDE 30
  - Recency effect
  -

- Constructive memory   } SLIDE 31
  - o Prior experience
  - o Encoding specificity
  - o Flashbulb memories   — → SLIDE 32
- Anatomy of memory
  - o Hippocampus   }
    - ▪ Place cells   SLIDES
  - o Entorhinal cortex   35, 37, 38
    - ▪ Grid cells
  - o Other parts of cortex
- Memory deficits
  - o Amnesia
    - ▪ Anterograde   } SLIDE 7
    - ▪ Retrograde
      - • Ribot's law
  - o Alzheimer's disease   — → SLIDE 39

Concept Checklist – Lecture 6 + Literature

- Gazzaniga

    - Chapter 9: Memory

        - Cellular basis of learning and memory

- Ballard: An Introduction to Natural Computation (as pdf)

    - Chapter 1: Natural Computation

        - 1.1 Introduction

        - 1.2 The Brain

        - 1.4.2 Learning

        - 1.5 Overview

    - Intermezzo

        - THE CORTEX AS A HIERARCHICAL MEMORY

        - NEURAL NETWORK MODELS

    - Chapter 8: Supervised learning

        - 8.2 Perceptrons

Concepts

- Learning over different timescales   } SLIDE 13
    o Developmental learning
    o Behavioral learning
    o Evolutionary learning
- Hebbian learning —→ SLIDE 5
    o Hebb's rule —→ If a synapse is active when a postsynaptic neuron is active, the synapse will be strengthened
- LTP / LTD
    o Synapse strengthening and weakening   } SLIDES 6, 7, 8
    o Associative LTP
        ▪ Cooperativity
        ▪ Associativity
        ▪ Specificity
    o NMDA receptor
- 3 projection pathways in the Hippocampus   } SLIDE 4
    o Perforant pathway
    o Mossy fiber pathway
    o Schaffer collateral pathway

- Types of Learning in Machines
  - Supervised learning
  - Reinforcement learning
  - Unsupervised learning
    - Content addressable memories

  SLIDE 12.

- Artificial Neural Networks
  - Units/Nodes *SLIDE 14*
  - Connection weights
  - Activation function *→ SLIDE 17*
  - Layers
  - Bias node -- *Always set to "on"*
  - Types of general structure
    - Fully connected *SLIDE 16*
    - Feed-forward
    - Recurrent
  - Perceptron
    - Perceptron weight learning rule *→ SLIDE 18, 22*
    - Linear separability *→ SLIDE 25*
    - Multi-layer perceptron *→ SLIDE 34*
      - Hidden layers
      - Continuous (differentiable) activation function
      - Back-propagation rule
        - Weight changes for hidden layers *SLIDE 34*
      - Pro's and Con's *→ SLIDE 35, 45*
  - Deep learning *→ SLIDE 36*
    - Many layers, analogous to human visual system
    - Combination of supervised and unsupervised *→ SLIDE 36* *SLIDE 37*

Concept Checklist – Lecture 7 + Literature

- Gazzaniga

  - Chapter 3: methods of cognitive neuroscience

    - Methods to perturb neural function

    - Structural analysis of the brain

    - Methods for the study of neural function

    - The marriage of Function and Structure: Neuroimaging

    - Converging methods

Concepts

- Research design
  - Correlational   } SLIDE 3
  - Experimental
- Computer modeling
  - Symbolic modeling
  - Connectionism   } SLIDE 5
  - Realistic neuronal modeling
  - Braitenberg vehicles —▸ SLIDE 4
  - Pro's and Con's —▸ SLIDE 6
- Lesion Studies
  - Dissociations
    - No dissociation
    - Single dissociation } SLIDE 7
    - Double dissociation
  - Pro's and Con's —▸ SLIDE 8
- Structural Imaging
  - CT / CAT —▸ SLIDE 10
  - Structural MRI
    - MRI system
      - Magnet (1.5T – 9.4T)   } SLIDE 11
        - Why higher fields?
      - Gradient coils
      - Radio frequency coil
    - Protons / spins —▸ SLIDE 12
    - Larmour frequency
    - Gyromagnetic ratio   } SLIDE 13
    - T1 weighted, T2 weighted, T2* weighted
    - Diffusion MRI / DTI —▸ SLIDE 15
      (complement with book)
      Pages 93,94

