

SEARCH 4 MOP
Section 16 - Neurocognitive Assessment
Table of Contents

16. NEUROCOGNITIVE ASSESSMENT.....	16-1
16.1. INTRODUCTION	16-1
16.2. SETTING UP FOR ASSESSMENT: TESTING TIPS.....	16-1
16.2.1. <i>Prior to Starting Actual Testing.....</i>	<i>16-1</i>
16.2.2. <i>Guidelines for Cognitive Test Administration</i>	<i>16-2</i>
16.2.2.1. General Instructions.....	16-2
16.3. STANDARDIZING ADMINISTRATION	16-3
16.4. OTHER ADVICE	16-4
16.5. MATERIALS NEEDED FOR TESTING	16-4
16.6. IPAD SETUP	16-5
16.7. OVERVIEW OF ASSESSMENT PROCESS.....	16-5
16.7.1. <i>Determining Handedness.....</i>	<i>16-7</i>
16.7.2. <i>What To Do If There's A Problem During Testing.....</i>	<i>16-9</i>
16.8. TESTING INSTRUCTIONS FOR NIH TOOLBOX COMPUTERIZED COGNITIVE BATTERY FOR THE IPAD.....	16-14
16.8.1. <i>NIH Toolbox Touch Screen Tutorial.....</i>	<i>16-14</i>
16.8.2. <i>Pattern Comparison Processing Speed Test Instructions.....</i>	<i>16-15</i>
16.8.3. <i>List Sorting Working Memory Test.....</i>	<i>16-17</i>
16.8.4. <i>Flanker Inhibitory Control and Attention Test.....</i>	<i>16-25</i>
16.8.5. <i>Dimensional Change Card Sort Test.....</i>	<i>16-29</i>
16.8.6. <i>Picture Sequence Memory Test.....</i>	<i>16-34</i>
16.8.7. <i>Picture Vocabulary Test</i>	<i>16-39</i>
16.9. COMPLETING AND SAVING THE ASSESSMENT.....	16-41
16.10. ADDITIONAL INFORMATION	16-41
16.11. NAVIGATING THE IPAD.....	16-42
16.12. USING THE BLUETOOTH WIRELESS KEYBOARD.....	16-44

16. Neurocognitive Assessment

16.1. INTRODUCTION

The National Institutes of Health (NIH) Toolbox initiative sought to assemble a set of brief, comprehensive assessment tools that would be useful to clinicians and researchers in a variety of settings, with particular emphasis on measuring outcomes in longitudinal epidemiologic studies and prevention or intervention trials across the lifespan (ages 3-85). Such a battery was developed to ensure that assessment methods and results can be used for comparisons across existing, and later with completed, studies. There are multiple domains assessed by the NIH Toolbox: Cognition, Sensory-Motor and Emotional Functioning. The instruments within the Toolbox were chosen based upon paradigms used in clinical assessment, or experimental paradigms. They are administered in a manner that minimizes the time required to assess each individual and can be completed by research personnel, limiting the need for a psychologist, PT or neuropsychologist at all sites.

The SEARCH 4 study will use the Cognition domain of the NIH Toolbox. We will be using the iPad platform for administration, a format introduced in summer 2015, making evaluation substantially less cumbersome. You will be administering some, but not all of the measures in the Cognition domain. The same tests will be administered to all participants, but the form of the test and the specific items presented differ from examinee to examinee based upon skill and age. There are 2 custom batteries for SEARCH 4 installed upon the iPad you will use, one for participants 8-11 years of age and a second for individuals 12 years of age and older. The tests within the batteries will be administered in the same order to all participants. This was previously established in the iPad you will be using. The Battery includes (in this order) the Touch Screen tutorial, Pattern Comparison Processing Speed Test, List Sorting Working Memory Test, the Flanker Inhibitory Control and Attention Test, the Dimensional Change Card Sort Test, the Picture Vocabulary Test, and the Picture Sequence Memory Test. The order was designed to minimize anxiety and frustration for participants.

16.2. SETTING UP FOR ASSESSMENT: TESTING TIPS

It is important that tests are administered in a standard manner with each participant.

16.2.1. *Prior to Starting Actual Testing*

- Choose a quiet, comfortable area.
- Make certain that the participant is wearing glasses or a hearing aid if they normally do so.
- Put up a sign to indicate “Testing in Process.”
- Confirm the age of the examinee so that you choose the correct battery. All examinees 11 years of age and younger will complete one battery. Individuals

older than 12 years of age (up to 11 years 11 months and 30 days) will complete the second. If you are testing a child who will turn 12 next week they get the younger person's battery.

- Make certain that you have all the equipment you need.
- If there is a phone in the room, mute the ringer. Mute cell phones and pagers.
- Check your keyboard to make sure it powers up. Make certain the Bluetooth connection is established. Keep extra batteries in the testing area. (See Section 16.11 for instructions on pairing the iPad and Bluetooth)
- Wi-Fi should be turned off during testing so that you do not receive emails, etc.
- Have the manual, Home Base, and the score sheet for List Sorting Working memory available.
- Make certain the iPad is charged.

Do not update the testing iPad to the next operating system version unless instructed to do so by the Coordinating Center. Do not update your version of the NIH Toolbox unless you are instructed to do so by the Coordinating Center.

16.2.2. Guidelines for Cognitive Test Administration

It is important that administrators follow a standardized procedure to ensure that reliable and valid data are obtained. The way in which the testing is administered to a participant can affect the responses of the participant, by altering effort, attention, understanding of instructions, etc. It is important that the administrator adhere strictly to the written guidelines and these general tips for test administration.

16.2.2.1. General Instructions

Prior to each administration, review the test instructions for the tests to be administered. This is especially true during your initial testing sessions, before you become comfortable with the materials, and during periods when you are not using the equipment and tests regularly.

The administrator plays a critical role in the process of data collection. There is the potential for the quality of the participant's responses to be affected by the attitudes and actions of the technician. Therefore, the technician should:

Have a relaxed and friendly manner, helping to put the participant at ease while conveying the importance of the testing. Spend a few minutes putting the participant at ease with light conversation.

Be patient and polite. Convey a sense that the participant's answers are important. Do not rush.

Observe the participant for signs of strain or stress (e.g., becomes nervous, puts less effort into tasks, and starts making excuses). Try to help the participant relax with generic reassurances and encouragement (e.g., “you’re doing fine”).

Reassure the participant that it is not expected that they will be able to answer every item correctly. In fact, in many cases the program increases complexity to assess the range and consistency of performance (e.g., Picture Vocabulary).

Family members or friends may accompany the participant to the clinic. They should not be present during test administration. Explain to the friend or family member that it is often more difficult for participants to do their best when they are being observed by people they care about, that test standardization precludes their presence and be prepared to suggest a place where the family member or friend can wait comfortably during testing.

16.3. STANDARDIZING ADMINISTRATION

Variability in administration introduces bias in data collection. Testing guidelines are established so that each tester administers the instruments in the same way. The administrator’s presence should not bias the participant’s perception or response to questions, and different administrators should be able to obtain the same responses from the same participant.

To enhance standardization:

- Do not provide either verbal or non-verbal responses that could influence the participant’s responses. For example, do not nod or shake your head, convey surprise, pleasure or disapproval to any answer. The technician’s role is to obtain uninfluenced responses to the questions.
- Be thoroughly familiar with the instruments before administering them. This ensures that participant questions or concerns can be easily addressed. Practicing test administration with someone who is pretending to be a participant helps to reduce the mechanical style that sometimes results from reading unfamiliar material. Practice administrations are required by SEARCH 4 protocol. New administrators will be expected to demonstrate comfort and competence in administration prior to completing research protocols. Periodic reviews and quizzes will be used to maintain adherence to standardization.
- Convey a sense of acceptance. Be gracious and adaptable to all participants regardless of whether their dress, appearance, style of speech or personal preferences are consistent with your values and preferences.
- Encourage correct performance during the practice and sample items.

- Read all directions to the participant verbatim, both sample and actual test directions. **Do not ad lib instructions.**
- Keep explanations to a minimum. Avoid interpreting or paraphrasing instructions.
- Offer generic phrases of encouragement during and between tests but do not offer any information on the correctness of a particular response (including nonverbal communication like nodding or shaking your head). If the participant is persistent, explain that you are not permitted to give feedback. Be attentive to acceptable prompts. For example on **Pattern Comparisons Processing Speed Test** succinct prompts such as “look at the screen; are these the same, yes or no; **remember to choose as quickly as you can**” are acceptable.
- During *List Sorting Working Memory* attempt to not let the participant know if their response has been correct or incorrect.
- The more comfortable you are with the procedures the more you will be an effective evaluator. You will be able to pay attention to the participant, rather than worrying about completing correct administration.

