2. MEASURING THINKING OBJECTIVELY IN COGNITIVE PSYCHOLOGY USING REACTION TIMES: TWO CLASSIC STUDIES

2.1. INTRODUCTION

Thinking is a process that cannot be seen, it must be inferred from subsequent behaviour. Thinking "goes all the way from the ability to perceive the world around us by sight, hearing, touch, and smell, through our ability to reason, to solve problems, to use language, to learn and remember, and to move and act in the world" (Medin et al 2001 p4).

For cognitive psychology, which emphasises the scientific approach, it is necessary to find objective ways to measure thinking. In other words, it is how the aspect of thinking being studied is operationalised. A common way is to use reaction times - "the length of time it takes people to do something of interest" (Medin et al 2001).

The measurement gained feels objective and is comparable between participants and studies (table 2.1). When the speed of response to a stimulus is used by pressing a key as quickly as possible, a warning signal is usually given first and then a random waiting period to the stimulus. A lot of practice is required to stabilise performance (over 100 repetitions). But averaging the data can be problematic. The data are positively skewed (ie there are more longer reaction times from the early trials). It can be represented by the median, or the central 90% or 95% of the distribution (Rose 2000).

Two classic studies from cognitive psychology are included as examples of how researchers use reaction times in their work.

2.2. EXAMPLE: MEMORY (Collins and Quillian 1969)

This experiment tested the speed of response to true or false questions about information in semantic memory. The researchers proposed that information is stored as hierarchies of general and specific facts. For example, the statement "a robin is a bird" is easier to access

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STRENGTHS	WEAKNESSES
1. Clear objective score. 2. Allows comparison between participants in the study, and between studies. 3. Gives the researchers interval or ratio data (1), which allows the use of parametric statistics. 4. Reliable measuring system ie units of time do not change in quantity. 5. Can measure reaction times of both conscious and non-conscious behaviour (eg neurons firing). 6. Can be used to measure stimulus intensity because generally reaction times decrease as stimulus intensity increases. 7. Performance on reaction time trials does stabilise after practice.	1. The validity of reducing cognitive processes to reaction times. 2. Assumptions have to be made about changing reaction times. For example, if individuals take longer to verify that a picture is of a mammal than it is of a dog, what does that tell us? 3. Reaction times can vary due to order effects - reduced by practice or increased with fatigue or boredom. 4. Problems of averaging the data over many trials. 5. Some reaction times are very fast (milliseconds) and are difficult to measure accurately. 6. Often reaction time measures take place in artificial lab environments with tasks low in ecological validity. 7. Cannot be used to measure sensory mechanisms that detect sustained attention.

Table 2.1 - Strengths and weaknesses of using reaction times as measures of thinking.

because it is specific and thus takes less time to find in memory than the statement "a robin is an animal". This latter statement is general and stored higher in the hierarchy of information taking longer to access (figure 2.1; table 2.2).

This model has been challenged by contrary evidence. For example, the response time to the statement that "a chicken is a bird" is longer than to "a chicken is an animal" (Medin et al 2001).

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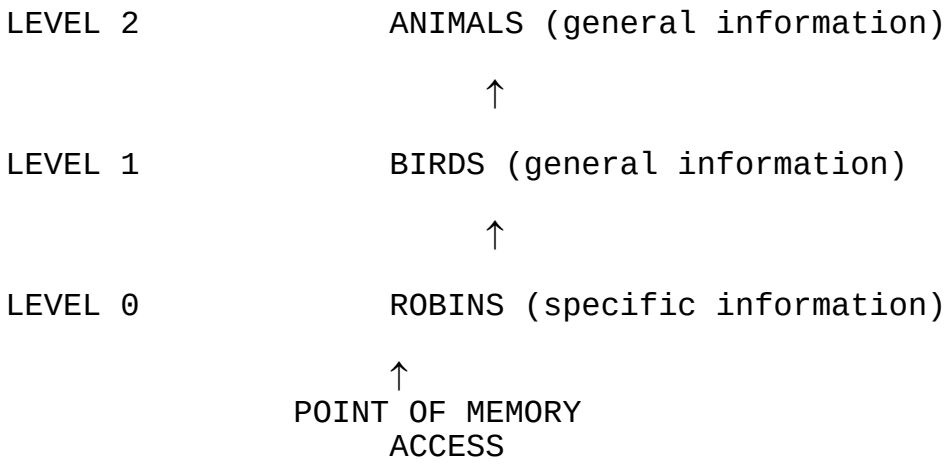

Figure 2.1 - Simple example of the hierarchical organisation of memory.

Statement to verify as true of false	Level of information in memory	Approximate mean reaction time (milliseconds)
Canary can sing	0	1300
Canary can fly	1	1350
Canary has skin	2	1500

Table 2.2 - Example of mean reaction times based on statement asked to verify as true or false.

2.3. EXAMPLE: PERCEPTION (McGinnies 1949)

This classic experiment tested the idea of "perceptual defence" in the process of visual perception. Perceptual defence is the "filtering" (at a below conscious level) of information that is emotion-inducing or unpleasant. The upshot is that individuals will take longer to consciously recognise anxiety-provoking words than neutral ones.

Using a Gerbrand's Mirror Tachistoscope, which shows words for 0.01 - 0.05 seconds, sixteen students were asked to response on recognition of the word. Eighteen words were used , of which seven were critical words (taboo for the time)(eg penis, whore) and the others were neutral (eg broom, stove). The order of presentation was mixed together making this a repeated measures design.

The participants took significantly longer to recognise the critical words (mean difference of 0.045 seconds).

Critics (Howe and Solomon 1950) argued that

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participants were simply reluctant to say the critical words rather than taking longer to consciously recognise them, thereby challenging the idea of perceptual defence.

2.4. FOOTNOTE

1. Whether reaction times are interval or ratio data depends upon the existence of zero as a reaction time. Ratio data requires an absolute zero. It is more of a philosophical debate as to whether zero reaction time is possible.

2.5. REFERENCES

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