STUDY NOTES FINAL EXAM COGNITION

Week 6 Visual Processing.

The zoom-lens model is an analogy of the human eye: we can increase, or decrease, the area of focal attention at will, just as a zoom lens can be adjusted. Our visual system takes in an abundance of information and so our brain has developed mechanisms by which to filter the information. Two of these mechanisms are

- **Selective processing**; the brain reduces the load of visual processing by filtering information
- **Selective attention**; we focus on specific objects and ignore others.

** Selective visual information processing and eye movements.*

Selective processing is commonly referred to as attention; we selectively concentrate on a discrete patch of information. What we see, and what the brain receives, are two different things. The brain only receives a small amount of what we see in our visual field because of filtering of information. Visual attention illuminates a small part of the visual space around you, where little can be seen outside of this 'spotlight', and it can be redirected flexibly to focus on any object of interest. Selective processing includes:

- **Retinal filtering;** colour information is only encoded in the central visual field, not the periphery.
- **Cortical filtering**; fine details are only represented in central vision
- **Guided filtering**; using eye movements, fine details are only represented in the central vision and eye movements control where we are looking. Eye movements control the 'spotlight' of selective visual information processing. We can measure eye movements using camera-based eye trackers, which show saccades (small, rapid eye movements), and fixations (pauses in eye movement indicating where a person is attending – approx. 3 fixations per minute.)

But what determines where we look? Mechanisms may be involuntary or voluntary:

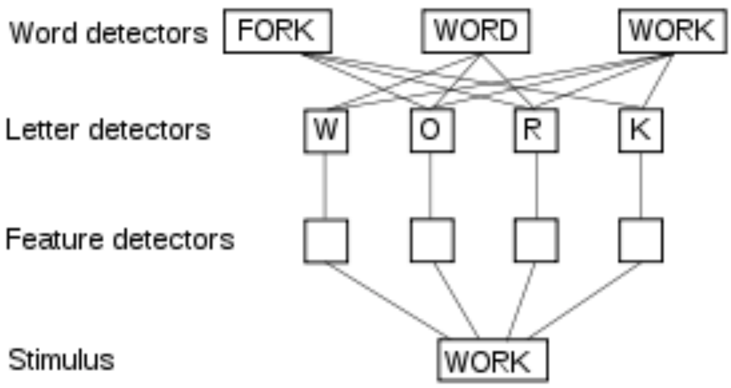
- **Involuntary:** stimulus salience (areas of stimuli that attract attention due to their properties). Visual saliency is the distinct, subjective perceptual quality, which makes some items in the world stand out more than others and grab our attention. Colour, contrast, and orientation are all relevant properties. Saliency maps indicate fixations related to bottom-up processing. Involuntary mechanisms are passive observation.
- **Voluntary:** driven by your environment or schemas; fixations are influenced about prior knowledge about what is typically found in different scenes, for example, if you want to find the microwave you will scan the kitchen space. Task demands can override stimulus saliency; eye movements and fixations are closely linked to the action a person is about to take.

** Attention and eye movements*

We shift our attention across a visual field. We do this through 3 types of attention:

1). **Exogenous attention –** involuntary; guided by bottom-up visual signals, rapid shift in attention guided by survival, triggered by external stimuli (eg. Being predated by a lion).

2). **Endogenous attention:** voluntary/task orientated; guided by top-down visual signals, slow shifts in attention that are goal orientated; attention is given to a spatial location → anticipation (eg. Mating).



Slot coding is one of the problems with the IAM. Used in the model, it cannot capture the similarity between words with letters in the wrong order The Cambridge email is an example of this → it doesn't matter what order the letters are in, as long as the first and last letters are in the right place. This is because the human mind does not read every letter by itself, but the word as a whole. If a letter position is coded precisely, then people would not be able to read jumbled text such as the Cambridge email. So the slot-code assumption of the IAM wrongly predicts similarity. In transposed-letter priming studies, subjects respond quicker to target word JUDGE if the priming word is JUGDE than if it is JUNPE.

**Automatic retrieval of phonology*

Is phonology retrieved automatically in silent reading? Frost (1998) had a strong phonology hypothesis that phonological representation is a necessary product of processing printed words, and that phonological processing is mandatory (obligatory). Van Orden (1987) believed that homophones (words having a single pronunciation but two spellings) have an interference effect → participants in study made numerous errors when asked to make a semantic categorisation. Eg ROWS vs ROSE. Rastle 2006 meta-analysis showed that word processing is faster when preceded with phonologically identical nonword primes than by primes similar in spelling but not phonology, for example RT is faster for target word CLIP when prime is PLIP, and slower for KLIP. This suggests phonological processing occurs rapidly and automatically.