Have fun! You are spending time with interesting people who are contributing to the study. Make certain you communicate this.

16.4. OTHER ADVICE

- Words to offer as encouragement:
 - “Just do the best that you can. As long as you do the best that you can, you are doing what we want you to do.”
 - “These tasks are designed so that no one gets all the answers correct. As long as you are doing the best that you can, you are doing what we want you to do.”
 - “Lovely” or “Thank you.” – noncommittal acknowledgement
- Be aware that there are discontinue rules on some tests.

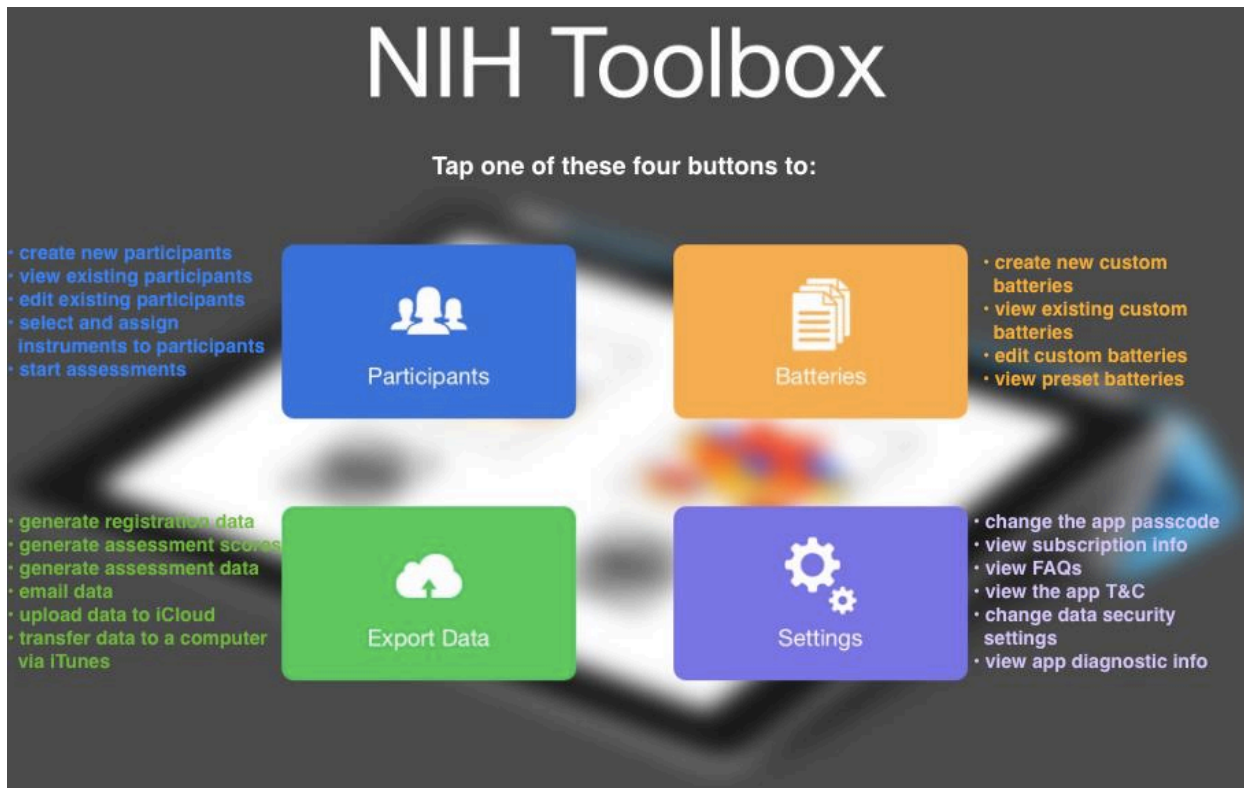
16.5. MATERIALS NEEDED FOR TESTING

- Sign for door (testing in progress, do not disturb)
- Spare batteries for keyboard
- Keyboard
- “Home base” – used for Dimensional Change Card Sort Test and Flanker Inhibitory Control and Attention Test
- iPad
- Score sheet for List Sorting Working Memory.

16.6. IPAD SETUP

- The iPad is always set up in the landscape position (horizontal orientation) for the NIH toolbox. The program will NOT rotate. Use the stand in the case to hold the iPad at a 45 degree angle.
- Make sure that the keyboard is functional. The keyboard is needed for List Sorting Working Memory only.
- Make sure Wi-Fi is turned off and that pop-ups are disabled.
- Make sure that the iPad is charged
- Make certain that the sound is on and is at an appropriate volume for the participant.

Figure 1. The NIH Toolbox



16.7. OVERVIEW OF ASSESSMENT PROCESS

- **ADD A NEW PARTICIPANT**
 - **Determine if the participant is < or > 12 years– confirm age**
- **CHOOSE CORRECT BATTERY (SEARCH 4 or 8-11 SEARCH 4) AND ADD A NEW ASSESSMENT**

- ADMINISTER THE TEST
- SEND DATA TO COORDINATING CENTER

1) ADD A NEW PARTICIPANT

- Tap the Participants button (blue) on the NIH Toolbox home page
- Tap “Add New Participant” in the upper right hand corner
- Add demographic information
- **Demographic information** to be entered for each participant includes:
 - Study ID
 - Gender
 - Birthdate
 - Highest Education Level Completed
 - Mother’s level of education (required for people < 18 years of age)
(unknown is an option but failure to include this data will limit scoring options)
 - Handedness (see below 16.7.1)
 - Race
 - American Indian or Alaska Native
 - Asian
 - Black or African American
 - Native Hawaiian or other Pacific Islanders
 - White
 - Other
 - Not provided
 - Ethnicity
 - Hispanic or Latino
 - Not Hispanic or Latino
 - Not provided

16.7.1. Determining Handedness

If a participant does not know or cannot tell the examiner his/her handedness, the following questions should be used to establish it:

- a. Which foot do you use to kick a ball? Left/Right
- b. Which hand do you use to pick up and throw a ball? Left/Right
- c. Which hand do you use to write or draw? Left/Right

Whichever is selected at least two times, from the above three questions (right or left) is determined to be the dominant hand.

You can enter much of the demographic data and chose the battery before the participant arrives. If you do so you will have to update the demographics (handedness and educational level) if you don't have that information beforehand. You will be able to find the participant to update demographics within the NIH toolbox by using "SEARCH participants". You will need the patient ID number to do so.

- 2) TAP "ADD NEW ASSESSMENT" (under demographic data)

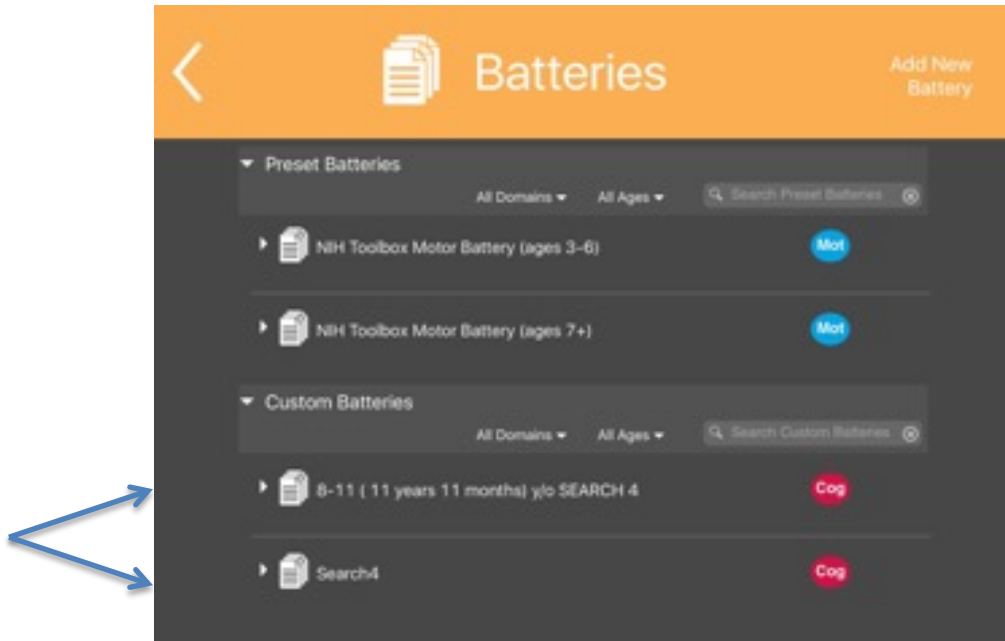
Figure 2. The New Participant page

The screenshot shows the 'New Participant' page in the SEARCH application. The page has a blue header with a back arrow and a person icon. Below the header, there is a 'Participant' section with a list of fields: Identifier, Name, Gender, Birthdate, Highest Education Level Completed, Mother's Education, Handedness, Race, and Ethnicity. Each field has a 'Done' button. At the bottom, there is an 'Assessments' section with a red circle around the 'Add New Assessment' button. The text 'This participant has no assessments.' is displayed below the button.

