

Psychometric properties of the attention network test in Iranian children and adults

Zahrasadat Hosseini¹ , Siavash Talepasand^{2*} 

1. Master Student of Educational Psychology, Faculty of Psychology and Educational Sciences, Semnan University, Semnan, Iran

2. Associate Professor, Department of Educational Sciences, Exceptional Children, Faculty of Psychology and Educational Sciences, Semnan University, Semnan, Iran

Abstract

Introduction: The attention system can be divided into alerting, orienting, and executive control networks. The validation of attention measurement tools is important in psychology. The present study aimed to investigate the psychometric properties of the Adult Attention Network test and Children Attention Network test.

Methods: A total of 184 children (6-9 years old) and 184 adults (44-20 years old) were selected by multi-stage cluster random sampling method, and the attention network test was performed on them. Cronbach's alpha was used for validity analysis, independent t-test, Mann-Whitney U test, and one-way analysis of variance was used to compare groups. Analyzes were performed using SPSS-24 software.

Results: Findings showed that Cronbach's alpha coefficient for the test was the total attention network of adults (0.88), and its dimensions were alerting dimension (0.80), orientation dimension (0.79), and executive control dimension (0.84). Cronbach's alpha was also obtained for the whole children's test (0.82) and each of the subscales, including alerting (0.70), orienting (0.70), and executive control (0.76). There was no significant difference in the children's attention test scores in the three dimensions of alerting, orienting, and executive control between girls and boys and men and women. There is no significant difference between the children's attention network test scores in the dimension of orienting and executive control in different age groups. Nevertheless, there is a significant difference between different age groups in alerting and total attention network test.

Conclusion: The current study's findings concluded that the adult and child attention network test has acceptable validity and can be used as a tool in psychological research.

Received: 23 Aug. 2021

Revised: 18 Jan. 2022

Accepted: 25 Jan. 2022

Keywords


Reliability
Attention network test
Alerting
Orienting
Executive control

Corresponding author

Siavash Talepasand, Associate Professor, Department of Educational Sciences, Exceptional Children, Faculty of Psychology and Educational Sciences, Semnan University, Semnan, Iran

Email: Stalepasand@semnan.ac.ir



 doi.org/10.30514/icss.24.1.84

Citation: Hosseini Z, Talepasand S. Psychometric properties of the attention network test in Iranian children and adults. *Advances in Cognitive Sciences*. 2022;24(1):84-97.

Extended Abstract

Introduction

Attention is generally believed to be a feature of the whole brain, but Posner and Petersen 1990 showed the existence of three networks of attention: alerting, orienting, and executive control in neural areas (14). Inspired

by this theory, Fan et al 2002 developed a simple tool called Attention Network Test to measure adult attention network performance. Designed and implemented (13). Researchers have developed many experiments based on

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the original ANT; such as in 2004, Rueda et al. Developed and performed a child version of the ANT to study the development of these networks in childhood (15). ANT is designed for fMRI studies that include all three attention networks and can be used to measure the performance of attention networks. It is also simple enough that it can be used to obtain data on children, patients, and animals. This test can also be used to measure the effect of behavioral and pharmacological interventions in each of the networks (13). ANT in a variety of clinical studies, including Attention Deficit Hyperactivity Disorder (16), Schizophrenia (3), Alzheimer's disease (17), and other studies with autism, mild trauma, brain injury, and the effects of training are used (25). This test takes about half an hour to run (13). Regarding the numerous applications of attention network testing and its applicability in healthy human statistical populations, brain-injured patients, and monkeys, and the ability of both versions to measure all three attention networks in a short time, the researcher considers due to the lack of this tool in Iran. Examine its psychometric properties.

Methods

One hundred eighty-four adults (Men and women) between the ages of 20 and 44 and four groups of 46 children (23 boys and 23 girls) between the ages of six, seven, eight and nine years participated in the experiment. All participants had normal or corrected vision conditions, and all participated in the experiment with their consent (adults) and the written consent of their parents.

