RTPD

**1: Introduction:** Examines implicit memory and skill learning 🡪 learning which can occur without conscious awareness of it and if learning is task dependant

**2: Hypothesis:** - Participants are expected to become **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

**3: 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 (C, V, B, N)

- Between subjects counterbalancing of first stimuli type

- Fixed sequence except for every 5th block

After first 20 blocks, P are asked if any sequence was noticed.

**4: Results:** Figure 1: Sequence learning as determined by RT. **Position have lower RT than digits, fixed sequences have lower RT random**. *Looks like* RT for fixed decreases (and is lower than random) 🡪 Sequence learning.

Repeated ANOVA: Confirms 🡪 Main effect of stimulus (RT is significantly lower), and Block (different RT across blocks)

Interaction stimulus and block (Differences varies dependent on stimulus and block number)

Figure 2: Does order of completion matter? Main effect of stimulus NO effect of order 🡪 **RT is lower in position regardless of completion**. Interaction stimulus and order 🡪 Learning transfer, faster at a task if they tried the other task first. Still, position is always faster than digit.

**5: Results** Figure 3: Learning for random blocks. Repeated ANOVA: Main effect of stimulus type and block 🡪 RT faster for position and RT variates between the blocks**.**

Low RT due to skill 🡪 Positive correlation for block 1+19 (fixed) and 1+20 (random). 🡪 P with lowest RT in 1 also had the lowest in 19+20. Most significant in random (20), where learning didn’t occur.

Figure 4 Accuracy: ANOVA Main effect of stimulus (position has fewer errors) and sequence type (fixed have fewer errors🡪learning). Significant positive correlation between RT and ACC 🡪 Speed-accuracy trade-off

Individual 🡪 **Less pronounced hierarchy between fixed and random stimulus**

**6: Conclusions:** Skill learning can happen non declaratively and can translate between 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.

**7: Discussion:** Asking participants if they noticed a sequence may 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

- **Simon effect**: Lower RT when spatial congruent between stimulus and response

- **SNARC-effec**t (spatial-numerical association of response code): Faster RT when indicating low numbers using left hand, faster RT when indicating high numbers using right hand (like on a ruler 🡪 largest numbers to the right)

- **Procedural memory** (Ashby & O’Brien): learning happens through repetition but doesn’t have to be explicit or conscious.

- Cowan’s model of working memory (LTM, WM, focus of attention)

- Baddeley’s multicomponent model (phono, visio, episodic)

- Atkinson & Shiffrin: stage model (input, attention, STM, rehearsal, LTM)

- Craik & Lockhart: levels of processing

**8: Grand perspective**: **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). 🡪**H.M.** (bilateral hippocampi removal) had intact skill learning

**Other tasks testing implicit memory**:

o 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