The assessment will be added and then you will define which battery.

Tap the clipboard icon, then tap “Add instruments” scroll down to the bottom of the “available batteries” list, choose the correct battery for your examinee, based upon age- and then tap “DONE.”

Figure 3. Batteries



3) ADMINISTER ASSESSMENT

Press “Start.” The SEARCH Batteries will always be presented in the following order:

- NIH Toolbox Touch Screen Tutorial
- The NIH Toolbox Pattern Comparison Processing Speed
- The NIH Toolbox List Sorting Working Memory
- The NIH Flanker Inhibitory Control and attention Test
- The NIH Dimensional Change Card Sort Test
- NIH Toolbox Picture Vocabulary Test
- NIH Toolbox Picture Sequence Memory Test.

You will need to enter the same passcode you use to open the iPad when testing is completed.

The 2 most demanding measures are The List Sorting Working Memory and the Picture Sequence Memory Tests. They are purposefully not administered at first, or one after another.

16.7.2. What To Do If There's A Problem During Testing

- Pause, Skip and Stop - If you need to pause (e.g., the participant becomes upset), skip (e.g., there's a fire alarm sounding during a timed test) or stop (the participant refuses to continue).
 - Put two fingers on the screen and rotate clockwise
 - You will be given the choice to:
 - Stop assessment
 - Skip Instrument
 - Resume instrument
- Follow the prompts. You'll be asked to document the reason for the pause, skipping or stopping.

Please call (303-803-5693) or email (Greta.wilkening@childrenscolorado.org) if you need to skip tests or the entire assessment so that we are aware of problems as they arise and can seek to address issues prospectively.

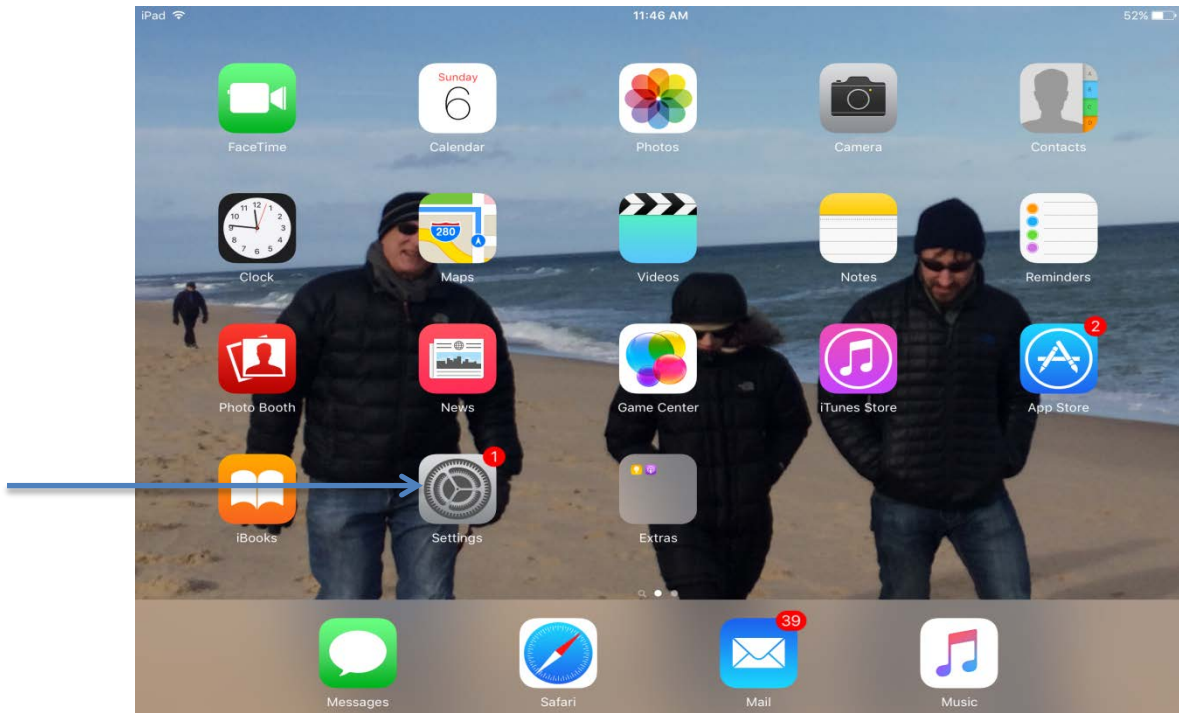
4) EXPORT DATA TO COORDINATING CENTER

Complete the web-based Data Quality and Completion sheet on-line. Submit this to the Coordinating Center.

To export the testing results to the coordinating center you will need to have email set up on your iPad. Make certain this has been established.

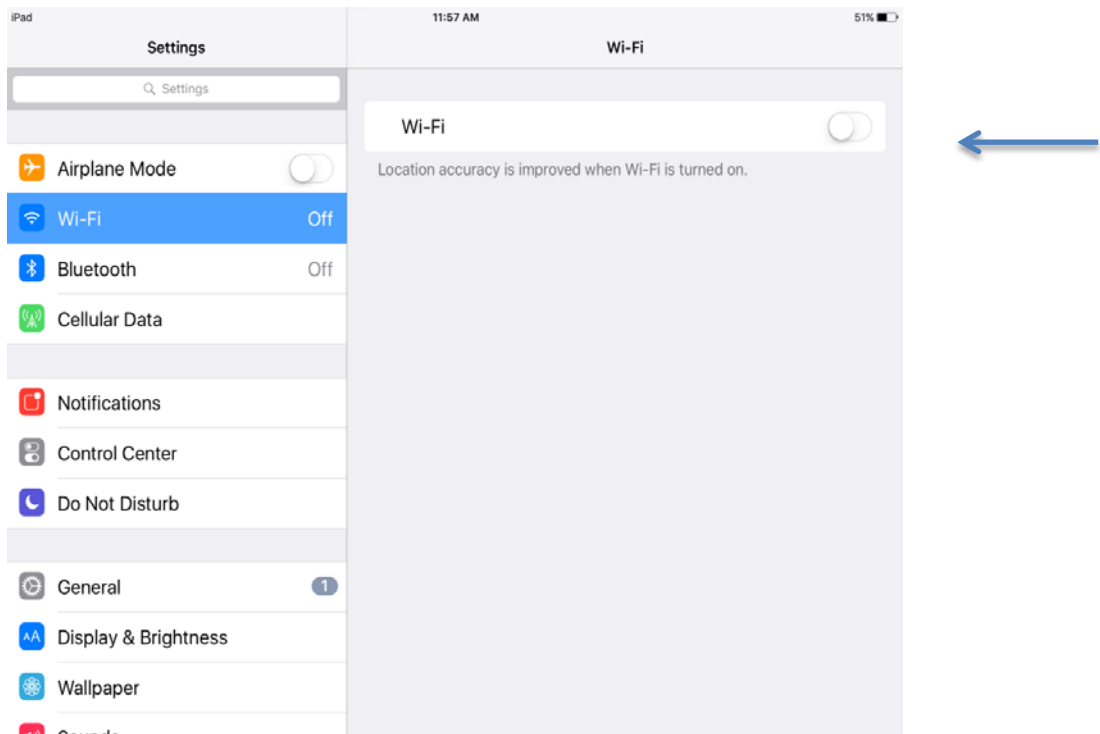
Turn on Wi-Fi on the iPad. To do so, tap the settings icon on the iPad:

