This is an *exhaustive* list of the topics that you need to revise, that is, you will only be tested on topics that are included here. You may be asked about any of the topics listed above in the exam. The quizzes always focus on materials from the previous 2-3 weeks, and the materials you need to revise for each quiz are clearly indicated below.

Quiz 1:

Turing machines:
- cognition as computation
- understand the key components of a Turing machine
- predict what a Turing machine will do given a description of the machine (rules, states, tape, current position of tape)
- explain what a simple Turing machine does (e.g. "this Turing machine counts in reverse binary")
- understand what a Universal Turing Machine is and what it is capable of (but there won't be any questions about how a UTM actually works)
- understand what the Turing Test is

Physical Symbol Systems:
- syntax vs. semantics
- symbols, expressions, processes, designation, interpretation
- the Physical Symbol System Hypothesis
- the Chinese room argument

Language as a PSS
- understand & reason about how different aspects of simple generative grammars correspond to elements of PSSs
- Chomsky's argument about how simple automata (word-chain devices) are not sufficient to handle language
- understand phrase structure rules (e.g. S -> NP VP) on a basic level
- understand the key insight behind principles & parameters and X-bar theory on a basic level (cf. Pinker chapter)

Language is not an instinct
- what is modularity?
  - possible arguments for / against
- what is innateness?
  - possible arguments for / against

Quiz 2:

Self-organisation
- positive / negative feedback loops – what are they, recognise them when you see them

- open non-equilibrium systems – what's open? what's non-equilibrium?
- phase transitions: stability vs instability, control parameter / order parameter, adaptive landscape (showing attractor / stable states vs. unstable states) – understand these concepts and be able to apply them to specific examples
- how is termite nest building an example of self-organisation?
- how did we explain the synchronous flashing of fireflies in class?
- how is this an example of self-organisation?

Perceptron
- how does a neuron work? including basic terminology (e.g. axons, dendrites, post-synaptic potential – see slides & Gurney (1997))
- perceptrons & perceptron networks – predict the behaviour of a network given specific inputs; be able to say what it does; for simple problems, be able to come up with specific weights / threshold values
- the perceptron learning rule (understand intuition, no need to know formula)
- linear separability

Connectionism
- distributed representations
  - graceful degradation
  - generalisation
- gradient descent (understand the concept and what it means for the training of parameters in a connectionist network)

Quiz 3:

Deep Learning
- interpreting the pattern of connections in a neural network (cf. https://adamharley.com/nn_vis/)
- some different network / layer types:
  - fully connected feed forward
  - recurrent (only as much as is discussed in the reading);
  - convolutional (cf. https://www.youtube.com/watch?v=FmpDIaiMIeA)

LLMs
- language modelling
  - traditional n-gram models
  - recurrent neural network
  - transformer architectures / attention mechanism
- how are LLM's trained?
  - unsupervised pre-training
  - supervised fine tuning, reinforcement learning with human feedback
  - the notion of scaling (number of parameters, size of training data)
- formal vs. functional language competence

Embodied Cognition
- how does embodied cognition differ from traditional cognitive science?

- what is the *replacement hypothesis*?
- the four stages of embodied explanations according to Wilson & Golonka (2013)
- the outfielder problem + its embodied explanation
- the A-not-B problem + its embodied explanation

Situated Cognition
- embodied cognition vs. embedded cognition vs. extended cognition
- online vs. offline embodiment
- constitutive vs. causal embodiment
- the Otto vs. Inga example (extended cognition)

Quiz 4:

Evolution of cognition
- evolution of human cognition
  - the Swiss army-knife view
  - the New Thinking
- techno-social coevolution
- gene-culture coevolution
- cumulative cultural adaptation

Cognitive technology
- what are possible responses to the observation that connectionist networks (and related approaches) often can't handle "higher cognition"?
- how can cognitive technologies contribute to this issue?
- how do language and labelling simplify higher-level / more abstract tasks?

Cultural evolution
- individual learning vs. social learning
- how does the combination of individual + social learning enable the accumulation of knowledge?
- social learning as an evolutionary response to environmental variability
- relationship between the proportion of individual / social learners vs. fitness (assuming that the two kinds of learning are independent)
- under what circumstances does social learning increase average population-level fitness?
- true imitation
- content vs. context biases
- prestige & success biases

Not included in quizzes (but could be included in exam):

Iterated learning
- what is iterated learning?
- why does transmission error (typically) decrease in the course of iterated learning?

- systematic underspecification
- compositionality