



Measuring the components of attention with the Attention Network Test: Is it reliable?



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Background

Posner's model of attention [1] assumes three underlying and relatively independent brain networks that carry out functions involved with:

Alerting - achieving and maintaining sensitivity to incoming stimuli.

Orienting and selection - selection of information from sensory input.

Executive control - resolving conflict among thoughts, feelings and responses.

These networks differ in the underlying functional and neural circuitry and neurochemical modulation [2].

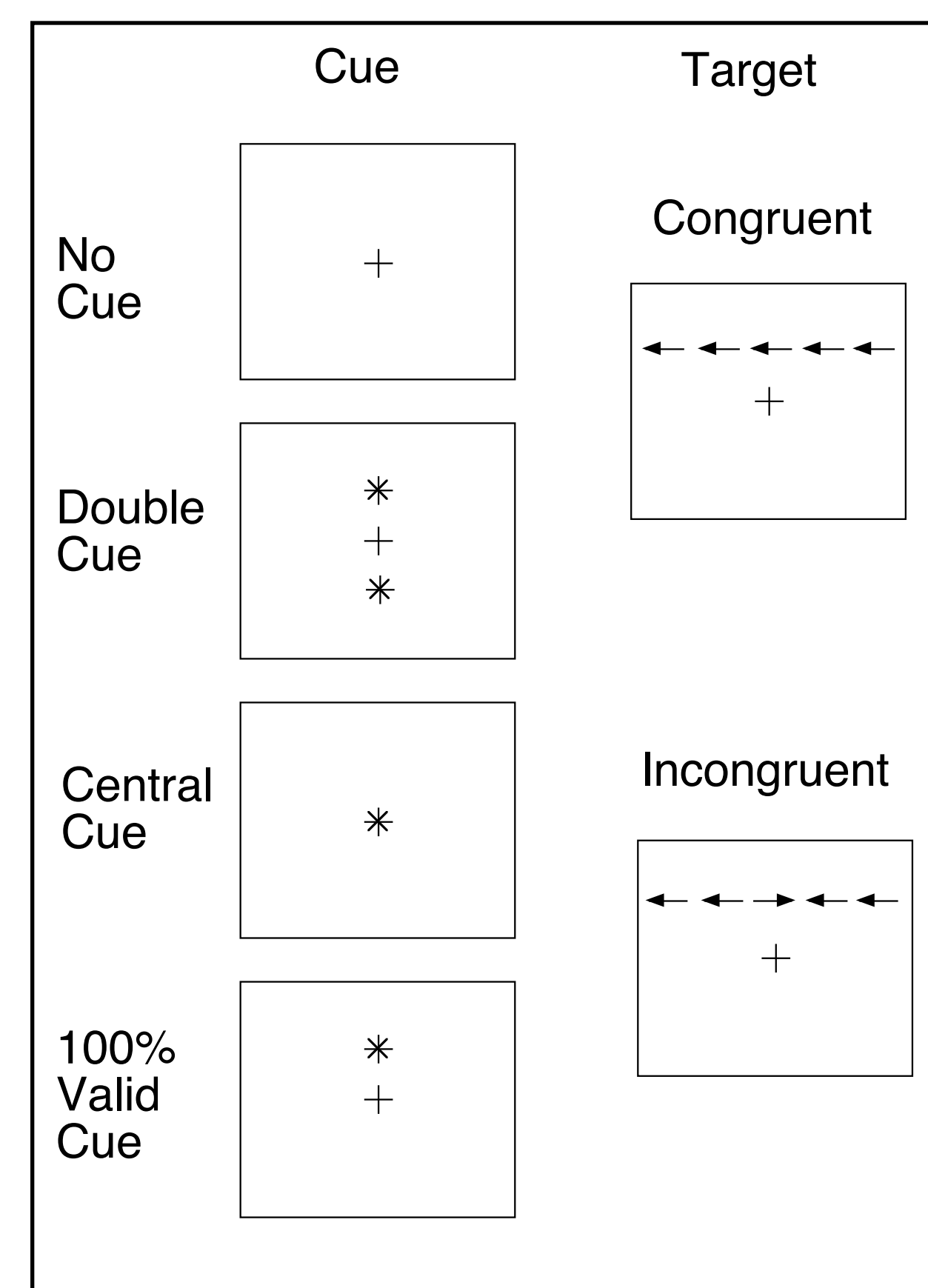
Posner and colleagues developed the **Attention Network Test** (ANT) as a means to measure the efficiency of each of these networks in children and adults [3].