- • Anistropic diffusion ⟶ Page 94
  - ▪ Pro's and Con's ⟶
- • Functional Imaging
  - o Single cell recording
    - ▪ Pro's and Con's } SLIDE 18
  - o EEG
    - ▪ ERP ⟶ SLIDE 21
    - ▪ Time-frequency analysis ⟶ SLIDE 19
    - ▪ ECoG ⟶ Electrocorticography (book) ⟶ Pages 102, 103, 104
    - ▪ Pro's and Con's ⟶ SLIDE 20
  - o MEG
    - ▪ Pro's and Con's ⟶ SLIDE 22
  - o PET
    - ▪ Anihilation & gamma rays } Book
    - ▪ Subtraction method
    - ▪ Pro's and Con's ⟶ SLIDE 26
  - o fMRI
    - ▪ BOLD, oxyHb and deoxyHb ⟶ SLIDE 28
    - ▪ Block design & event-related design ⟶ Page 108
    - ▪ Rt-fMRI, BCI & Neurofeedback ⟶ SLIDE 34
    - ▪ Pro's and Con's ⟶ SLIDE 27
  - o Spatial & temporal resolution
    - ▪ Relative resolutions of modalities } ?
      - • Log size vs. log time plot
- • Methods to perturb function
  - o Pharmacological studies ⟶ Page 87
  - o TMS
    - ▪ Pulsed TMS } SLIDE 32
    - ▪ Repetitive TMS
  - o tDCS ⟶ Page 89
  - o Genetic manipulation } Pages 89, 90
    - ▪ Knockout procedures

Concept Checklist – Lecture 8 + Literature

- Gazzaniga

  – Chapter 2: Structure and Function of the nervous system

    - Development of the nervous system

- Ballard: An Introduction to Natural Computation (as pdf)

  – Intermezzo

    - GENE PRIMER

    - LEARNING ACROSS GENERATIONS: SYSTEMS

  – Chapter 12: Genetic Algorithms
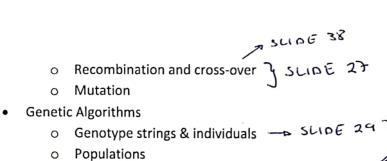
Concepts

- Brain evolution
  - Brain size to body size ratio → SLIDE 5
  - Brain size increase in hominids → SLIDE 6
  - Bigger brains
    - Number of neurons ⎫ SLIDES 15, 16
    - Arborization of dendrites ⎬
    - Number of synapses ⎭
- Radial Unit Hypothesis ⎫
  - Symmetrical & assymmetrical division ⎥
  - Radial glia cells & radial migration ⎥ SLIDES
  - Radial unit & cortical column ⎬ 9, 10, 11, 12, 13, 14
  - Inside-out formation of cortex ⎥
  - Ventricular zone, sub-ventricular zone, intermediate zone ⎥
  - Cortical plate, marginal zone ⎭
- Synaptogenesis ⎫ SLIDE 19
- Synapse elimination/pruning → SLIDE 17 ⎭
- Myelination ⎫ SLIDE 20
  - Differential timing in human development ⎭
- Brain Plasticity ⎫
  - Learning ⎬ SLIDES 21, 22, 23
  - Reorganization ⎥
    - Phantom limbs ⎭
- Basic Genetics
  - Chromosomes ⎫ SLIDE 26
  - Genes ⎭
  - DNA
  - Genotype & Phenotype → SLIDE 27, 30
                              31

- o Recombination and cross-over } SLIDE 27 ↗ SLIDE 38
- o Mutation
- Genetic Algorithms
  - o Genotype strings & individuals → SLIDE 29 } SLIDE 32
  - o Populations
  - o Fitness value/function
  - o Reproduction
    - Cross-over } SLIDE 33 → SLIDE 38 39
    - Inversion *
    - Mutation → SLIDE 40
  - o Selection strategies
    - Elitist → SLIDE 34
    - Roulette wheel → SLIDES 35, 36
    - Tournament → SLIDE 37
    - Pro's and Con's
  - o GA: Pro's and Con's → SLIDE 42