Figure 4. The Settings Icon



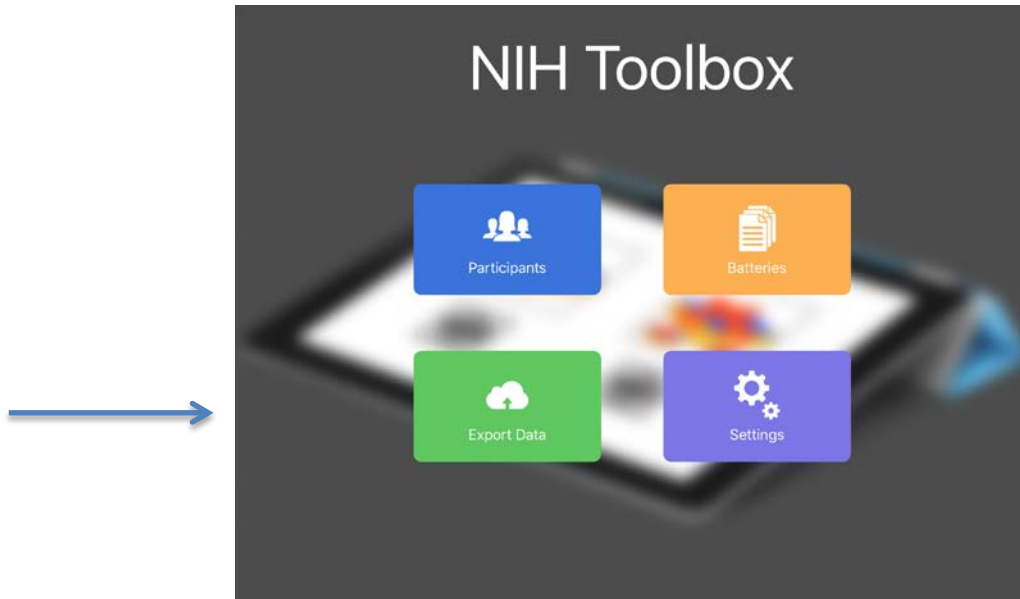
Then turn on Wi-Fi, choosing the correct network:

Figure 5. Wi-Fi Network Selection

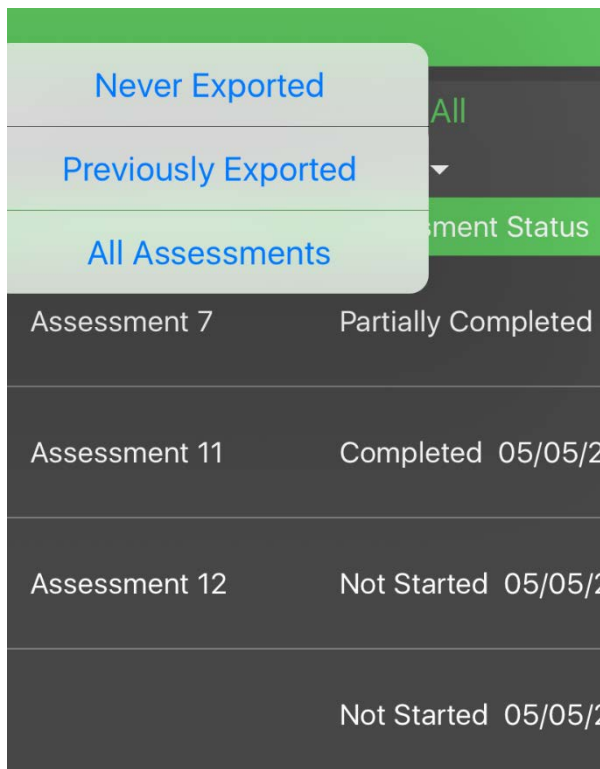


Go to the NIH toolbox home page. Tap “Export Data”.

Figure 6. “Export Data” Selection

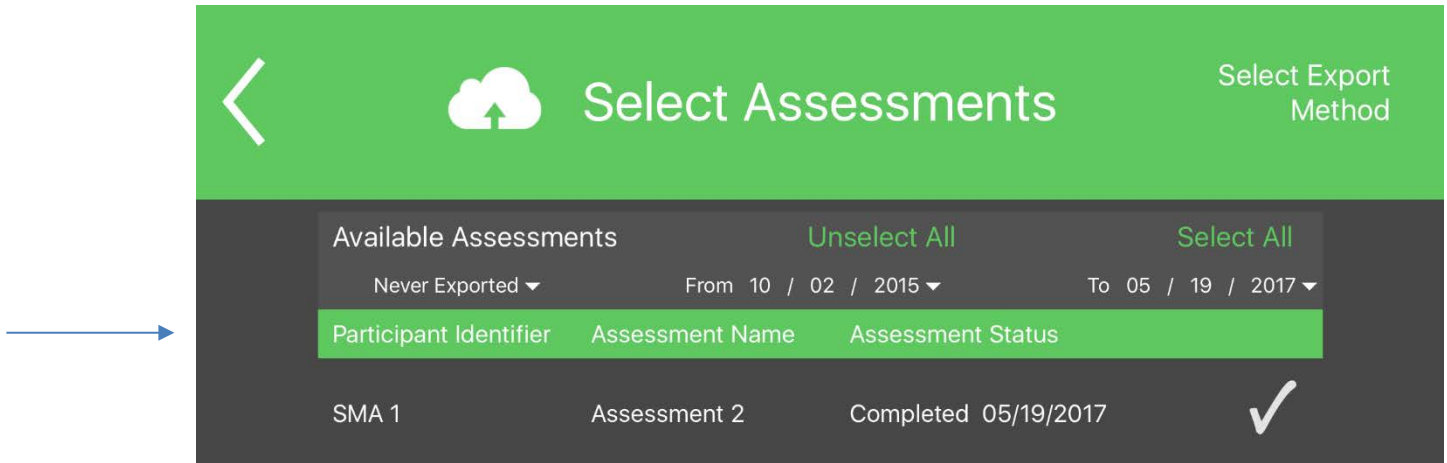


You will see a list of the **Available Assessments**; e.g., all the data those that can possibly be exported. You will choose from a list which includes Never Exported, Previously Exported and All Assessments. You should choose **Never Exported**.

