

Hemispheric interference in manual verbal tasks psychology essay



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Research has shown that different hemispheres are responsible for different functions. It is argued that if two or more tasks are loaded on the same hemisphere, the overall performance of these tasks will deteriorate. This occurrence has been explained by the hemispheric interference theory which states that multiple tasks demanding cognitive attention from the same hemisphere will encounter interference due to the additional demands. In this study, this phenomenon was examined among 378 subjects using the manual-verbal task paradigm. Participants were asked to balance a dowel rod on their left and right hands alternatively across two conditions - silent and verbal. Their preferred handedness were also taken into account and assessed by the Edinburg Handedness Inventory. Results obtained from an independent t-test analysis revealed that interference in right hand balancing is significantly more than left hand balancing in the verbal condition. This suggested that magnitude of interference is larger when both tasks utilize the same hemisphere. Furthermore, it was also evident that interference occurs during dual tasks in both left and right hand condition. This suggested that contrary to several prior studies, speech is bi-lateralized.

Hemispheric Interference in Manual-Verbal Tasks

Extensive research has been done on brain hemispheres and the different functions each of them is responsible for. Clinical research reveals that the left hemisphere is responsible for speech and fine motor abilities while the right hemisphere is accountable for spatial functions (McGowan & Duka, 2000). However, when it comes to motor skills, roles of left and right hemisphere have been shown to be asymmetrical, that is, the left hemisphere is responsible for manual tasks on the right hand and right

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hemisphere controls tasks on the left (Hiscock & Kinsbourne, 1979).

Asymmetrical cerebral lateralization and unilateral hand preference are usually correlated since birth. It was also noted that hemispheric lateralization occurs at a very young age but does not necessarily increase with it (Hiscock & Kinsbourne).

With these on board, it is argued that when dual-tasks are lateralized, that is, they load on the same hemisphere, performance will decline because of the increased cognitive demands on a limited brain capacity. This phenomenon has been explained by cerebral lateralization interference which explains that mutual interference occurs in the event of hemispheric sharing between several tasks, resulting in an overall decrement in performance of tasks (Kinsbourne & Cook, 1971).

However, it should be noted that due to each task's distinct characteristics and demands, lateralization do not occur in a consistent manner. This in turn affects the amount of interference incurred. For example, in an experiment done by Hiscock, Kinsbourne, Samuels and Krause (1987), it was observed that speaking was more disruptive as opposed to memory encoding in a dual task paradigm where subjects were finger tapping. This suggests that different cognitive processes involved result in different lateralization and interference of varying magnitude.

Other factors such as difficulty have also been observed to affect this phenomenon. An experiment done by Hicks (1975), which consisted of a manual task (finger tapping) across verbal tasks of various difficulty levels revealed that the more complex the verbal task was, the worse the manual

task was performed. This finding can be interpreted to show that the more cognitively demanding a task is, the greater the interference. Other independent variables observed to affect concurrent task performance and hemisphere interference include gender and practice effects (Medlan, Geffen & Mcfarland, 2002).

As mentioned, vocalization utilizes the left hemisphere. However, it is noteworthy that there are various underlying cognitive processes that lead to vocalization. Factors that influence these cognitive processes include task's stimulus and intention. In an experiment done by Steiner, Green and White (1992), it was observed that when subjects are required to process the meaning of a verbal task before recitation, there was a larger interference in the manual task, as opposed to the mere act of reading. This suggests that increased complexity of verbal task, such as the need for comprehension, results in a greater magnitude of interference.