* INVERSION MUTATION

| 1 | 2 | 3 | 4 | 5 | 6 |

Select two random indexes

| 1 | 2 | 3 | 4 | 5 | 6 |

↑ ⟨6⟩ ↑

Reverse the sequent

| 1 | 5 | 4 | 3 | 2 | 6 |

✓

Concept Checklist – Lecture 9 + Literature

- Gazzaniga

  - Chapter 11: Language

    - The anatomy of language

    - Brain damage and language deficits

    - The fundamentals of language in the human brain

    - Language comprehension

    - Neural Models of speech production

Concepts

- Language & Linguistics
  - Syntax
    - Phoneme } SLIDE 6
    - Grapheme
  - Semantics } SLIDE 6
    - Morpheme
  - Lexicon → SLIDE 7
    - Semantic network → SLIDE 21
  - Prosody } SLIDE 6
  - Pragmatics
- Language acquisition
  - Stages → SLIDE 9
  - Overextension error } SLIDE 10
  - Irregular verb errors
  - Critical period → SLIDE 11
- Anatomy of Language
  - Lateralization
  - Peri-sylvian language network } SLIDE 13
    - Inferior frontal cortex
    - Broca's area
    - Inferior parietal lobule
    - Superior temporal gyrus
    - Wernicke's area
    - Arcuate fasciculus
- Aphasia → SLIDE 14
  - Broca's aphasia → SLIDES 15, 16
  - Wernicke's aphasia → SLIDES 17, 18
  - Conduction aphasia → SLIDE 19

- Language Comprehension
  - Semantics
    - Denotation } Book
    - Connotation
  - Syntax
    - Phrase structure grammar } SLIDES 23, 24, 25
    - Chomsky's transformational grammar
  - Perceptual Analysis
    - Speech
      - acoustic analysis } SLIDE 26
      - phonological input code & auditory word form
      - Coarticulation & segmentation problem } SLIDE 27, Book Page 482
      - Invariance problem * ↳ Book
    - Reading
      - Visual analysis } SLIDE 26
      - orthographic input code & visual word form
      - Pattern recognition
        - Selfridge's pandemonium model → SLIDE 29
        - McLelland & Rumelhart's connectionist model → SLIDE 30
  - Lexical Analysis
    - Lexical access } SLIDE 26
    - Lexical selection   Book Page 475
    - Lexical integration
  - Conceptual activation → SLIDE 26
- Speech Production
  - Slips of the tongue
    - Anticipation } SLIDE 31
    - Perseveration
    - Substitution
    - Reversal/Spoonerism
  - Levelt's model
    - Conceptual preparation } SLIDE 32
    - Lexical encoding   Book
      - Lexical selection
      - Morphological encoding
      - Phonological encoding
    - Articulation
    - Self monitoring
- Can computers understand language?
  - Turing test
    - Alan Turing } SLIDES 38, 39, 40
    - ELIZA
    - A.L.I.C.E.
    - WATSON

stop consonants...

* Theory of acoustic invariance states that invariant objects of speech perception are located directly in the speech signal. Problem → experimental data that the invariant acoustic properties identified by the theory are used in perception is weaker than the evidence that such invariants exist, but proponents of the theory offer no evidence at all that these properties are used more, or more often than the traditional (variable) acoustic properties.

Concept Checklist – Lecture 10 + Literature

- Sternberg

  – Chapter 11: Problem solving & Creativity

    • Expertise: Knowledge & problem solving ✓

  – Chapter 12: Decision making & Reasoning

    • Deductive reasoning ✓

    • Inductive reasoning ✓

Concepts

- Deductive Reasoning → SLIDE 3
  o Premises, Conclusion, Quantifier → SLIDE 4
  o Atmosphere effect
  o Categorical reasoning → SLIDE 4
  o Conditional reasoning → SLIDE 6
    ▪ Syllogistic reasoning
      • Modus ponens (Method of affirming) } SLIDE 7
      • Modus Tollens (Method of denying)
      • Denying the antecedent error → SLIDE 8
      • Affirming the consequent error → SLIDE 9
    ▪ Wason selection task → SLIDES 11, 12, 13, 14

- Inductive Reasoning → SLIDE 3
  o Heuristics & (Bias)
    ▪ Availability heuristic → SLIDE 16
    ▪ Representativeness heuristic → SLIDE 17

- Expertise
  o Three stages of skill acquisition:
    ▪ Cognitive stage
    ▪ Associative stage   } SLIDE 18
    ▪ Autonomous stage
  o Power law of learning → SLIDE 19
  o Tactical learning } → SLIDE 21
  o Strategic learning → SLIDES 21, 22
  o Deliberate practice → SLIDE 23

- Intelligence
  o IQ test
    ▪ Relative/Normative
    ▪ Subtests → SLIDE 26
    ▪ Factors → SLIDE 27
      • Only one: g (IQ)
      • More   } SLIDE 28
      • Crystallized & Fluid intelligence

Modus ponens: $p \rightarrow q$
Modus tollens: $\neg q \rightarrow \neg p$
Denying: $\neg p \rightarrow \neg q$
Affirming: $q \rightarrow p$.