Attention Network Test

The ANT was developed by Fan and collaborators in 2002, being first described in the paper "Testing the Efficiency and Independence of Attentional Networks." The ANT is basically the combination of the flanker task and the spatial cueing task. The test requires participants to

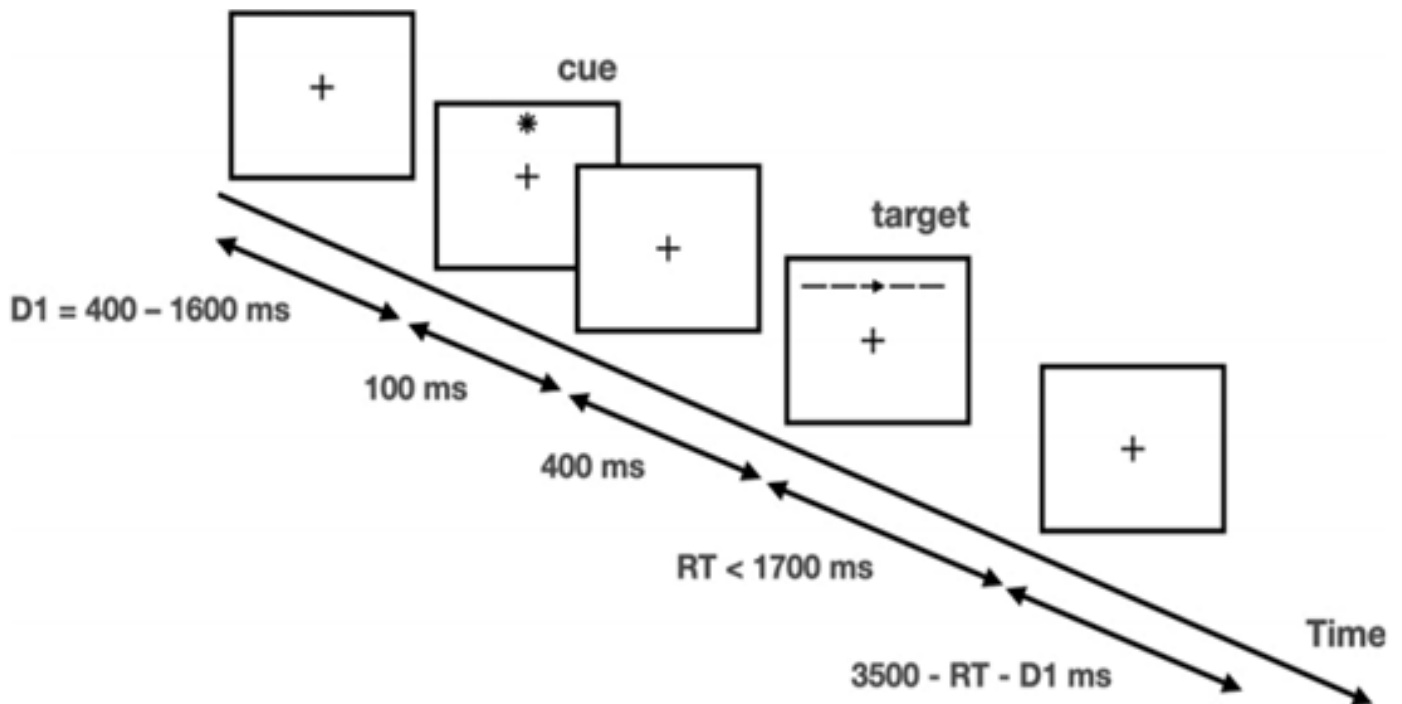
press a left or a right key according to the direction of a central arrow (target) presented above or below fixation. Targets are preceded by one of four cue conditions: no cue, double cue, center cue, or spatial cue. The critical flanker conditions are (1) congruent, (2) incongruent, and (3) neutral. The sequence of events in a typical trial is illustrated in Fig. 1. A session typically consists of a 24-trial practice with feedback and three 96 trial experimental blocks with no feedback and can be administered in about 20 min (13).

Child Attention Network Test

The child ANT was developed and introduced by Rueda et al. 2004. In this version, the arrows are replaced by yellow fish that could either be alone or in a group of five (like the arrows). The idea was the same as with the arrows; that is, there could be congruent, incongruent, or neutral fish. As with the original ANT, the cues are double, central, spatial, or no cue at all. The background has a blue-green color. The children are instructed that they are supposed to feed the central fish, pressing the key button corresponding to the direction in which the central fish was pointing. Feedback was also provided. Positive feedback consisted of fish blowing bubbles and a child's voice exclaiming "Woohoo!". Negative feedback consisted of a simple tone with no animation (15).