With that being said, verbalization is often coupled with a manual task as a means of assessing hemispheric laterality and interference. An early indication of asymmetric lateralization where a left lateralized effect was observed was evident in a dual-task experiment done by Kinsbourne & Cook (1971). Subjects in this experiment were noted to struggle with manual tasks on their right hand when they were asked to speak simultaneously. This finding has since then been replicated in various experiments, such as those done by Hicks (1975) and Hiscock, Kinsbourne, Samuels & Krause (1987), who attributed the asymmetry of interference to the fact that both right-hand tasks and speaking are controlled by the left cerebral hemisphere of right-handers. It was suggested that with competition for attention and <https://assignbuster.com/hemispheric-interference-in-manual-verbal-tasks-psychology-essay/>

abilities from concurrent tasks, the performance will inevitably decline due to the limited capacity of the hemisphere (Hiscock et al., 1987). It was further noted in the paper done by Hicks (1975) that this occurrence does not extend to left hand movements as they are controlled by the right cerebral hemisphere, which was noted to be rather disassociated from its left counterpart.

However, if such an explanation is accurate, no interference should be noted when the tasks are managed by the left hand as the two tasks are loading on separate hemispheres. In contrary, prior research has shown that there is a sizeable interference effect even when manual tasks were performed on the left hand. This result suggests bilateral lateralization (Dimond & Beaumont, 1972). In other words, verbal tasks might utilize both hemispheres instead of only the left, as previously hypothesized. This finding was affirmed by Beaton (1979), who stated that this interaction is a result of function sharing between hemispheres and is dependent on the cognitive demands of the task.

In order to examine this phenomenon further, we build on the work of Kinsbourne & Cook (1971) to examine if there is any difference in hemispheric interference between left and right motor skills using a manual-verbal task combination. Correspondingly, the manual task in this experiment consisted of balancing a dowel stick across two conditions, silent and speaking (single and dual task respectively). The influence of verbal task on manual task was examined by performance of dowel balancing, measured in time (seconds). It was hypothesized that in the speaking condition, dowel-balancing time on the right hand will be shorter than the left hand. It was <https://assignbuster.com/hemispheric-interference-in-manual-verbal-tasks-psychology-essay/>

predicted that this would occur because the act of speaking significantly interferes with the right hand balancing in the left hemisphere. This paper aims to covers the methodological and empirical foundations underlying the theories of cerebral lateralization interference.

Method

Subjects

All 378 subjects were undergraduates enrolled in enrolled in PSY3350 Biological Psychology, Sensation and Perception in Edith Cowan University. All students did a checklist of questions regarding their preferred handedness and assessed by the Edinburg Handedness Inventory. Results obtained defined the handedness of the subject and revealed a mean handedness quotient of 0. 83 (SD = 0. 20). Only right-hander's balancing time were taken into account in this experiment.

Material and Design

Subjects were assigned to groups of four. A wooden dowel rod (1. 25 cm x 92 cm long) was used for the dual task balancing experiment. Students were asked to balance the dowel rod on alternate hands across two conditions - silent and speaking. Time taken to balance was measured by a fellow group mate with a phone. For the speaking condition, another group mate held a conversation with the subject based on any topic (not limited). On top of that, Edinburg Handedness Inventory with a total of 10 questions based on daily activities was used to measure degree of preferred handedness. This test has been deemed sufficiently reliable by Oldfield (1970) to assess handedness in large populations. An experiment done by Williams (1991)

further concluded that this test is reliable with a cronbach's alpha of .93, indicating internal consistency.

Procedure

Students were asked to gather in a classroom for the evening class. A brief introduction and purpose of the dual-task experiment was given by the lecturer before the start of the experiment. The experiment was held either in the classroom or the corridor, both of which were air-conditioned. In a standing position, subjects were asked to balance a dowel rod vertically on their index finger for as long as they can. Each trial commenced when the timer said "start" and ended when the subject lost control of the dowel rod i. e. dowel rod fell to the ground or hit against something. The experiment consisted of eight trials in total - right and left trials alternated across two conditions, silent and speaking. The balancing time of each trial was recorder by a timer. Each condition was timed twice before the average was calculated. In the speaking condition, a conversation on a random topic was held with a fellow group mate. After the experiment, subjects were then instructed to complete the Edinburg Inventory Checklist that measured one's preferred handedness based on a checklist of 10 questions about daily activities. Upon completion, both time sheet and Edinburg Handedness Inventory were handed in together to the lecturer for further analysis.