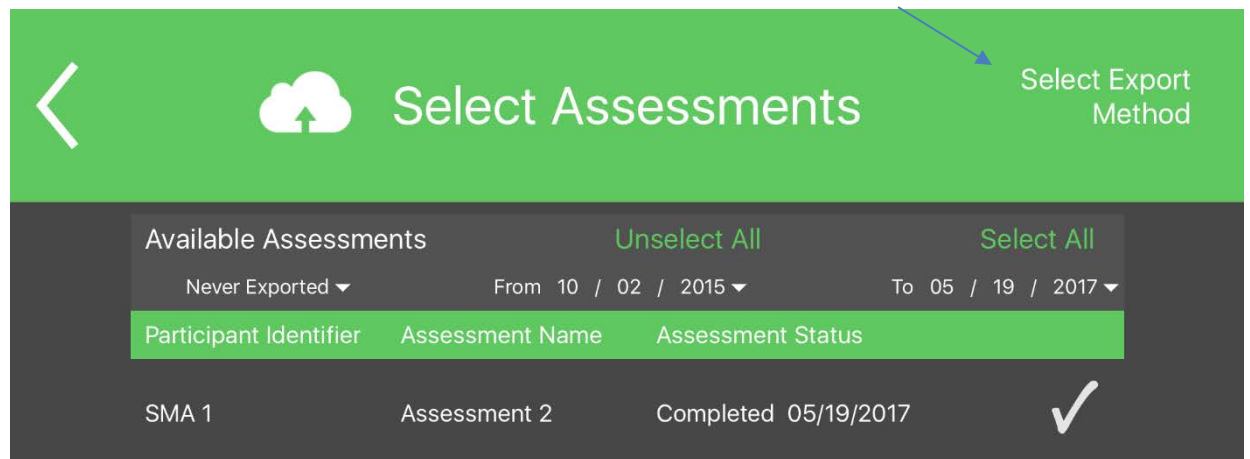


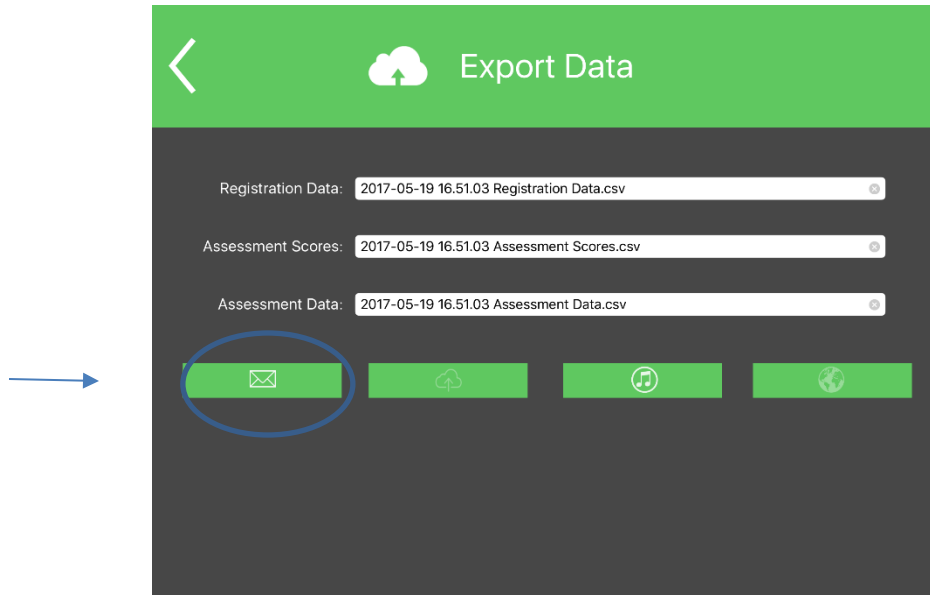
You will see a list of the new testing sessions, that have not yet been exported.

Choose **Select all. Only the new testing sessions will remain and be checked.**

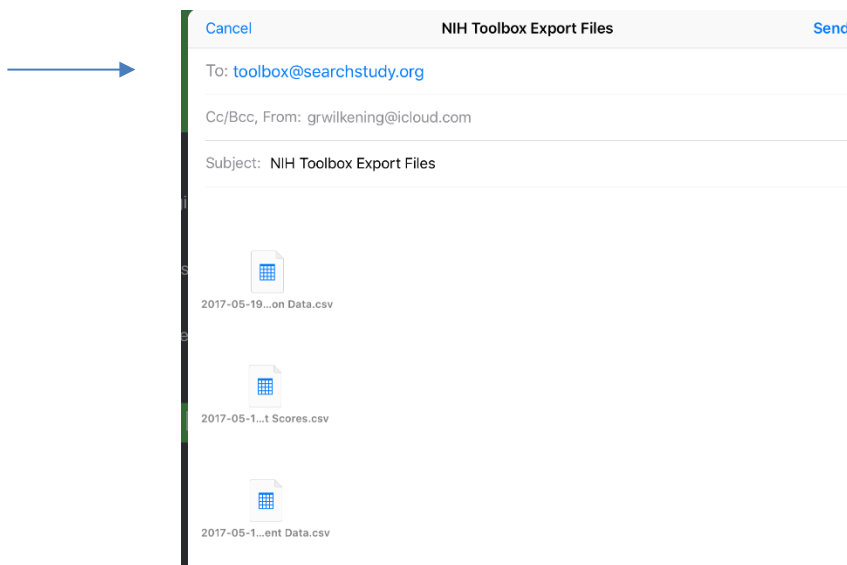


Then tap **Select Export Method.** Choose the *envelope* icon.





An email, with the attachments (testing sessions) that you chose will follow. Enter the email address: toolbox@searchstudy.org



You will receive confirmation that the data has been received from the Coordinating Center.

Export data each day that you complete NIH Toolbox assessments. Data you export will remain on the iPad.

Only de-identified data should be emailed.

16.8. TESTING INSTRUCTIONS FOR NIH TOOLBOX COMPUTERIZED COGNITIVE BATTERY FOR THE IPAD

Instructions for tests are provided in the order the tests will be administered.

16.8.1. NIH Toolbox Touch Screen Tutorial

NIH Toolbox Touch Screen Tutorial 3+ is recommended for anyone not familiar with using an iPad or similar device. We will present this to all examinees for consistency and to assure that all participants are taught in the same manner.

Description

This series of screens is designed to help participants to use the iPad and specifically the touch screen.

The examiner may want to demonstrate, move the participant's finger, or, in other ways, encourage the participant to do the required actions if they experience difficulty.

Instructions

The task is introduced with the Title Screen: NIH Toolbox Touch Screen Tutorial 3+. At the bottom of the screen is a button Touch and Hold Here to Continue. Touch and hold that button to begin the tutorial.

Read the next screen to the participant: *First, you will practice touching pictures on the screen.* When finished reading, touch the button at the bottom of the screen that says: Touch and Hold Here to Continue.

Read: *Touch the flower on the screen.* After participant touches the flower, the next screen appears. If participant does not touch the flower, the flower remains on the screen.

Read: *Good! Now we are going to do some more.* Touch the button at the bottom of the screen that says: Touch and Hold Here to Continue.

Read: *Now, touch the star.* After participant touches the star, the next screen appears. If participant does not touch the star, the star remains on the screen.

Read: *Good! Let's do one more.* Touch the button at the bottom of the screen that says: Touch and Hold Here to Continue.

Read: *Now, touch the apple.* After participant touches the apple, the next screen appears. If participant does not touch the apple, the apple remains on the screen.

Read: *Good! Now, you are ready to continue.* When finished reading, touch the button at the bottom of the screen that says: Touch and Hold Here to Continue.

16.8.2. Pattern Comparison Processing Speed Test Instructions

Description

This is a task measure of **speed of processing**. It is an easy, timed task. It is of finite length (130 items or 85”).

Instructions

The task is introduced with the Title Screen: NIH Toolbox PC 7+. At the bottom of the screen is a button *Touch and Hold Here to Continue*. **Touch and hold that button to begin the test.**

Handedness: If this was not entered during registration, the iPad app will not allow this test to be administered. Instead, the examiner will need to ask a set of questions to ascertain handedness and to enter it in the participant registration screen. Once handedness is entered in the participant registration screen, it will automatically update the instructions on the test so that “RIGHT” or “LEFT” is displayed where appropriate.

An **audio** recording says:

“On each screen, you are going to see two pictures. Sometimes the two pictures are the same and sometimes the two pictures are NOT the same. If the pictures look the same, touch the ‘Yes’ button. If they do NOT look the same, touch the NO button. If you make a mistake during the practice, you will hear a message to try again. Use your _____ (dominant hand from handedness, audio will say “right” or “left”) index finger to respond. Let's try some for practice.”

When the audio recording is complete, “*Touch and hold here to continue*” appears on the screen. Touch and hold that button to begin the administration.

Examinees are to use the index finger (pointer finger to children) of their dominant hand to respond. You should remind the examinee of this.

The age group we are testing will have 6 practice items.

Practice Items

There are **6 practice items** (see Table 1). The first practice item is introduced with an **audio** recording asking:

“Are these the same? Remember, touch YES if they look alike or are the same and touch NO if they do not look alike and are NOT the same.”

For the other five practice items, an **audio** recording asks: “Are these the same?” If the participant answers correctly, an audio recording says: “That’s right!” The next item will then appear.

If the participant answers incorrectly, an **audio** recording explains why the answer is wrong. The correct answer will flash; item will stay on screen. If participant chooses correctly, an **audio** recording will say: “That’s right!” The next item will then appear.

If the participant chooses incorrectly another time, the program automatically moves to the next practice item after repeating the explanation above.

HINT: If the examinee cannot inhibit responding with their non-dominant hand you can give them something, such as a ball or a folded wash cloth, to hold with that hand.

You can remind examinees to pay attention and respond; use succinct clear instructions, such as “keep looking,” “here it comes,” “don’t forget to answer as quickly as you can” or “don’t forget to press the button.”

Table 1. Six Practice Items with Correct and Incorrect Responses

Practice item	Correct response	Incorrect response
1	Yes: both yellow flowers	No
2	No: a flower with stem & top of a flower	Yes
3	No: one present & many presents	Yes
4	Yes: both single presents	No
5	No: purple flower & red flower	Yes
6	Yes: both red flowers	No

NOTE: If a participant makes an error a second time after being corrected on two different practice items, the test will discontinue.