Procedure

Each participant completed the Attention Networks Test Via psychoPy software version 2020.2.4 on a personal computer with Windows 10 and a 14-inch monitor. Two participants completed the experimental session simultaneously, with the experimenter present throughout the test. In data analysis, descriptive statistics and the Kuder-Richardson coefficient were used to examine internal consistency, question-total correlation, and analysis of variance. Data analysis was performed using SPSS-24 software.



1. An example of the experimental procedure of the ANT (13)

Results

Before performing the relevant analyzes, the hypothesis of normality of the data was evaluated using the Kolmogorov-Smirnov test. The results showed that for the variables related to adults, the condition of data normality was not observed ($P < 0.05$), but this assumption is valid for the variables related to children. Homogeneity of variances of the total score, alerting, orienting, and the Levin F test assessed executive control for children. The results showed that the condition of homogeneity of variances was observed.

Findings indicated that Cronbach's alpha coefficient for the test was the total attention network of adults (0.88), and its dimensions were alerting dimension (0.80), orienting dimension (0.79), and executive control dimension (0.84). Cronbach's alpha was also obtained for the whole children's test (0.82) and each of the subscales, including alerting (0.70), orienting (0.70), and executive control (0.76).

To compare ANT scores in three dimensions of alerting,

orienting, and executive control in men and women, considering that the data distribution was not normal, from the non-parametric Mann-Whitney U test and compare the ANT scores of children in the same dimensions in girls and boys of the test. An independent t-test was used with Bonferroni modulation. The results demonstrated that there was no significant difference between the scores of the total attention network, alerting, orienting, and executive control test in men and women ($P > 0.05$). There was also no significant difference between the scores of boys and girls ($P > 0.05$).

One-way analysis of variance was used to determine the difference between children's ANT scores and its three dimensions in different age groups.

The results revealed that there was no significant difference between the scores of the orienting and executive control dimension in different age groups ($P > 0.05$), but there was a significant difference in the alerting dimension and the total test score between different age groups ($P < 0.05$). The Scheffe test was used to compare the two

age groups regarding alertness and total test score. The Scheffé post hoc test results showed a significant difference between the age group of six6 years and nine years in the alerting dimension ($P<0.05$). There was a significant difference in the total score of the test between the age groups of seven and nine years and the age group of eight and nine years ($P<0.05$).

Conclusion

This study aimed to investigate the psychometric properties of ANT in children and adults in Iran. The results indicated that the ANT of adults and children has good internal similarity. This finding is in line with the results of research (13, 21-23). The results also revealed that there was no significant difference between the scores of the total attention network test, alerting, orienting, and executive control in men and women. This finding was consistent with the results of previous studies (26-28). Gang at al. 2013 found that women had better attention orienting than men but did not differ in alert and executive control (25). The study's findings also did not confirm the difference between the scores of girls and boys in the three dimensions of the attention network, which the studies (29) confirm this study's results. In addition to these findings, the results showed that there is no significant difference in the scores of the children's attention network test in the dimension of orienting and executive control in different age groups, but in the dimension of alerting and the total score of attention between different age groups. The current study's findings are consistent with the previous research results (15, 32-35).

The findings of the present study indicated that the ANT of adults and children has acceptable validity, and researchers can use it as a valid tool in psychological and clinical research. It is also suggested that this test be used

at the school level to measure the effectiveness of designed interventions.

Ethical Considerations

Compliance with ethical guidelines

The present study was conducted in accordance with ethical principles, including the consent of themselves (adults) or parents in order to participate in the research, respect for the principle of confidentiality of participants to their confidentiality, and freedom to leave the research process.

Authors' contributions

Zahra Sadat Hosseini: Presented the initial research plan, collected information and article writing, the data analysis, and all correspondence; his contribution was about 60%. Siavash Talepasand: Contributed to correcting the article and monitoring the research implementation process; his contribution was about 40%.

Funding

No financial support has been received from any organization for this research.

Acknowledgments

We express our deep gratitude for the sincere cooperation of all participants in this research, as well as the Health and Treatment Center and the Department of Education of Jajarm city, who cooperated with us in collecting the findings of the present study.

Conflict of interest

The authors of the present article state that there is no conflict of interest in writing this study. This study is extracted from dissertation 14729.