Penn

Penn CNB: The Penn CNB is a computerized neurocognitive test battery developed at the University of Pennsylvania. We included three subtasks of this battery that capture two specific cognitive domains: verbal memory (short term and delayed verbal memory tasks) and emotion recognition.

Computerized neurocognitive battery Penn CNB

The Penn CNB is a computerized neurocognitive battery developed by the Brain Behavior Laboratory of the University of Pennsylvania (Gur et al., 2001; Gur et al., 2010; Gur et al., 2012). The web-based Penn CNB is made available to administer online (https://penncnp.med.upenn.edu/). The battery quantifies cognitive functioning in different domains that link to specific brain systems, based on functional neuroimaging studies. Importantly, the latest version of the Penn CNB is able to detect age and sex differences in a population-based sample of 3500 (pre-)adolescents between 8 and 21 years old (Gur et al., 2012). The web-based Penn CNB is translated in Dutch and validated in a sample of 1140 participants between 10 and 86 years old (Swagerman et al., 2016). We used subtasks of the online Dutch-translated Penn CNB in two domains. Additionally, a mouse practice task is administered as a control measure. These tasks take about 10 minutes in total. Each task starts with instructions that the administrator reads out loud. After each task the administrator indicates data quality with a code. In case of unreliable or incomplete data an explanation is added to de code, for example "unreliable because child is distracted" or "incomplete due to time constraints".

Mouse Practice task

All children start with the Mouse Practice task that measures sensorimotor speed (Gur et al., 2001; Gur et al., 2010; Gur et al., 2012). Children click as quickly as possible on a green square that disappears after the click. The square gets smaller and smaller and reappears at different locations on the screen. The response time measured in this task can be used to correct for differences between children in their ability to move the mouse and click on targets. After the task the administrator can fill in whether the trials are valid with a code and comments. The task starts with some practice trials.

Word Memory task – immediate and delayed

Immediate and delayed verbal memory performance is quantified with the Penn Word Memory task (Gur et al., 1997; Gur et al., 2001; Gur et al., 2010; Gur et al., 2012). Children are asked to remember words that are displayed one by one. Next, these target words are mixed with novel words and children are asked to indicate whether they saw each word before ("certainly", "probably", "probably not", "certainly not"). Delayed verbal memory is then assessed after a delay of 20 minutes by asking the children again to respond to a new mix of targets words and distractors. Response time and accuracy are measured.

Emotion Recognition task

Social cognition is measured with the 40-item Emotion Recognition task (Gur et al., 2002; Gur et al., 2012). In the task pictures of faces are presented one by one.

The faces are either neutral or display an emotional expression: happy, sad, anger or fear. The children are asked to choose the expressed emotion in a multiple-choice format (“happy”, “sad”, “anger”, “fear”, “no emotion”). Response time and accuracy are measured. The child can practice one trial where feedback is provided until the right answer is given.

Literature

Gur RC, Ragland JD, Mozley LH, Mozley PD, Smith R, Alavi A, Bilker W, Gur RE. Lateralized changes in regional cerebral blood flow during performance of verbal and facial recognition tasks: Correlations with performance and ”Effort” Brain and Cognition. 1997;33:388–414.

Gur RC, Ragland D, Moberg PJ, Turner TH, Bilker WB, Kohler C, Siegel SJ, Gur RE. Computerized neurocognitive scanning: I. Methodology and validation in healthy people. Neuropsychopharmacology. 2001;25:766–776.

Gur RC, Sara R, Hagendoorn M, Marom O, Hughett P, Macy L, Turner T, Bajcsy R, Posner A, Gur RE. A method for obtaining 3-dimensional facial expressions and its standardization for use in neurocognitive studies. J Neurosci Methods. 2002;15(115):137–143.

Gur RC, Richard J, JHughett P, Calkins ME, Macy L, Bilker WB, Brensinger C, Gur RE. A cognitive neuroscience-based computerized battery for efficient measurement of individual differences: standardization and initial construct validation. Journal of Neuroscience Methods. 2010;187(2):254-262.

Gur RC, Richard J, Calkins ME, Chiavacci R, Hansen JA, Bilker WB, Loughead J, Connolly JJ, Qiu H, Mentch FD, Abou-Sleiman PM, Hakonarson H, Gur RE. Age group and sex differences in performance on a computerized neurocognitive battery in children age 8-21. Neuropsychology. 2012;26(2):251-65.

Swagerman SC, de Geus EJC, Kan KJ, Nieuwboer HA, van Bergen E, Koenis MMG, Hulshoff Pol HEH, Gur R, Gur R, Boomsma DI. The Computerized Neurocognitive Battery: Validation, aging effects, and heritability across cognitive domains. Neuropsychology. 2016;30(1):53-64.