Test Items

An **audio** recording introduces the test items: “Now we’ll do some more. Remember, use your _____ (right/left; audio will say the dominant one) index finger to respond. Touch YES if the pictures look the same and touch NO if they do NOT look the same. It is important that you choose as quickly as you can.”

When the audio file is complete, “*Touch and hold here to continue*” appears on the screen. Touch and hold that button to continue with the test items.

For both test and practice items, *if the participant does not respond within 10 seconds, the audio asks: “Are these the same?”*

When either 130 items appear or 85 seconds of testing time has occurred, the test will end (if a participant is working on an item when time is up, he/she will be permitted to complete it).

This is a timed task. Please remind the participants that they should respond as quickly as they can. You can repeat this reminder throughout the test. Do this succinctly and in a fashion that is a comment, not a criticism, and does not interrupt their performance.

16.8.3. List Sorting Working Memory Test

Description

This measure is a test of the participant's ability to hold in mind and to manipulate information simultaneously.

There are 2 conditions:

- 1) 1 List condition - Remembering and recalling the animals (or foods) in size order from smallest to largest (based upon the picture presented)
- 2) 2 List condition - Remembering and recalling the foods in size order from smallest to largest, followed by the animals in order size (based upon the picture presented) from smallest to largest.

There are 2 trials at each level.

List Sorting Working Memory is a more challenging task. You should anticipate that some participants will be chagrined by the difficulty they experience. It is acceptable to give the examinee a break between items if necessary.

The test will end when an examinee fails one of the items at a specific level of difficulty.

During the 2 list condition you may remind the examinee of the task: "First tell me the fruits in size order, followed by the animals in size order."

SCORE USING THE EXAMINER ANSWER SHEET - DO NOT TRUST YOUR MEMORY!

YOU WILL BE ENTERING THE SCORE FOR EACH ITEM VIA THE KEYBOARD (1 = CORRECT AND 0 = INCORRECT). THIS IS THE ONLY TEST FOR WHICH THE SCORES NEED TO BE ENTERED MANUALLY, AND THE ONLY TEST THAT USES THE KEYBOARD IN THE BATTERY WE ARE UTILIZING.

Instructions

YOU WILL NEED THE KEYBOARD AND THE LIST SORTING WORKING MEMORY EXAMINER ANSWER SHEET TO COMPLETE THIS TEST. THE EXAMINER WILL PROVIDE SOME INSTRUCTIONS AND WILL SCORE USING THE KEYBOARD (1 = CORRECT, 0 = INCORRECT). MUCH OF THE INSTRUCTION WILL BE PRESENTED IN AN AUDIO FORMAT VIA THE iPad.

Before beginning the test, the wireless keyboard should be paired by Bluetooth with the iPad. Bluetooth must be on in Settings. For administration, the **examiner needs to be able to view the iPad and have the keyboard and the NIH Toolbox List Sorting Working Memory Test Examiner Answer Sheet easily accessible for scoring participant responses.** You will be scoring via the keyboard.

The task is **introduced with the Title Screen: NIH Toolbox LS 7+**. To check the Bluetooth connection, the examiner is asked at the bottom of an initial page to: Press Spacebar to Continue. Touching the spacebar begins the test. If the spacebar does not work, try re-pairing the keyboard or changing the batteries in the keyboard.

During the practice items and the testing:

PRESS 1 and then the spacebar for correct responses

PRESS 0 and then the spacebar for incorrect responses

1-List Condition

Read the screen: “You are going to see some pictures one at a time on the screen. After each set of pictures, you will see a blank screen. When you see the blank screen, I want you to tell me the names of the pictures in size order from smallest to biggest. For example, if I show you a motorcycle, a bus, and a car, you would say: motorcycle, car, bus.”

“From now on, you will hear most of the instructions from the iPad. Do you have any questions?”

Let’s practice. *Press Spacebar to continue.*

1-List Practice Item 1: Trial 1: After the pictures are presented and the screen is blank, an **audio** recording says: “Now say the animals in size order.”

Correct Response: If participant says DOG, HORSE, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When the text appears on the screen, ask: “Are you ready?” After the participant answers affirmatively, press the spacebar and 1-List Practice Item 2 will be presented.

Incorrect Response: If participant does not say DOG, HORSE, press 0 and then press spacebar. An **audio** recording says: “Let’s try that again.”

Trial 2 (if Trial 1 was incorrect): An **audio** recording continues: “You saw a DOG and a HORSE; the DOG is smaller than the HORSE. Now say the animals in size order.”

Correct Response: If participant says DOG, HORSE, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When it appears on the screen, ask: “Are you ready?” When the participant answers affirmatively, press the spacebar and 1-List Practice Item 2 will be presented.

There is a discontinue rule after 3 practices:

REVIEW: All the 1-List practice items have the same format. First, the examiner asks for the names of the pictures in size order from smallest to largest. If the examinee answers incorrectly there are 2 more opportunities for the participant to provide a correct answer.

The first comes after a verbal explanation and a repeat of the question; the second comes after replaying the item on the screen, followed by a verbal explanation and then repeating the question. If, after three opportunities, the participant continues to answer incorrectly, the test will be discontinued and no more items will be presented.

Incorrect Response: If participant does not say DOG, HORSE, press 0 and then press spacebar. An **audio** recording says: “Let’s try that one more time.”

Trial 3 (if Trial 2 was incorrect): After the pictures are presented one more time and the screen is blank, an **audio** recording says: “You saw a DOG and a HORSE; the DOG is smaller than the HORSE. Now say the smaller animal and then the bigger animal.”

Correct Response: If participant says DOG, HORSE, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When it appears on the screen, ask: “Are you ready?” When the participant answers affirmatively, press the spacebar and 1-List Practice Item 2 will be presented.

If participant answers the question incorrectly after 3 trials, press 0 and then press spacebar. **Test will be discontinued.**

1-List Practice Item 2: Trial 1: After the pictures are presented and the screen is blank, an **audio** recording says: “Now say the animals in size order, starting with the smallest animal.”

Correct Response: If participant says RABBIT, SHEEP, ELEPHANT, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When it appears on the screen, ask: “Are you ready?” When the participant answers affirmatively, press the spacebar and the 1-List introduction screen will be presented.

Incorrect Response: If participant does not say RABBIT, SHEEP, ELEPHANT, press 0 and then press spacebar. An **audio** recording says: “Let’s try that again.”

Trial 2 (if Trial 1 was incorrect): An **audio** recording continues: “You saw a RABBIT, SHEEP and ELEPHANT; the RABBIT is smaller than the SHEEP and the SHEEP is smaller than the ELEPHANT. The RABBIT is the smallest animal, the SHEEP is the next biggest animal, and the ELEPHANT is the biggest animal. Now, say the animals in size order, starting with the smallest animal.”

Correct Response: If participant says RABBIT, SHEEP, ELEPHANT, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When it appears on the screen,

ask: “Are you ready?” When the participant answers affirmatively, press the spacebar and the 1-List introduction screen will be presented.

Incorrect Response: If participant does not say RABBIT, SHEEP, ELEPHANT, press 0 and then press spacebar. An **audio** recording says: “Let’s try that once more.”

Trial 3 (if Trial 2 was incorrect): After the pictures are presented again and the screen is blank, an **audio** recording says: “You saw a RABBIT, SHEEP and ELEPHANT; the RABBIT is smaller than the SHEEP and the SHEEP is smaller than the ELEPHANT. The RABBIT is the smallest animal, the SHEEP is the next biggest animal, and the ELEPHANT is the biggest animal. Now, say the animals in size order, starting with the smallest animal.”

Correct Response: If participant says RABBIT, SHEEP, ELEPHANT, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When it appears on the screen, ask: “Are you ready?” When the participant answers affirmatively, press the spacebar and presentation of the 1-List introduction screen will be presented.

If participant answers the question incorrectly, press 0 and then press spacebar. **Test will be discontinued.**

The 1-list practice items are summarized in the table below.

