

Think and do. Motor rather than cognitive performance is (consistently) impaired in dual-task situations in preschool children.

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INTRODUCTION

The ability to perform two tasks at the same time, also known as dual-tasking, is crucial to cope with many tasks of our daily life. Most importantly, we have to take in and process a lot of information, and make decisions on the go (e.g. during walking, playing, and working). While growing evidence suggests that our dual-tasking ability is impaired in late adulthood, little is known of how young children perform in dual-tasking situations.

The present study examined (a) whether preschool children are able to deal with dual-task demands, and (b) whether they would prioritize motor or cognitive demands during dual-task situations.

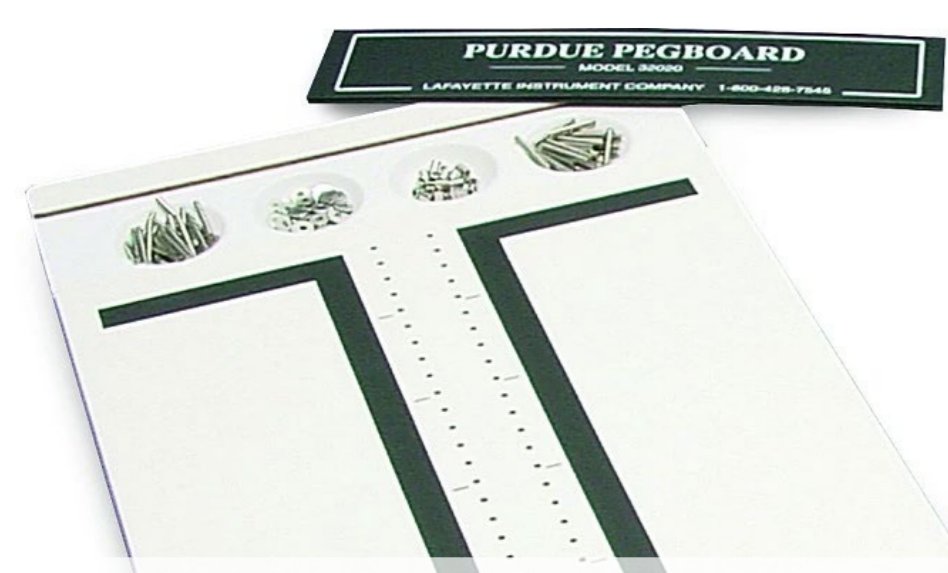


Figure 1. Purdue Pegboard task. Children were asked to insert as many pins in the holes as possible with their dominant hand – in the dual-task conditions, Pegboard and n-back or AX-CPT tasks were performed at the same time.

METHODS

Thirty-two preschool children (20 girls, Mage = 71.6 ± 4.0 months) were tested individually in their daycare facilities. To keep children motivated, testing was embedded in a pirate training and children received a stamp on a treasure map for each task they completed. After all testing, children were rewarded for completing their pirate training.

All participants completed a manual dexterity task (Purdue Pegboard, see figure 1) under single and dual-task conditions. In dual-task conditions, children were confronted with the following tasks that had to be performed concurrently to the motor task:

- a working memory task (auditory n-back task, see figure 2)
- an attention and inhibition task (auditory version of the AX-Continuous Performance Task using animal sounds; based on [1])

mouse – dog – goose – **goose** – cow – horse – **horse** – dog – mouse – dog – cow – **cow** – mouse – **mouse** – goose – dog – **dog** – horse – mouse – **mouse** – cow – horse – **horse** – goose – **goose** – cow – **cow** – horse – dog – **dog**

Figure 2. Example of the auditory 1-back task. The list of animals was read to the children and children had to say “Yes” whenever the current animal matched the animal one step earlier in the sequence (highlighted in purple). Children were asked to complete the 1-back task in single and dual-task conditions respectively (max. 10 points per list). Presentation of the list took exactly 60 seconds to match duration of the Pegboard task in the dual-task condition.

