Title	Attentional efficiency and English performance
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Source	*The NIE Researcher*, 3(1), 14-16
Published by	National Institute of Education (Singapore)

Attentional Efficiency and English Performance

Kerry Lee

Introduction

Attention is a central aspect of most information processing theories. Success in learning and remembrance are contingent upon our ability to achieve and maintain an alert state (alerting), during which we focus selectively on the to-be-remembered material (orienting). When multiple memory traces are available, attention is again required to assist in deciding on the correct response (conflict resolution). Posner and Petersen (1990) argued that three neuro-anatomical networks are responsible for these functions. This is supported by recent neuro-imaging findings. The alerting, orienting, and conflict resolution networks are found to be largely distinct, with focal points in the fronto-parietal/thalamus, bilateral superior parietal, and the anterior cingulate respectively (Fan et al., 2001).

Despite the importance of attentive processes in learning, there is a dearth of findings on the relationship between attentiveness and academic performance amongst non-clinical samples. Of those that are available, most tended to utilize teachers' ratings (e.g., Merrell & Tymms, 2001). Although such ratings may serve as one indicator of attentiveness, they are likely to be based on behavioural manifestation of attentiveness. The risk is that less visible differences in attentiveness are neglected.

This paper presents some preliminary data on individual differences in attentional efficiency and its relationship with English performance. A children's version of the attentional network test (ANT, Fan et al., 2002) was used. This computerised test combines the cue reaction time and the flanker tasks used in previous studies (see Figure 1). It yields three indexes designed to measure the efficiency of the alerting, orienting, and conflict resolution networks.

Method

Participants

Eighty-eight primary 3 children participated in the experiment. The sample was recruited from a government school in Singapore and contained about the same number of boys and girls. The children participated with informed consent from their parents.

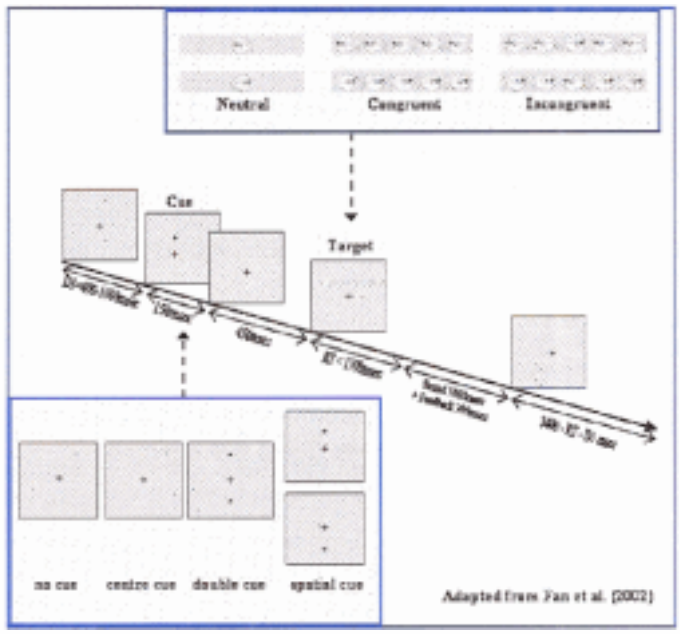
Instruments and Procedure

English performance. A written test which comprised items on grammar, vocabulary, phonology, reading comprehension, and composition was used. Content of the test was drawn from curriculum material that had not been taught explicitly in class.

Attentional Network Test. The ANT contained 24 individually administered practice trials and 144 test trials. Within each trial, children were presented with a row of one or more fish (see Figure 1). The target was the fish in the middle. It faced either the left or the right hand side of the screen. Children had to identify whether the fish was facing left or right by pressing the appropriate button on a mouse.

There were 12 types of test trials, formed by a full factorial manipulation of two variables: flanker type (neutral, congruent, and incongruent) or cue type [none, centre, double, and orienting). In the neutral condition, the target fish appeared by itself. In the congruent and incongruent conditions, the fish was flanked on either side by fish facing the same or the opposite direction respectively. In 75% of trials, appearance of the fish was cued by an asterisk. The cue provided either no information on where the fish was to appear (in the middle or double cue conditions) or explicit information on whether it was to appear above or below the fixation point (in the orienting condition).

Figure 1



Scoring

Three indexes were generated using subtractions from Fan et al. (2002).
Alerting = RT (all no-cue trials) - RT (all double cue trials)
Orienting = RT (centre cue) - RT (orienting cue)
Conflict = RT (incongruent) – RT (incongruent)

Results

One child failed to complete the procedure and data from two children were found to be multivariate outliers. These data were excluded from the analyses. To examine the relationship between attentional efficiency and English performance, data from the two variables were analysed in a standard regression. Reaction time and accuracy score from the various ANT conditions were analysed in a doubly multivariate analysis of variance.

Regression analysis

Inter-correlation between the three indexes revealed little inter-dependence (see Table 1). The three indexes predicted reliably to English performance and accounted for 13% of its variance. Of the three indexes, only alerting efficiency provided significant contribution.