Table 2. The 1-list Practice Items

P1 Presentation: Horse Dog (flashing)			
	<i>Question</i>	<i>Response</i>	<i>Next step</i>
Q1	Smaller first, then Bigger	If Dog Horse, press 1; If Horse Dog, press 0	If 1, goes to P2; If 0, goes to Q2
Q2	Smaller first, then Bigger	If Dog Horse, press 1; If Horse Dog, press 0	If 1, goes to P2; If 0, goes to Q3
Q3	Smaller first, then Bigger	If Dog Horse, press 1; If Horse Dog, press 0	If 1, goes to P2; If 0, test discontinued
P2 Presentation: Elephant Rabbit Sheep (flashing)			
Q1	Animals in size order, starting with the smallest	If Rabbit, Sheep, Elephant, press 1; If any other order, press 0	If 1, goes to 1-list test items; If 0, goes to Q2
Q2	Animals in size order, starting with the smallest	If Rabbit, Sheep, Elephant, press 1; If any other order, press 0	If 1, goes to 1-list test items; If 0, goes to Q3
Q3	Animals in size order, starting with the smallest	If Rabbit, Sheep, Elephant, press 1; If any other order, press 0	If 1, goes to 1-list test items; If 0, test discontinued

1-List Test Items:

Say: “Let’s look at some more pictures. Remember, after you see the pictures you will see a blank screen. Once you see this blank screen, I want you to tell me what you just

saw in size order from smallest to biggest. **It is important to pay attention to the size of the object on the screen when putting things in size order from smallest to biggest.** Are you ready?"

When the examinee answers in the affirmative press the spacebar to continue and the presentation of the 1-List test items will begin.

As noted earlier, after the examiner chooses 1 or 0, the question: "Are you ready?" appears on the screen. **Once confirming that the participant is ready and attending, the examiner presses the spacebar to move on to the next item (list of objects).**

You will check for adequate readiness and attention with each item.

For the examiner, there is a ***code at the bottom right side of the iPad screen*** to indicate which item is being administered. The examiner should use this code to look up the correct response on the NIH Toolbox List Sorting Working Memory Test Examiner Answer Sheet, and then score the item using the keyboard (1 or 0).

2-List Condition

REVIEW: The 2-List practice items have the same format. First, the examiner (via an audio recording asks for the foods from smallest to largest and then for the animals from smallest to largest. If the answer is correct, the examiner via the audio recording moves on to the next question. If the participant answers incorrectly, there are two more opportunities to get a correct answer. The first opportunity comes after a verbal explanation and a repeat of the question; the second comes after replaying the item on the screen, followed by a verbal explanation and then a repeat of the question. If after a total of three opportunities, the participant continues to answer incorrectly, the test will automatically be discontinued and no more items will be presented. The practice items are detailed below.

FOOD Followed by ANIMALS

Say: "We're going to look at more pictures. This time, you will see both food and animals in a set of pictures. I'd like you to tell me the food first, and then the animals, in size order from smallest to biggest. It is important to pay attention to the size of the object on the screen when putting things in size order from smallest to biggest. Let's start by looking at some more pictures together." *Press Spacebar* to continue.

After each answer, the examiner should indicate whether it was correct (1) or incorrect (0) on the keyboard. Then the question "Are you ready?" appears on the screen. When the participant answers affirmatively, the examiner should press the spacebar to continue.

2-List Practice Item 1:

Trial 1: After the pictures are presented and the screen is blank, an **audio** recording says: "Say the food, then the animal."

Correct Response: If participant says BANANA, BEAR, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When it appears on the screen, ask: “Are you ready?” When the participant answers affirmatively, press the spacebar and 2-List Practice Item 2 will be presented.

Incorrect Response: If participant does not say BANANA, BEAR, press 0 and then press spacebar. An **audio** recording says: “Let’s try that again.”

Trial 2 (if Trial 1 was incorrect): An **audio** recording continues: “The BEAR is an animal; the BANANA is a food. Now say the food first and then the animal.”

Correct Response: If participant says BANANA, BEAR, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When it appears on the screen, ask: “Are you ready?” When the participant answers affirmatively, press the spacebar and 2-List Practice Item 2 will be presented.

Incorrect Response: If participant does not say BANANA, BEAR, press 0 and then press spacebar. An **audio** recording says: “Let’s try that once more.”

Trial 3 (if Trial 2 was incorrect): After the pictures are presented and the screen is blank, an **audio** recording says: “The BEAR is an animal; the BANANA is a food. Now say the food first and then the animal.” If participant says BANANA, BEAR, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When it appears on the screen, ask: “Are you ready?” When the participant answers affirmatively, press the spacebar and 2-List Practice Item 2 will be presented.

If participant answers the question incorrectly, press 0 and then press spacebar. **Test will be discontinued.**

2-List Practice Item 2:

Trial 1: After the pictures are presented and the screen is blank, an **audio** recording says: “Say the food in size order from smallest to biggest and then say the animals in size order from smallest to biggest.”

Correct Response: If participant says PINEAPPLE, FROG, TIGER, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When it appears on the screen, ask: “Are you ready?” When the participant answers affirmatively, press the spacebar and the 2-list introduction screen will be presented.

Incorrect Response: If participant does not say PINEAPPLE, FROG, TIGER, press 0 and then press spacebar. An **audio** recording says: “Let’s try that again.”

Trial 2 (if Trial 1 was incorrect): An **audio** recording continues: “You saw a PINEAPPLE, a FROG, and a TIGER. The PINEAPPLE is a food; the FROG is the smallest animal, and the TIGER is the biggest animal. Now, say the food in size order starting with the smallest food, and then the animals in size order, from smallest to biggest.”

Correct Response: If participant says PINEAPPLE, FROG, TIGER, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When it appears on the screen, ask: “Are you ready?” When the participant answers affirmatively, press the spacebar and the 2-list introduction screen will be presented.

Incorrect Response: If participant does not say PINEAPPLE, FROG, TIGER, press 0 and an **audio** recording says: “Let’s try that one more time.”

Trial 3 (if Trial 2 was incorrect): After the pictures are presented and the screen is blank, an **audio** recording says: “You saw a PINEAPPLE, a FROG, and a TIGER. The PINEAPPLE is a food; the FROG is the smallest animal, and the TIGER is the biggest animal. Now, say the food in size order starting with the smallest food, and then the animals in size order, from smallest to biggest.”

Correct Response: If participant says PINEAPPLE, FROG, TIGER, press 1 and then press spacebar. An **audio** recording says: “That’s right.” When it appears on the screen, ask: “Are you ready?” When the participant answers affirmatively, press the spacebar and presentation of the 2-list introduction screen will be presented.

If participant answers the question incorrectly, press 0 and then press spacebar. **Test will be discontinued.**

The 2-list practice items are summarized in Table 3 below.

Table 3. The 2-list Practice Items

P1 Presentation: Bear Banana (Flashing)			
	<i>Question</i>	<i>Response</i>	<i>Next step</i>
Q1	Food first, then Animal	If Banana Bear, press 1; If Bear Banana, press 0	If 1, goes to P2; If 0, goes to Q2
Q2	Food first, then Animal	If Banana Bear, press 1; If Bear Banana, press 0	If 1, goes to P2; If 0, goes to Q3
Q3	Food first, then Animal	If Banana Bear, press 1; If Bear Banana, press 0	If 1, goes to P2; If 0, test discontinued
P2 Presentation: Frog Pineapple Tiger (flashing)			
	<i>Question</i>	<i>Response</i>	<i>Next step</i>
Q1	Food first, then Animals in size order, starting with the smallest	If Pineapple Frog Tiger, press 1; If any other order, press 0	If 1, goes to 2-list test items; If 0, goes to Q2
Q2	Food first, then Animals in size order, starting with the smallest	If Pineapple Frog Tiger, press 1; If any other order, press 0	If 1, goes to 2-list test items; If 0, goes to Q3
Q3	Food first, then Animals in size order, starting with the smallest	If Pineapple Frog Tiger, press 1; If any other order, press 0	If 1, goes to 2-list test items; If 0, test discontinued.

2-List Test Items

Read: “Let’s look at some more pictures. Remember, after you see the pictures, you will see a blank screen. Once you see this blank screen, tell me the foods first in size order from smallest to biggest, then the animals, in size order from smallest to biggest. Are you ready?” Press the spacebar to continue and the presentation of the 2-List test items will begin.

As before, after the examiner chooses 1 or 0, the question: “Are you ready?” appears on the screen. **Once confirming that the participant is ready and attending**, the examiner *presses the spacebar* to move on to the next item (list of objects).

There is a *code at the bottom right side of the iPad screen to indicate which item is being administered*. The examiner should use this code to look up the correct response on the NIH Toolbox List Sorting Working Memory Test Examiner Answer Sheet, and then score the item using the keyboard (1 or 0).

Answers must be correct and without intrusions.

Examinees can change their answer.

