Computerized Neurocognitive Testing in Twin Families

Suzanne C Swagerman, Eco JC de Geus, Kees-Jan Kan, Dorret I Boomsma
Department of Biological Psychology, VU University Amsterdam

Introduction

The WebCNP is a computerized test battery that enables measurement of performance on a wide range of neurocognitive domains. The computerized tests were adjusted from traditional neurocognitive tests, and have proven to be a reliable measure of cognitive performance. The tests are considered good endophenotypes in genetic studies in normal brain functioning and development, and in for example schizophrenia, and anxiety and depressive disorders.
Currently the Netherlands Twin Register (NTR) is using a Dutch translation of the WebCNP to collect data in twins and their family members.
After usability, reliability and validity of the Dutch WebCNP have been confirmed, the testbattery will be used for studies concerning brain functions in healthy development and aging.

Methods

Thus far 131 participants have completed the protocol: twins, their parents and/or siblings, and several non-twins. The majority, 96, of them were adolescents and young adults between 14 and 26 years old (42 male 54 female), and 35 adults between 38 and 58 years old (11 male 24 female).

During a protocol that lasted approximately 2 hours the following data were collected: blood pressure in rest and during the WebCNP, indices of autonomic and cardiovascular activity during the WebCNP and rest using the VU-AMS device, physical measures (length, weight, waist and hip circumference), and a lifestyle questionnaire.

The effects of age and sex on blood pressure, heart rate and cognitive domains will be investigated.

COGNITIVE DOMAINS MEASURED BY COMPUTERIZED TESTS:

SENSORIMOTOR (sm)
MOTOR PRAXIS

EMOTION (emo)
EMOTION DIFFERENTIATION

EMOTION (emo)
EMOTION RECOGNITION

MOTOR SPEED (mot)
FINGER TAPPING

ATTENTION (att)
CONTINUOUS PERFORMANCE

ABSTRACTION/MENTAL FLEXIBILITY (abf)
MATRIX ANALYSIS

FACE MEMORY (fmem)

SPATIAL MEMORY (smem)

VERBAL MEMORY (vmem)

LANGUAGE (lan)
LOGICAL REASONING

WORKING MEMORY (vmem)
LETTER / NUMBER N-BACK

AGE DIFFERENTIATION

ABSTRACTION/MENTAL FLEXIBILITY (abf)
CONDITIONAL EXCLUSION

SPATIAL PROCESSING (spa)
LINE ORIENTATION

Results

Blood pressure

Systolic blood pressure is significantly influenced by both sex and age, whereas there is a main effect of age on diastolic blood pressure and an interaction effect: the effect of sex was only present in the adult group.
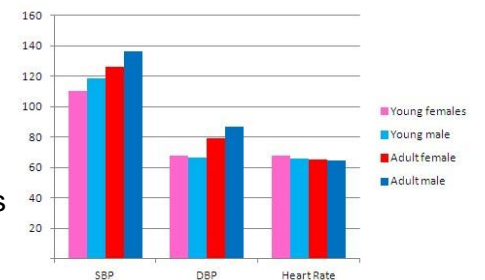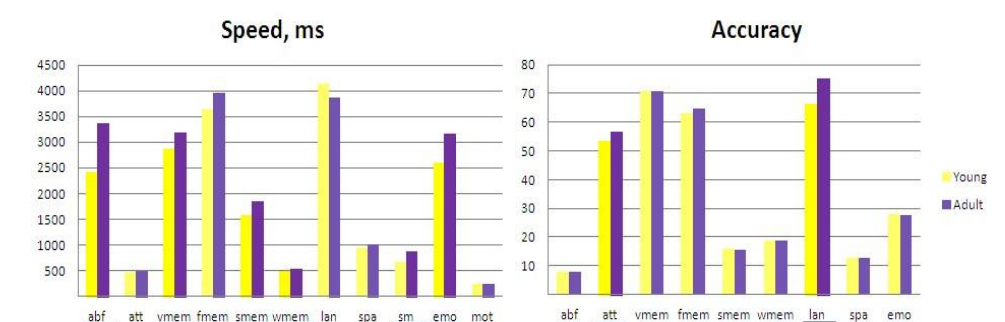
Cognitive functions and sex effects

Performance of women is more accurate on facial memory and faster on measures of language and sensorimotor skills. Males are faster on the sensorimotor and motor speed tasks, whereas they perform more accurate on spatial memory and spatial processing tasks.
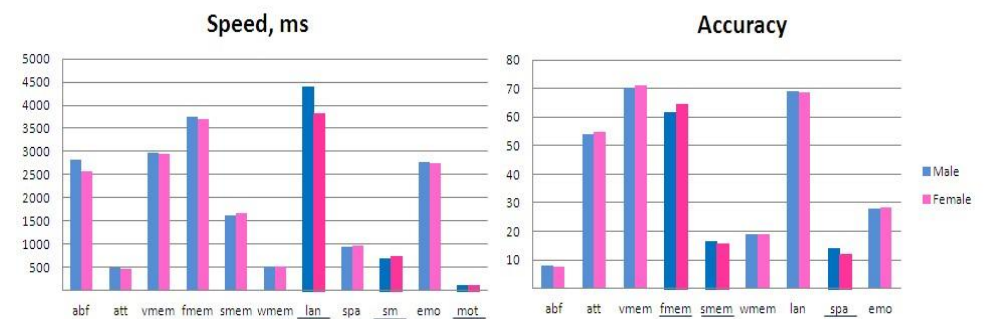
Cognitive functions and age effects

Adults outperform young adults and adolescents on measures of attention and language. Adults are slower in their responses on a wide range of cognitive domains: memory, abstraction and mental flexibility, emotion and sensorimotor skills.

Conclusions

Based on the currently available data, the Dutch WebCNP seems a reliable measure of cognitive performance, individual differences are found on all cognitive domains and effects of sex and age are present. As more data is collected, the relationship between autonomic and cardiovascular activity and cognitive performance will be further explored. Heritability estimates of the measures, as well as candidate gene studies and genome wide association studies can give further insight in the biological mechanisms underlying cognitive and autonomic functions.

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