RTPD

# Agenda

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# Introduction

Examines implicit memory and skill learning – learning which can occur without conscious awareness of it and if learning is task dependant

# Hypothesis

* Participants are expected to become faster and faster at completing the fixed sequence blocks but maintain a fairly steady RT for random blocks
* Positions will produce lower RT than digits as digits must be modally translated to provide spatial cue (Simon effect)
* Faster RT equals learning
* Speed/accuracy trade-off

# Method

* Computerbased reaction-time experiment
* 20 blocks of 24 trials, of positions or digits (1-4) shown for 500 ms
* Response indicated by key press with corresponding finger
* Counterbalancing between positions or digits first between subjects
* Fixed sequence of cues/responses except for every 5th block

# Results

## Fig. 1: sequence learning as determined by RT

* Positions have lower RT than digits
* Fixed sequences have lower RT than random sequences
* Looks like RT for fixed sequences decreases (and is lower than random) -> sequence learning

Statistics:

* Main effect of stimulus: RT for positions significantly lower
* Main effect of block: Difference in RT across blocks -> may be caused by contrast between fixed and random
* Interaction stimulus and block: initial learning may be less effective for positions (floor/ceiling effect?)

## Fig. 2: Does order of completion matter?

* Main effect of stimulus, no effect of order: RT is lower in position-condition regardless of order of completion
* Interaction stimulus and order: general practice/training effect (how much lower RT is in positions depends on the order of completion)

## Fig. 2: Practice effect: test of only novel/random blocks – PAS PÅ HVIS DU IKKE HAR BRUGT DEN FØRSTE BLOCK

* Repeated measures ANOVA with only novel blocks (includes first block as it is effectively random)
* Main effect of stimulus: Position still has lower RT
* Not including first block gives effect of block: training effect -> better performance at later blocks
* Interaction stimulus and block: effects combine to make the first block in the digits condition have highest RT (not just additive)
* Slope is steeper for digits condition (larger difference between order groups) -> training in the positions condition may have greater effect

## Individual differences

* Positive correlation between performance in both conditions: P’s who did well in one condition also did well in the other, regardless of which block was measured
* The effect is stronger for random blocks suggesting individual differences (talent…)

## Fig. 3: Accuracy confirms findings + speed/accuracy trade-off

* Main effect of stimulus: position has fewer errors -> positions are easier (lower RT as well)
* Main effect of sequence type: fixed sequences have fewer errors -> sequence learning
* Significant positive correlation between RT and ACC -> Both conditions have speed/accuracy trade-off

## Fig. 4: Individual data

* Less pronounced hierarchy between fixed and random in digits -> modally translating cues takes longer regardless of training
* Much messier than average -> individual experiences may differ

# Conclusion

* Skill learning can happen non declaratively and can translate to different stimulus types
* RT was lower and ACC higher for position-task vs digit task (might be due to Simon effect)
  + Modally (spatial) valid cues lower RT and increase ACC compared to abstract/symbolic cues
* Speed/accuracy trade-off was present.

# Discussion

* Did asking participants if they noticed a sequence make them aware of one and increase their efficiency in the next experiment?
  + This would lead to a false conclusion, that they have learnt it on their own without awareness

# Grand perspective™

* Grounded cognition (Barsalou)
* Procedural memory (Ashby & O’Brien): learning happens through repetition but doesn’t have to be explicit or conscious.
  + Is dependent on basal ganglia and prefrontal cortex (note: No hippocampus)
* H.M. had intact skill learning
* **Knowlton et al**.: Probabilistic weather prediction task -> Predict the weather from cues. Amnesic patients (hippocampus, no declarative memory of the task, but performance improved), Parkinson patients (basal ganglia, has declarative memory of the task, but no performance improvements).
  + Amnesic patients will make up a story to explain how they learned a task (which they have no memory of learning) - they just fill in the blanks of their memory (the patient itself will believe the story)
* **Simon effect**:Lower RT when spatial congruent between stimulus and response
* **SNARC**-effect (spatial-numerical association of response code): Faster RT when indicating on lower numbers using left hand, faster RT when indicating higher numbers using right hand (like the ordering on a ruler -> largest numbers to the right)
* Cowan’s model of working memory (LTM and STM operate on same tissue)
* Baddeley’s multicomponent model
* Atikinson & Shiffrin: stage model
* Craik & Lockhart: levels of processing
* Ebbinghaus: Forgetting and learning curve.
* Brown-Peterson task
  + Trigram of letters -> interference task (counting backwards in threes) -> recall trigram
  + Proactive interference: performance decreases following each trail, but when task is changed, performance increases back to baseline
* Other tasks testing implicit memory:
  + **Classical conditioning**, mirror drawing, Tower of London, Priming tasks (speed of recognition for previously seen material),
  + Repetition priming in fMRI: When the task has been done before, the brain will complete the task faster and with less effort the second time around
    - Repetition of the same stimulus: weaker signal in viewpoint-specfic areas -> When the task has been done before, the brain will complete the task faster and with less effort the second time around