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| **Domain:** | Substance Use-related Neurobehavioral and Cognitive Risk Factors |
| **Measure:** | Cognitive Flexibility (Dimensional Change Card Sort) |
| **Definition:** | This measure assesses flexibility in detection and use of rules that govern behavior. |
| **Purpose:** | Cognitive flexibility is one component of the multidimensional construct "executive function." This measure provides a marker of the development of executive function. Substance use has been shown to correlate with deficits in both cognitive flexibility and other aspects of executive functioning. |
| **Essential PhenX Measures:** | Current Age |
| **Related PhenX Measures:** | Working Memory Executive Function |
| **Collections:** | Cognition Substance Use-related Neurobehavioral and Cognitive Risk Factors |
| **Keywords:** | Child, Cognitive Flexibility, DCCS, Dimensional Change Card Sort Border Version, Dimensional Change Card Sort Standard Version, Drug Abuse, Drug Use, Executive Function, Neuropsychiatry, NIH Toolbox, Substance Abuse, Substance Use, SAA, Substance Use-related Neurobehavioral and Cognitive Risk Factors |

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| **Protocol Release Date:** | February 24, 2012 |
| **PhenX Protocol Name:** | Cognitive Flexibility (Dimensional Change Card Sort) - Older Children, Adolescents, and Adults |
| **Protocol Name from Source:** | The Expert Review Panel has not reviewed this measure yet. |
| **Description:** | The Dimensional Change Card Sort (DCCS) Border Version is an interviewer-administered task that measures the flexible use of rules to govern behavior as a means of providing an index of executive function development. In this task, the assessor asks the participant to sort bivalent test cards according to a randomly changing dimension (e.g., color or shape). The dimension by which to sort is indicated by the presence or absence of a border on the card.  The Dimensional Change Card Sort task is a freely available, simplified version of the Wisconsin Card Sort test. For more information about the Wisconsin Card Sort test, please refer to the [link[www.cognitiveatlas.org/task/id/tsk\_4a57abb949f21|Cognitive Atlas Interpretation]]. |
| **Specific Instructions:** | None |
| **Protocol:** | **Summary of the Dimensional Change Card Sort (DCCS) Border Version**  The Dimensional Change Card Sort (DCCS) Border Version makes use of two different styles of bivalent cards, displaying for example a red boat and blue rabbit. The test cards additionally have either no border or a black border.  The protocol consists of the following two steps:  1. The assessor sets up two sorting trays displaying target cards representing the two different styles of card. The participant is then given instructions for sorting the set of test cards: cards with borders should be sorted according to one dimension (e.g., color) and cards without borders should be sorted according to the other (e.g., shape). The assessor demonstrates the procedure using one card with a border and one without.  2. The testing phase is carried out. The assessor instructs the participant to sort twelve test cards, six with borders and six without.  **Scoring**  Participants who correctly sort nine or more of the twelve test cards are considered to have passed the task.  If both the DCCS Standard Version and DCCS Border Version are administered, an alternative scoring scheme is as follows:  Score of 0 - Participant failed the pre-switch phase of the standard version.  Score of 1 - Participant passed the pre-switch phase of the standard version, but failed the post-switch phase.  Score of 2 - Participant passed the pre-switch and post-switch phases of the standard version, but failed the border version.  Score of 3 - Participant passed the pre-switch and post-switch phases of the standard version and passed the border version. |
| **Selection Rationale:** | The Dimensional Change Card Sort (DCCS) is an easily administered and widely used measure of executive function. |
| **Source:** | Zelazo, P. D. (2006). The dimensional change card sort (DCCS): A method of assessing executive function in children. *Nature Protocols*, *1*(1), 297-301. |
| **Life Stage:** | Adult Child Adolescent |
| **Language of source:** | English |
| **Participant:** | Adults and children aged 5 years or older |
| **Personnel and Training Required:** | The assessor should be trained to respond in a neutral, nonevaluative, noncorrective manner during the task. The assessor should be trained in how to respond to hesitant or resistant behavior by the participant. |
| **Equipment Needs:** | The assessor will need two sorting trays with panels for displaying target cards, and will need to fabricate each of: two styles of bivalent target cards (e.g., one card displaying a red boat and the other a blue rabbit), seven standard test cards (four of one style of target card and three of the other), and seven border test cards (four of one style of target card and three of the other, all having a black border around them). |
| **Standards:** | |  |  |  |  | | --- | --- | --- | --- | | **Standard** | **Name** | **ID** | **Source** | | Common Data Element (CDE) | Person Cognitive Flexibility Questionnaire Assessment Score | 3371717 | [CDE Browser](https://cdebrowser.nci.nih.gov/CDEBrowser/search?elementDetails=9&FirstTimer=0&PageId=ElementDetailsGroup&publicId=3371717&version=1.0) | |
| **General references:** | Errico, A. L., King, A. C., Lovallo, W. R., & Parsons, O. A. (2002). Cortisol dysregulation and cognitive impairments in abstinent male alcoholics. *Alcoholism: Clinical and Experimental Research*, *26*(8),1198-1204.  Klüber, A., Murphy, K., & Garavan, H. (2005). Cocaine dependence and attention switching within and between verbal and visuospatial working memory. *European Journal of Neuroscience*, *21*,1984-1992.  van der Plas, E. A., Crone, E. A., van den Wildenberg, W. P., Tranel, D., & Bechara, A. (2009). Executive control deficits in substance-dependent individuals: A comparison of alcohol, cocaine, and methamphetamine and of men and women. *Journal of Clinical and Experimental Neuropsychology*, *31*(6), 706-719.  Verejo-García, A., Bechara, A., Recknor, E. C., & Pérez-García, M. (2006). Executive dysfunction in substance dependent individuals during drug use and abstinence: An examination of the behavioral, cognitive and emotional correlates of addiction. *Journal of International Neuropsychological Society, 12*,405-415. |
| **Mode of Administration:** | Interviewer-administered evaluation |
| **Derived Variables:** | None |
| **Requirements:** | |  |  | | --- | --- | | **Requirement Category** | **Required** | | Major equipment | No | | Specialized training | No | | Specialized requirements for biospecimen collection | No | | Average time of greater than 15 minutes in an unaffected individual | No | |
| **Process and Review:** | The Expert Review Panel has not reviewed this measure yet. |