Table 1
Summaty of Standard Regression Analysis for Variables Predicting to English Performance (EP)

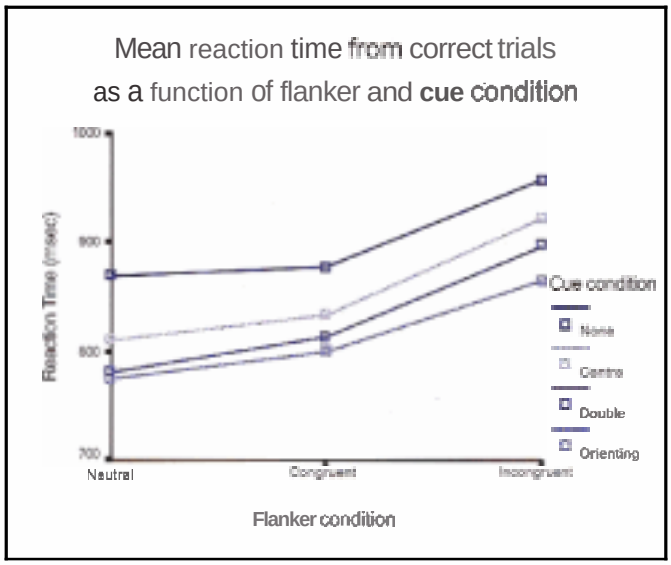
Variables	OR	AL	EP	*B*	*SE B*	ß
Orienting (OR)	-	-	1	.03	.01	.20*
Alerting (AL)	-.05	-	.23*	.03	.01	.27*
Conflict (CF)	.01	.03	-.15	-.02	.01	-.19

Note. $R = .36$, $R^2 = .13$, $p = .01$; * $p < .05$, ' $p = .053$

Analyses of Variance

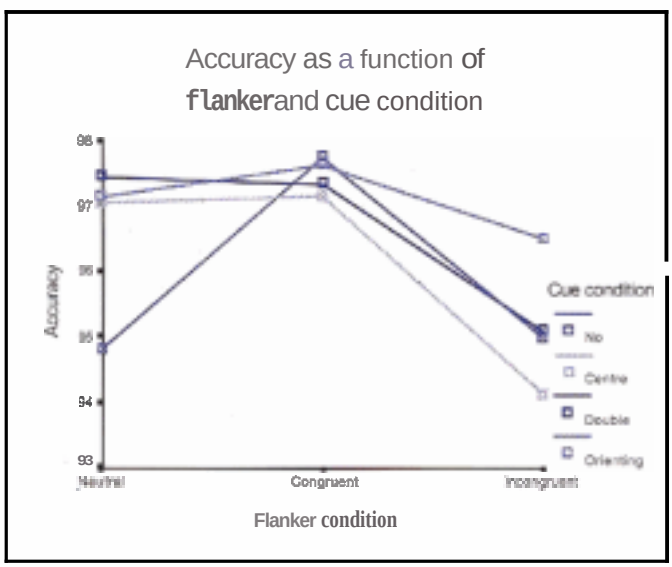
Multivariate analyses revealed significant effects for both the flanker, 44, 83) = 97.23, $p < .01$, $\eta^2 = 82$, and the cue conditions, $F(6, 81) = 42.40$, $p < .01$, $\eta^2 = 76$. The interaction term did not attain significance. Regarding reaction time, children were slower when flankers were present than when they were absent. They were at their slowest when flankers were incongruent. Responses were faster when cues were present. As expected, spatial cues produced the fastest reaction time, followed by the double and centre cues (see Figure 2).

Figure 2



Accuracy differed across flankers conditions. The best accuracy was achieved in thecongruent condition followed by the neutral then the incongruent conditions. Children achieved 97% accuracy in the spatial cue condition. All other conditions resulted in similar but lower accuracy (see Figure 3).

Figure 3



Discussion

Although the ANT scores predicted reliably to English performance, it is interestingto note only the alerting index attained significance. A follow-up study using a larger sample is currently under-way. If the findingreplicates, one implication for classroom practice is that it is important to "signpost" or signal events prior to their occurrence. The follow-up study will also examine the extent to which predictive power varies across academic subjects. This will provide information on the contributions of basic attentional processes versus individual preferences.

The low inter-correlation amongst the three indexes are consistent with the view that the three attentional networks are functionally independent. Although the lack of interaction findings is consistent with this interpretation, it should be noted that the accuracy scores revealed an interaction effect when a more liberal statistical technique was used. Whether this was an artefact will need to be examined in the follow-up study. Interestingly, evidence for independence is clearer in this study than in the adult data obtained by Fan et al. (2002). If this finding replicates, it may point to possible developmental differences in network efficiency.

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Acknowledgement

This study was partially supported by an EDRF grant. Thanks to (a) Sean Kang for his technical and conceptual assistance, (b) pupils and staff from Boon Lay Garden Primary for their cooperation, and (c) JinFan for providing access to the ANT and for his advice on data extraction.