

ACTIVITIES AND ACHIEVEMENTS QUESTIONNAIRE

1. Non-Technical Summary

A 1000 word (maximum) summary of the main research results, in non-technical language, should be provided below. The summary might be used by ESRC to publicise the research. It should cover the aims and objectives of the project, main research results and significant academic achievements, dissemination activities and potential or actual impacts on policy and practice.

The project aimed to further our understanding of the fundamental psychological processes underlying the perception and representation of basic psychophysical properties (e.g., length). These processes are assumed to be common to a wide range of cognitive tasks, such as categorization, recognition, and identification. We focussed on the task of absolute identification, which is ideal because it involves a simple, stripped down task, with features common to many other tasks. On each absolute identification trial, participants had to identify a randomly chosen stimulus from a set of (six or eight) stimuli that varied only in one property (we used the distance between two points and the frequency of an auditory tone). Each stimulus was given a label according to its rank position in the set (e.g., the shortest distance is labelled '1' and the longest '8'). Feedback, the correct response, was provided after participants made a response. We were interested in both the responses participants made and the time it took to them to make those responses.

Although absolute identification in principle is very simple, a perplexing result is that when the set of to-be-identified stimuli is greater than about six, performance is less than perfect and declines as the set size grows (this is known as the 'set-size effect'). In particular, not all stimuli are equally poorly identified. The stimuli at the ends of the set (the smallest and largest in magnitude) are responded to faster and more accurately than stimuli towards the centre of the set (the 'bow effect'). Both the set-size and bow effects are robust findings and were evident in all our experiments.

It seems intuitive that increasing the separation between adjacent stimuli (i.e. spreading out the range of values in the stimulus set) should greatly increase performance, as stimuli should become more perceptually distinct. However, previous studies investigating the effect of different stimulus spacings produced conflicting results. We therefore conducted a systematic exploration of possible reasons why some studies found only very small improvements in accuracy for widely-spaced stimuli compared to narrowly-spaced stimuli, and why some report faster responding for narrowly-spaced sets and other for widely-spaced sets. In our experiments, the widely-spaced stimuli were identified more accurately than the narrowly spaced stimuli (ranging from a 12-74% improvement, depending on the experiment and the measure of response accuracy used). This is much lower than expected; the difference in spacing between the wide and narrow sets was 100%. Stimulus spacing did not have a consistent effect on the speed with which people responded. We also found that the presentation time of a stimulus (half a second versus presentation until a response is made) affects the speed of responding depending on the stimulus spacing. Along with the finding that participants appear to change their response strategy depending on the order in which they complete the different experiment tasks, these findings have important implications for the design of future experiments.

We also investigated the impact that presenting a stimulus more than once on a trial has on performance. Previous research has suggested that presenting a stimulus

more than once increases identifiability because an independent representation of the stimulus is created with each additional presentation. The experiments in this series investigated alternative explanations for this effect (e.g., was it simply due to the fact that increasing the number presentations increases the available time to perceive a stimulus?). We demonstrated that, contrary to previous work, with relative long presentation additional presentations do not seem to help by allowing further information to be gathered about a stimulus, but performance improves largely because of the associated increase in time that people have to decide between possible response options. These findings have broad implications both for models of absolute identification and for other areas of research. An article describing this research has been submitted for publication in a top international journal.

The next experiments more directly investigated the process of how stimulus information is accumulated and represented. In these experiments, stimuli were presented on screen for very brief durations (from a few milliseconds to a few hundred milliseconds). Somewhat surprisingly, and counter to one established model, people performed at maximum accuracy after just a short duration (around 50-100 milliseconds). Despite the short presentation times and high level of accuracy, participants took a long time to complete each response, suggesting again that the main determinate of performance in absolute identification is the response selection process. Additionally, we found that the relationship between response speed and accuracy across the different condition of the experiments (which also varied stimulus spacing and set size) was consistently different for different individuals, suggesting that people may systematically vary how they approach the task. We have submitted an article describing this research to a top international journal for publication.

Having explored in detail the perceptual processes in absolute identification, the final series of experiments focussed on response selection, which the previous experiments have suggested is a crucial component. By manipulating the length of time that participants had to make a response, whilst keeping the stimulus presentation time constant (so that perceptual processing was held constant), we could examine the decision process on its own. We found that increasing non-stimulus processing time has a relatively small (and sometimes no) effect on accuracy and response times. However, any effect of extending the time available for response selection, whilst keeping perceptual processing constant, demonstrates that response-selection is crucial in determining performance in absolute identification.

Overall, the project has successfully aided our understanding of the processes underlying the perception of, representation of, and response to simple stimuli. Although perceptual processes are important, it is the response selection stage that is the main determinant of performance in absolute identification (and probably in other tasks too). The results have important implications for theories of absolute identification but will be of interest to researcher in other areas as well. Several findings are still puzzling and require further exploration before a satisfactory account can be offered. We hope to secure future funding to clarify these issues.