** Reading Aloud*

Within different languages (English, German, Italian, French etc) individual phonemes (smallest unit of sound) are represented y graphemes. Graphemes are letters or letter clusters that correspond to a single phoneme, for example b, ee, sh, igh (as in bee and sigh) go together but not pl, cr, st. **Orthographic depth** refers to the tendency for words to be ambiguous. For example, some spelling-to-sound mappings are ambiguous or inconsistent, such as OUGH → THOUGH, COUGH, TOUGH etc. Some words have irregular mappings, such as PINT and MINT, they should rhyme but they don't.
We do not read all letter strings the same way. There are reading words and pseudowords (nonwords that have letter strings that could be a word). PINT is an irregular word, JINK is a pseudoword. Most skilled readers can read both irregular words and pseudowords correctly. JINK can be read by means of application of spelling-to-sound mapping rules. PINT is a word but it violates the rule about mapping grapheme to phoneme. In order to pronounce PINT correctly, we must have a stored pronunciation for that word (mental dictionary).

Week 12 Cognitive Neuropsychology.

** What is cognitive neuropsychology?*

Cognitive neuropsychology is the study of deficits in memory (amnesia), vision (object/face/colour recognition) and language (aphasia). A sub-field of cognitive psychology, a study of cognitive deficits allows us to learn about normal cognition. Deficits can be

- developmental; failed to develop normally
- acquired; result of brain injury later in life

Three reasons to study cognitive deficits are to understand the deficit, for diagnosis and treatment, to understand where cognitive functions are localised in the brain, and to understand normal cognition. Studying abnormal or atypical conditions enables us to learn about normal conditions in other fields such as mutations (genetics), diseases (medicine), earthquakes and volcanoes (geology), supernova (astronomy), and cognition (neuropsychology).

** Definitions and methods*

CN is interested in deficits and functions of the mind, not the brain. Fundamental concepts behind CN are that the mind is a computing device providing mental representations. The brain is the hardware that implements the representations and computations. There is a clear distinction between cognitive and neural explanations and between a task or a behaviour and the underlying mental computations.

Methods involved in CN look at any aspect of cognition (visual, language, audition, attention etc) and individual case studies of dissociations and errors. A case study is an intensive scientific study of a single individual with a cognitive deficit. There is large variability in deficits across individuals, and this variability can be informative. Averaging results across multiple individuals can be misleading so instead must conduct multiple experiments with a single individual to draw conclusions.

Single dissociation: pattern of results in which one task or cognitive ability (eg. Ability to recognise faces) shows impairment, whil another task or ability (eg. Ability to recognise objects) is intact or much less impaired. Compare to control participants (same age etc.) to determine if actual impairment.
Double dissociation: two complementary single dissociations across individuals. Strong evidence that the two functions are cognitively separate (eg. Reading and spelling).

** Example case studies*

Case study 1: Visual perception

Study conducted by Zihl et al. 1983 on patient LM. A stroke produced bilateral lesions of occipital cortex. Patient could see and identify stationary objects but was unable to perceive movement (akinetopsia). Pt saw the world as a serried of snapshots and couldn't cross the road because couldn't judge movement of cars. Also couldn't pour tea or coffee. In order to determine the normal visual perception system explaining LM's dissociations we need to make inferences about the normal system based on how it breaks down.

Case study 2: Spelling

Case PW (Rapp et al. 1997) was a 52 yo man with left hemisphere stroke caused by parietal and frontal damage. Leads to question do we access a phonological (spoken) representation in our minds before an orthographic (written) representation? PW good at drawing picture but not at spelling out word of the name of drawing.

Some evidence can be found in errors rather than dissociations like PW's case. Within a single domain or task, errors made by an individual reveal information about the underlying system. What are the properties of the system such that an error like that can be produced

Case HE (McCloskey et al. 1994) was a 62 yo with left hemisphere stroke affecting parietal lobe. Would incorrectl spell double letters in words. For example, when prompted with SHELL wrote SHEEL, when prompted with NEEDLE wrote NEDDLE, PRETTY wrote PREETY etc. What must orthographic coding of double letters be like such that it can break down in a way that produces these kinds of errors? There is prior representation of consonants/vowels in spelling ie. CCVCCV structure.

Case study 3: Reading

Case NG (Caramazza 1990) was a 79 yo woman with left hemisphere stroke affecting parietal lobe. When prompted with PARK would read PART, QUICK would read QUIET, HUMID would read HUMAN etc. Same effect was shown if stimulus words were presented backwards. Common error was misreading of last 2/3 letters of the word.

We can use evidence from dissociations and errors to learn about
- multiple divisions of cognitive processes of visual perception
- role of phonology in spelling
- representation of doubled letters in spelling
- representation of letter order in reading

CN is the study of deficits to learn about normal cognition. Primary method of study is case studies which give us key insights from dissociations and errors and are strengthened by converging evidence from other subfields.