Results

Data with a total sample size of 378 was collected. This included time measured across four different conditions: left hand-silent, left hand-verbal, right hand-silent and right hand-verbal. It was hypothesized that in the

speaking condition, dowel-balancing time on the right hand will be shorter than the left.

Table 1

Average time of dowel balancing across conditions and interference incurred

Condition / Dependent Variable

Mean

Std. Deviation

(seconds)

Left Silent

11.05

18.15

Left Verbal

10.34

18.76

Right Silent

17.27

29.04

Right Verbal

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12. 80

20. 67

Amount of Left Balancing Interference (Verbal-Silent)

$\hat{a}^0. 72$

10. 19

Amount of Right Balancing Interference (Verbal-Silent)

$\hat{a}^4. 48$

19. 18

Table 1 shows the average time of dowel balancing across conditions and interference incurred in left and right hand in the verbal condition. It is evident in Table 1 that overall, balancing on silent condition for both left ($M = 11. 05$ sec, $SD = 18. 15$) and right hand ($M = 17. 27$ sec, $SD = 29. 04$) is better than balancing in the verbal condition for both left ($M = 10. 34$ sec, $SD = 18. 76$) and right hand ($M = 12. 80$ sec, $SD = 20. 67$). Furthermore, right balancing interference ($M = -4. 48$ sec, $SD = 19. 18$) is larger than left balancing interference ($M = -. 72$ sec, $SD = 10. 19$). A dependent two-tailed t-test conducted was able to further confirm that there this difference is significant, $t(377) = 3. 8$, $p < 0. 005$.

Discussion

It was hypothesized that verbalization shortens dowel balancing time on the right hand more than the left. Results obtained from this experiment support

this hypothesis. It was noted earlier in this paper that manual tasks are managed by asymmetrical hemispheres and speech by the left hemisphere. Hence, a larger interference was observed in right hand balancing and speaking as they are both left lateralized. This is in favour of prior dual tasks researches, such as those done by Kinsbourne & Cook (1971) and Hicks (1975), who attributed the interference to additional cognitive demands on a limited hemisphere capacity that arise from simultaneous tasks.

Furthermore, it was theoretically suggested that speech is controlled by the left hemisphere alone. In contrary, results from this experiment did not reflect this as interference was evident in both left and right hand balancing during dual tasks, differing only in degree of influence. One explanation for this present result is that under different stimulus conditions, verbalization might utilize both hemispheres due to the different cognitive processes involved. Bi-lateralizing of speech is thus inferred. These findings lend further support to the studies done by Beaton (1979) and Dimond and Beautmont (1972), who indicated that when the demands of the tasks exceed a certain level, unilateral hemispheric processing gives way to bilateral processing.

Lastly, it is also noteworthy that lateralized interference in this and prior experiments seem to only occur in one direction i. e. the verbal task affects the manual task. An explanation for this occurrence can be derived from the selective attention theory formed by Stroop (1935), who states that when the brain is confronted with different type of information to register, it has a tendency to do the activity that requires the least usage of cognitive abilities first. Dowel balancing is a manual task that requires minimal cognitive effort

but demand ongoing attention while speaking, in this case, is a routinized verbal skill.

In conclusion, hemispheric interference occurs during dual tasks due to the additive demands on the brain of a limited capacity. However, contrary to popular research, interference may occur in both hemispheres instead of just the designated section responsible for the task. This suggests bi-lateralization which indicates that both hemispheres may be utilized, depending on the cognitive demands. That being said, there are still many unanswered questions about cerebral lateralization. In particular, it remains unclear in this experiment which aspect of language and nonverbal ability is being lateralized. This is because an unlimited topic produces an unlimited variety of question, which might result in different cognitive processes and hence, different lateralization. Future research should include cross-validating dual tasks results across various conditions to identify the confounding factors that affect single versus dual task influence on performance.