RESULTS

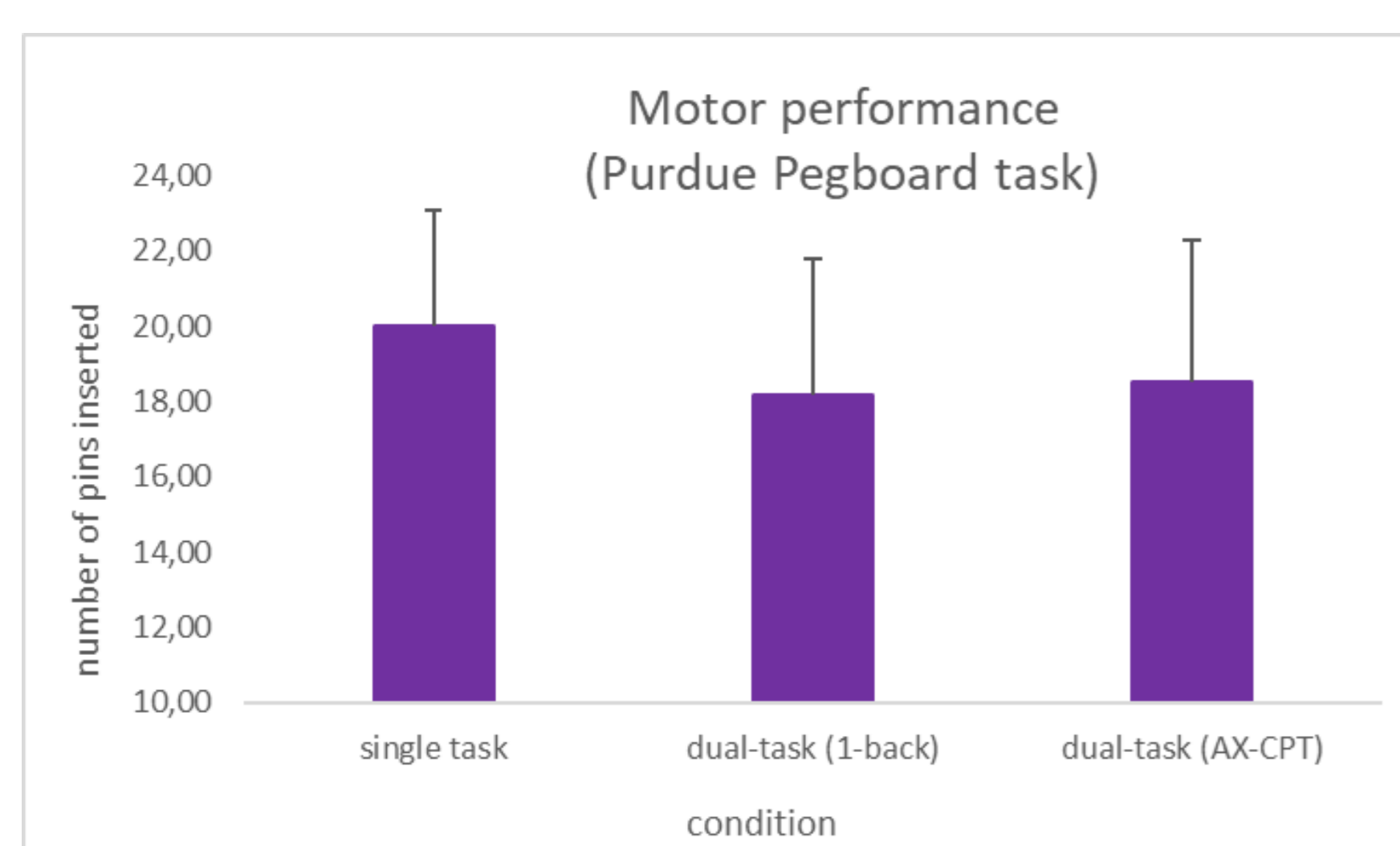


Figure 3. Pegboard performance under single and dual-task conditions. Error bars indicate standard deviation.

Our data revealed that manual dexterity performance (see Figure 3) was negatively affected by both the n-back task (mean difference = 1.84; CI: 0.92, 2.77; $p < 0.001$) and the AX-CPT task (mean difference = 1.52; CI: 0.39, 2.63; $p = 0.002$). However, while also AX-CPT performance was reduced under dual-task as compared to single-task conditions ($p < 0.001$), n-back task performance was not affected during dual-tasking ($p = 0.69$) (see Figure 4).