→ Illusory Correlation:
Spurious cause-effect relationships
categories that are going
together...

→ Overconfidence:
over evaluation of skills,
knowledge or judgement

→ Hindsight Bias: when
looking at a situation
retrospectively, we believe
we easily can see all the
signs and events leading
up to a particular outcome

Shortcuts they may lead to
inaccurate conclusions

} Heuristics and Biases
in deductive reasoning.

- o Flynn effect! → Substantial and long-sustained increase in both fluid and crystallized intelligence test scores measured in many parts of the world from 1930 to the present day.
- o Construct validity → the degree to which a test measures what it claims or purports to be measuring.
- Artificial Intelligence:
  - o Consistent } SLIDE 34
  - o Complete
  - o INDUCE
    - ▪ Medin, Wattenmaker & Michalski (1987)
    - ▪ Categorization algorithm
    - ▪ Category validity vs. Cue validity
    - ▪ Humans tend to category validity
    - ▪ INDUCE tends to cue validity
    - ▪ Product- Process- equivalence
  - o DEEP BLUE → Won Kasparov Chess
  - o Dijkstra → "Asking if computers can think is like asking if submarines can swim".

Concept Checklist – Lecture 11 + Literature

- Gazzaniga

  - Chapter 14: Consciousness, Free Will and the Law

    - Anatomical Orientation ✓

    - Consciousness ✓

    - Neurons, Neuronal groups and Conscious experience ✓

    - Abandoning the concept of free will ✓

Concepts

- Anatomy of consciousness
  - Core consciousness
    - Brianstem, thalamas, RAS   } SLIDE 2
  - Extended consciousness
    - Cerebral cortex
- Clinical perspective
  - Impairments
    - Somnolence
    - Sopor   } SLIDE 3
    - Come
    - (Brain death)
    - Vegetative state → SLIDE 4
    - Locked-in syndrome → SLIDE 5
  - Terri Schiavo case → Right-to-die legal case in USA
- Sleep   Irreversible persistent vegetative state.
  - Stages
    - 1
    - 2   } SLIDE 11
      - Sleep spindles, K-complexes
    - 3&4
      - Slow wave sleep
    - REM/ paradoxical sleep → SLIDE 13
      - Dreaming
  - Eye movements and EEG
  - Sleep cycles through the stages   } SLIDE 12
    - Cycle change through the night
  - Functions of sleep
    - Save energy
    - Restore the brain
    - Memory : strengthen and weaken connections

- o REM sleep functions (not clear functions)
    - ▪ NN of REM: memory 'cleanup] neural network model of dreaming
      → and remove noise and outliers
    - ▪ Echidna does not dream
- • Binding problem
  - o What is the problem
  - o Clinical neuropsychological evidence for the binding problem]
    - ▪ Apperceptive agnosia
    - ▪ Achromatopsia → color (feature integration)   SLIDE 18
    - ▪ Prosopagnosia
    - ▪ Semantic dementia → semantic-conceptual binding
    - ▪ Simultanagnosia (Balint's syndrom) location binding
    - ▪ Akinetopsia → motion → serial, event binding.
  - o Feature integration theory ⟹ SLIDE 19
  - o Binding by neuronal synchronization → SLIDES 21, 22, 20
- • Free will → SLIDE 23, 24
  - o Readiness potential → SLIDE 25
  - o Libet's experiment]
    - ▪ RP   SLIDES 27, 28,
    - ▪ W   29, 30, 31
    - ▪ W-S
    - ▪ EMG
  - o Soon's fMRI experiment → SLIDES 32, 33
  - o Qualia:
    - ▪ Chalmers easy problem & hard problem]
    - ▪ Nagel What it's like to be a bat   SLIDE 34
    - ▪ Inverted Spectrum Problem
    - ▪ Mary the colour scientist

how the brain integrates information, categorizes and discriminates environmental stimuli, etc.

explaining the relationship between physical phenomena and experience

→ explaining qualia
    (subjective experience)

Wonder what another person's experience is like i.e. when they both look at the same colour.

Nagel: "what is like to be a bat?"
(philosopher)   (if you have to ask, you will never know)

experiment argues against the view that the universe is entirely physical

*Blindsight: phenomenon that patients suffering a lesion in their visual cortex can respond to a visual stimuli presented in the blind part of their visual field. (these activities happen outside the realm of consciousness. Patients will deny that they can do a task, yet their performance is clearly above that of chance. Such patients have access to information but do not experience it).