Computer based method for investigating divided attention and interference

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To assist students understand the difficult concepts of divided attention and interference, a new purpose built computer & mouse task is compared with an existing paper & pencil version, and yields complementary results. The pencil & paper task provides first-hand experience of divided attention and interference for the students. The computer & mouse task further extends the learning experience to the student's workstation outside of the classroom, and has potential for larger scale implementation. The computer & mouse task is a good tool with some advantages over the paper & pencil task.

Keywords: interference, divided attention, motor task, interference task, experimental technique.

Introduction

Attending to two simultaneous events, locations or tasks is generally considered to be divided attention (Styles, 1997). Divided attention implies that two disparate tasks compete for resources, and as the combined load of the tasks approaches or exceeds available capacity, some measurable decrement in task performance may be detected, and is referred to as interference. To demonstrate interference, it is useful to have tasks which share some resources, such as neural centres, or centres in close proximity. Based on neurophysiological models, two tasks that share resources are a tapping (motor) task, and a verbal arithmetic task. The left pre-central region controls the movement of the right hand, while nearby in the left frontal region is the speech production area, known as Broca's area (Bradshaw & Nettleton 1983). The proximity of these cortical regions implies some level of overlapping resources. Also a difficult arithmetic task will create a high load enhancing any interference effect.

An existing paper & pencil method has been used as an in-class experiment over several years to help students to experience divided attention and interference first-hand. More recently, a computer-based analogue has been developed to provide a quicker, easier way to collect and analyse the responses generated during the divided attention interference experiment. This paper compares the computer & mouse with the paper & pencil tasks and their respective results.

Methodology

Participants

	Pencil & paper	Mouse & computer
Total	N = 583	N = 32
Female	N = 463	N = 25
Male	N = 114	N =7
Right handed	N = 519	N = 28
Left handed	N = 59	N = 5
Mean age	22.1 ± 4.5	23.2 ± 7

Materials and methods

Two versions were used: the paper & pencil task, and the computer & mouse task. Both versions consist of a set of circles in which participants 'tap' (either with pencil on paper or mouse click on screen) in a

defined sequence beginning at the top left and continuing around the series in a clockwise direction, for a period of 30 seconds. The number of circuits or 'laps' is counted to provide a measure of task performance. This is the underlying task for both the motor and interference sections. For the motor task, this is the only action required. For the interference task, participants are required to simultaneously perform the tapping task and a verbal arithmetic task (serially subtracting sevens from a randomly supplied number). Participants record the final countdown number as well as number of laps to quantify their performance.

To assist in the evaluation of both tasks, participants were surveyed by questionnaire regarding their perceptions of the tasks, and the comparison between the paper & pencil and computer & mouse tasks.

Results

The results from the computer & mouse task showed a high degree of consistency with the paper & pencil task. The non-preferred hand showed a slower motor response than the preferred hand; while the interference task showed a performance decrement compared to the control task. The results illustrate that the overall patterns are the same in both tasks (Figure 1).

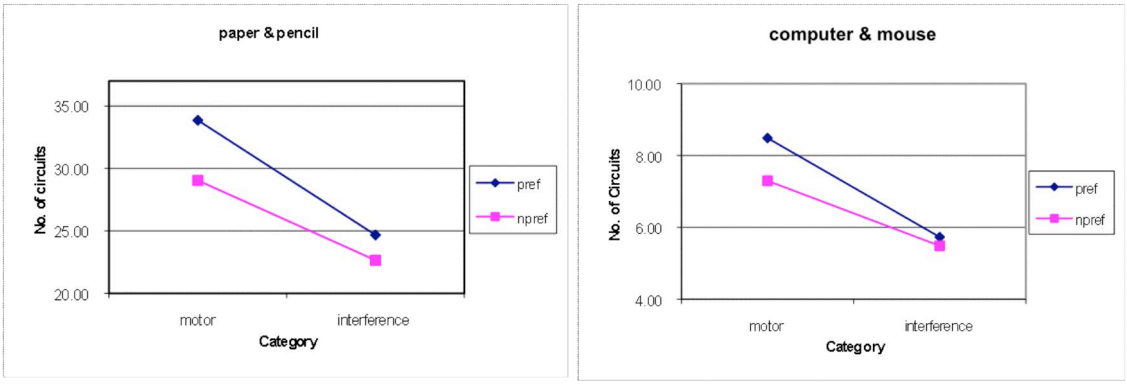

Figure 1: Results for paper & pencil task (left panel) and computer & mouse task (right panel), comparing the basic measures for performance of preferred/non-preferred hand and motor and interference tasks

Questionnaire results from 32 participants who completed both tasks yielded responses indicating 87.5% found the computer & mouse version of the task was as 'equally helpful' or 'more helpful' than the paper & pencil version in terms of assisting with their *understanding* of interference. Overall, more than half generally preferred the computer & mouse to the pencil & paper task.

Discussion

These data demonstrate that the computer & mouse task and paper & pencil task appear to index the same underlying processes, however, the meaning of the comparison is open to some interpretation given the small number of participants involved in the comparison. A larger study utilising paired participant data for both tasks is planned, and will ensure that more meaningful comparisons can be made without assuming any group effect for the differences between the paper & pencil and the computer & mouse tasks. It will also enable more power to be drawn from the study as each participant will be tested and compared under both conditions. A long-term goal is to enable a larger database to be established by using the computer & mouse task in a web-deliverable mode. This would provide a method to share the collection and results with other centres involved in teaching cognitive sciences (psychology, psychophysiology, neurosciences), contingent upon ethical considerations. The other advantages for the computer & mouse task include the ability to take the testing out of the classroom, and engage online learners in a more flexible and convenient way, and particularly with single users, not requiring a partner to count the number of laps.

The benefits of the computer & mouse task include single user accessibility, central collation of results, greater anonymity, and removal of peer pressure. Some potential new modes of teaching and student learning may benefit from the use of web technologies to collect, analyse, and communicate the findings.

References

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