In the ANT one of 4 possible cues precedes a target arrow surrounded by congruent or incongruent arrows. Orthogonal subtraction scores are used to provide a measure of each network:

Alerting =
RT (No cue) - RT (Double Cue)

Orienting =
RT (Center cue) - RT (Valid cue)

Executive =
RT (Incongruent) - RT (Congruent)



The ANT and subsequent variants (ANT-I, in which a tone is used as a warning cue and orienting is measured using uninformative cues) has been widely used to examine the functioning of attentional networks in both normal and clinical populations by Posner & colleagues and others [4]

While RT measures are sensitive to changes in cognitive processes, valid interpretation of differences in RT between tasks and between populations depends upon the underlying reliability of the measures obtained. The **purpose** of our study was to examine the reliability of the measures of different components of attention obtained from the ANT in children and adults.

Methods

Trial-by-trial data were obtained from published and unpublished research that administered the ANT or ANTI to non-clinical subjects. Reliability of network scores were calculated by an odd-even split-half correlation. Data from RT network scores is presented, but similar results are obtained when accuracy network scores are examined.

Results

Adult ANT	N	Alerting	Orienting	Executive
Weighted Mean	463	.12	.33	.75
AhnAllen	17	.49	.58	.87
Beutel	43	-.09	.46	.69
Breau	20	-.22	-.26	.60
Callejas (E1)	25	.27	.36	.44
Fan (2001)	104	.22	.34	.79
Fan (2002)	40	.37	.66	.70
Ishigami	99	.15	.20	.79
Neuhaus	16	.33	.46	.67
Oberlin	33	.14	.50	.86
Redick	52	-.14	.14	.80
Rueda (E2)	14	-.64	.44	.88

Adult ANTI	N	Alerting	Orienting	Executive
Weighted Mean	304	.39	.24	.66
Callejas (2004)	41	.25	.21	.68
Callejas (2005 - E1)	25	.47	.72	.56
Callejas (2005 - E2)	52	.11	-.06	.73
Callejas (2005 - E3)	25	.41	-.02	.74
Callejas (E2)	6	.59	.16	.25
Callejas (E3)	24	.42	.39	.70
Callejas (E4)	32	.62	-.04	.76
Ishigami	99	.47	.41	.59

Child ANT	N	Alerting	Orienting	Executive
Weighted Mean	192	.07	-.01	.24
Adolfsdottir	57	-.02	-.01	.38
Penny	29	.78	.01	.25
Rueda (E1)	48	-.07	-.14	.09
Rueda (E2)	14	.32	.47	.14
Rueda (E3)	44	-.22	-.03	.26

Child ANTI	N	Alerting	Orienting	Executive
Mullane	110	.16	-.11	.43

Conclusions

The data suggest wide variability in the reliability of network scores across networks, age groups and test variants.

The reliability of the **Executive** score is highest across test variants amidst adults, while low-to-moderate reliability is observed amidst children.

The reliability of the **Alerting** score is generally low, except for moderate reliability in the adult ANTI.

The reliability of the **Orienting** score is low-to-moderate in both test variants amidst adults, while extremely low reliability is observed amidst children.

We suggest that this pattern of reliability may account for the frequency with which researchers employing these tools obtain significant effects involving only the Executive network.

The results stand as a warning to researchers to take care in the design of experiments where differential reliability of measures may lead to differential power.

Given this potential confound, further study of the attention components by other tests, or repeated administration of the ANT to increase reliability is warranted before conclusions can be drawn about the differential functioning of the attention components represented in the ANT.

Background

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