PSYC20007: Cognitive Psychology

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KEY CONCEPTS

Null Hypothesis → all group means are equal	One-Way ANOVA only tells us the probability of the **null** hypothesis → reject or accept the null **Limitation of ANOVA** → does not tell you which group is different
Alternative hypothesis → at least one group mean is different	

Between-group variance → variability attributed to between group differences (experimental manipulation)	ANOVA compares **between-group variance** to **within-group variance** **Variability** ● Sample variability is similar to the population variability but not equal ● Sampling more people increases accuracy of population mean estimate ● The variability (spread) stays the same Null hypothesis states that the groups will differ only as much as **chance** makes them differ ● We know how variable the groups are the begin with (within-group variance) ● Manipulating experimental conditions **does not change** within-group variance (each distribution still looks roughly the same) but **does change** between-group variance
Within-group variance → variability within each group (naturally occurring due to random chance)	

F-statistic → ratio of between-group variance to within-group variance If between group variance is small, ratio is close to one If between group variance increases, ratio increases as well	The ANOVA analysis allows us to calculate the F-statistic, which allows us to determine a p-value
p-value → probability of observing the test statistic, F, assuming the null hypothesis is true	

Why do we need statistical tests?

In any dataset, there is **variability** due to:

- Individual differences
- Measurement error
- Experimental or Observational conditions
- Random fluctuations

Because of these factors, it is important that we use **RANDOM ASSIGNMENT**

AND < OR finding (simultaneous detection is worse than divided attention)

- Early Selection → Doesn't predict AND deficit (attenuation doesn't depend on stimulus) **X**
    - Any distinction between targets and non-targets only occurs in the LTM after the filter
    - Shouldn't affect filtering or the amount of attenuation
    - Whether something is a target or non-target should not affect efficiency in which is it recognised, should not predict that we would be worse with two targets instead of one
- Late Selection → competition gives AND deficit ✓

Early Selection:

- Predicts OR < SEL because there is attenuation with divided attention
- Does not predict AND < OR because attenuation shouldn't depend on the identity of the stimulus

Late Selection:

- Predicts AND < OR because two simultaneous targets will both be selected by "pertinence" and compete to get through filter
- Does not predict OR < SEL because if there aren't two targets, there should be no competition and no cost to dividing attention vs focusing attention

Structural and Capacity Theories (The 70's View)

Two ways **attention** can **limit performance**:

Structural (Bottleneck) Theories	Capacity (Resource) Theories
• Some neutral structures can only deal with **one stimulus at a time** • Competition produces processing "bottleneck" (filter theory) • ES → bottleneck getting into LTM • LS → bottleness getting out	• Information processing is **mental work** • Work requires **activation** of neural structure • **Limited capacity** to activate structure

↳ **Capacity Theory** (Kahneman, 1973)

- We can represent the **limits on our total ability** to activate neural structures as a **reservoir of capacity** (which is represented at the top)
- But the idea of capacity theory is that there is **top-down cognitive flexibility** in how we activate this **capacity** across multiple tasks (**flexibility** in how we allocate tasks)
- The reduction of capacity produces a deficit in divided attention tasks
- Differs from structural theories because capacity can be allocated *flexibly* to simultaneous tasks

Interfering Effects of Divided Attention

Strayer and Johnston (2001):

- Talking on a mobile phone interferes with driving (sharing capacity reduces accuracy and increases reaction time)

Evidence for Separate Orienting Systems

Nakayama & Mackeben, 1989:

Cuing Effect: Mean Rection Time $(MRT)_{invalid}$ - MRT_{valid}

- Different time course for central and peripheral cuing
- **Peripheral effect** → **fast and transient** ~150ms
- **Central effect** → **slow and sustained** (also requires cognition and processing) ~300ms

Jonides, 1981:

- Different effects of load in dual tasks (attention-demanding primary task, orienting secondary task)
- **Voluntary** orienting (central cue) **slowed by memory load**
- **Reflexive** orienting (peripheral cue) is **not**

Consistent with **different capacity demands** of two systems

Inhibition of Return

- When we use a flashed peripheral cue, the cuing effect is fast and transient (rapidly rises to a peak at ~150ms then dissipates)
- If we wait for a longer period, longer SOA (e.g. 300ms) then the cuing effect **reverses**
- **Slower** at the cued location than the uncued location

Found only with peripheral cues, not with central cues

Purpose:

- Ecological argument: Allows for efficient search of complex environment
- Prevents repeated search of the same location (don't need to maintain a cognitively costly 'mental map' of locations that have been searched)

Summary: Attentional Orientating Experiments

- Multiple sources of evidence for **two systems**:
  - Effects of SOA and cue type → reflexive system is faster, more transient; voluntary is slower, more sustained
  - Affected differently by load → suggests voluntary system is under more cognitive control
  - Reflexive shows inhibition of return, voluntary doesn't → reflexive controlled by different processes
- Combination of bottom-up and top-down control
  - Need to be able to focus attention, exclude irrelevant stimuli
  - Also to respond to unexpected threats

Week 7 - Attention in Space and Time (Visual Search and the Effects of Distractors)