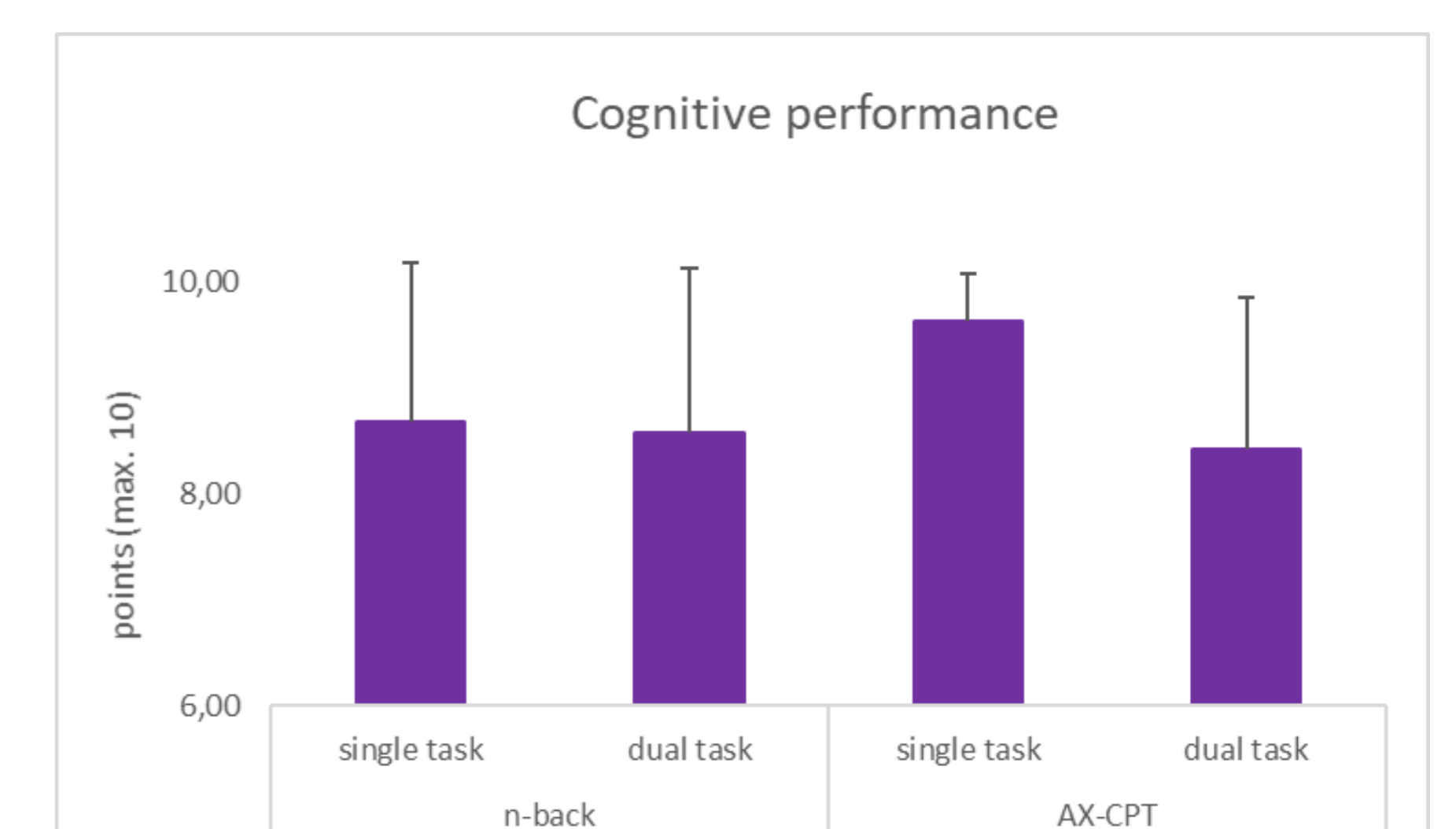


Figure 4. Performance in the n-back and AX-CPT tasks under single and dual-task conditions. Error bars indicate standard deviation.

DISCUSSION

The results of the present study indicate that preschool children are able to deal with dual-task demands with dual-tasking costs ranging from 7.6% to 9.4% for the motor task and from 1.3% (n-back) to 12.5% (AX-CPT) for the cognitive tasks on average. Motor performance was consistently affected by dual-task demands regardless of the simultaneously performed cognitive task. However, while attention and inhibition (AX-CPT) dropped significantly during dual-tasking (as a result of the dual-task design, which requires the distribution of limited attentional resources between both tasks), working memory performance (n-back) was not affected.

The present results may be explained with the nature of the tasks, the developmental stage of the children or the bottleneck theory. Considering the latter, the fact that motor and/or cognitive performance was reduced when being performed simultaneously provides further evidence that both are functionally linked at this age and draw on the same neuronal resources [2]. The fact that working memory performance was not affected by dual-tasking (while motor performance was reduced) indicates that children prioritized the secondary cognitive over the motor task in the dual-task situation – a finding previously reported for simple walking tasks [3].

REFERENCES

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