For some items the examinee can give a synonym for a fruit or an animal item (e.g., bunny for “rabbit”).

Figure 8. NIH Toolbox List Sorting Memory Test Examiner Answer Sheet

Live Item 1-LIST			
Code	Item A	Code	Item B
C	(Banana Watermelon)* Banana + Watermelon	D	(Apple Blueberry) Blueberry + Apple
A	(Pig Mouse) ** Mouse + Pig	B	(Bird Cow) Bird + Cow
E	(Pumpkin Strawberry Banana) Strawberry + Banana + Pumpkin	F	(Dog Horse Rabbit) Rabbit + Dog + Horse
G	(Elephant Butterfly Pig Rabbit) Butterfly + Rabbit + Pig + Elephant	H	(Pineapple Strawberry Pear Blueberry) Blueberry + Strawberry + Pear + Pineapple
I	(Bird Bear Elephant Dog Duck) Bird + Duck + Dog + Bear + Elephant	J	(Sheep Bee Horse Cat Mouse) Bee + Mouse + Cat + Sheep + Horse
K	(Blueberry Strawberry Lemon Pineapple Cherry Pumpkin) Blueberry + Cherry + Strawberry + Lemon + Pineapple + Pumpkin	L	(Horse Cat Turtle Bee Frog Dog) Bee + Frog + Turtle + Cat + Dog + Horse
M	(Dog Frog Elephant Butterfly Rabbit Tiger Camel) Butterfly + Frog + Rabbit + Dog + Tiger + Camel + Elephant	N	(Hamburger Popcorn Peach Pumpkin Corn Strawberry Lemon) Popcorn + Strawberry + Lemon + Peach + Corn + Hamburger + Pumpkin

**test begins here

Live Item 2-LIST			
Code	Item A	Code	Item B
O	(Cow Popcorn) ** Popcorn + Cow	P	(Rabbit Corn) Corn + Rabbit
Q	(Elephant Pumpkin Duck) Pumpkin + Duck + Elephant	R	(Apple Cat Watermelon) Apple + Watermelon + Cat
S	(Strawberry Dog Corn Turtle) Strawberry + Corn + Turtle + Dog	T	(Hamburger Pig Orange Lion) Orange + Hamburger + Pig + Lion
U	(Peach Elephant Blueberry Tiger Rabbit) Blueberry + Peach + Rabbit + Tiger + Elephant	V	(Cherry Duck Egg Bird Apple) Cherry + Egg + Apple + Bird + Duck
W	(Pineapple Monkey Cherry Bear Banana Turtle) Cherry + Banana + Pineapple + Turtle + Monkey + Bear	X	(Pineapple Pig Peach Mouse Blueberry Horse) Blueberry + Peach + Pineapple + Mouse + Pig + Horse
Y	(Orange Butterfly Egg Cow Blueberry Duck Pineapple) Blueberry + Egg + Orange + Pineapple + Butterfly + Duck + Cow	Z	(Rabbit Pear Bird Watermelon Sheep Cherry Tiger) Cherry + Pear + Watermelon + Bird + Rabbit + Sheep + Tiger

**test begins here

16.8.4. Flanker Inhibitory Control and Attention Test

Description

This measure is based upon an experimental paradigm. The Flanker tasks require the participant to focus on a particular stimulus while inhibiting a response to the stimuli on either side (flanking) of it. Failure to inhibit an automatic response may limit the capacity to reach task goals, a higher level cognitive task. On congruent trials, all the fish

or arrows are pointing in the same direction. On incongruent trials, the flanking fish or arrows are pointing in the opposite direction of the middle arrow. Congruent and incongruent trials are mixed.

The word “middle” appears on the screen for all participants; for younger participants (ages 3-11), an audio recording also says “MIDDLE,” to remind participants where to focus (a star in the middle of the screen). Older participants only see the word MIDDLE.

There are 2 forms of the test (8 years 0 months - 11 y 11 months or 12 years 12 months). The correct form will be administered if you have chosen the correct battery based upon the examinee’s age. Please choose the correct instructions, below.

There are 20 test trials for both age groups.

Instructions

For this measure you will need:

iPad

Home Base

You will be reading the instructions and demonstrating how to respond. **READ THE INSTRUCTIONS VERBATIM.**

All participants are instructed to choose one of two buttons on the screen that corresponds to the direction in which the MIDDLE arrow is pointing. They will choose by using the index finger of their dominant hand. As this measure is timed it is important that they use the correct finger.

Standard administration (all ages):

Standard instruction includes demonstration of the use of Home Base.

Practice items

All participants are first presented with four practice trials. If the participant responds incorrectly, an audio recording provides feedback and highlights the correct choice. Similarly, a separate audio file plays each time the participant gets a practice item correct. Participants must get at least three out of four practice trials correct to advance to the test items. If these participants get fewer than three out of four practice trials correct, they can complete up to two more sets of four practice trials, with the same cutoff to advance to the test trials.

If the participant does not respond after five seconds to a practice trial, prompt him/her to do so by saying: “Choose one of the buttons.”

There is an automatic discontinue. In order to continue the examinee must be correct on 3 of the 4 practice items.

Test Trials

Training for home base precedes the arrow trials for all examinees.

Table 4. NIH Toolbox FL 8-11 Script and Examiner's Actions

8 - 11 year old instructions	SCRIPT	Examiner's Actions
Title Screen	NIH Toolbox FL 8-11	E** touches and holds button to continue.
Home Base Introductions	In this task, you will see a row of arrows pointing different ways. But first, we are going to learn about Home Base. This is your Home Base. Put your finger on Home Base and wait for the next picture.	E reads screen and points to the home base; then touches and holds button to continue.
Practice Introduction	You will see a row of arrows. You should choose the button that matches the way the MIDDLE arrow is pointing.	E points to left arrow and demonstrates touching the correct arrow.
	If the MIDDLE arrow is pointing this way, choose this button.	E demonstrates touching arrow button.
	If the MIDDLE arrow is pointing this way, choose this button.	E demonstrates touching arrow button.
	Sometimes all the arrows will point the same way. Sometimes the middle arrow will point a different way, like this [picture of incongruent arrows]. You should always choose the button that matches the way the MIDDLE arrow is pointing.	E reads screen, points to the arrows, and demonstrates touching arrow button.
Transition to practice items	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Remember; put your finger back on Home Base after you answer.	E reads screen; then touches and holds button to continue.
Practice Items set 1	4 practice items	
More practice, if less than 3 out of 4 correct on set 1	Let's practice some more. If the MIDDLE arrow is pointing this way, choose this button.	E reads screen and demonstrates touching arrow button.
	If the MIDDLE arrow is pointing this way, choose that button.	E demonstrates touching arrow button.
Transition to more practice items	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Remember; put your finger back on Home Base after you answer.	E reads screen; then touches and holds button to continue.
Practice Items set 2	4 practice items	
More practice, if less than 3 out of 4 correct on set 2	Let's practice some more. If the MIDDLE arrow is pointing this way, choose this button.	E reads screen and demonstrates touching arrow button.

8 - 11 year old instructions	SCRIPT	Examiner's Actions
	If the MIDDLE arrow is pointing this way, choose that button.	E demonstrates touching arrow button.
Transition to more practice items	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Remember; put your finger back on Home Base after you answer.	E reads screen; then touches and holds button to continue.
Practice Items set 3	4 practice items	.
Test ends, if less than 3 out of 4 correct on set 3		
Test Items Introduction	Now you're ready to do this without me. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Remember; put your finger back on Home Base after you answer.	E reads screen; then touches and holds button to continue.
Test items	20 items (arrows)	

Table 5. NIH Toolbox FL 12+ Script and Examiner's Actions

Ages 12	SCRIPT	Examiner's Actions
Title Screen	NIH Toolbox FL 12+	E touches and holds button to continue.
Home Base Introductions	In this task, you will see a row of arrows pointing different ways. But first, we are going to learn about Home Base. This is your Home Base. Put your finger on Home Base and wait for the next picture.	E reads screen and points to the home base; then touches and holds button to continue.
Practice Introduction	You will see a row of arrows. You should choose the button that matches the way the MIDDLE arrow is pointing.	E points to left arrow and demonstrates touching the correct arrow.
	If the MIDDLE arrow is pointing this way, choose this button.	E demonstrates touching arrow button.
	If the MIDDLE arrow is pointing this way, choose this button.	E demonstrates touching arrow button.
	Sometimes all the arrows will point the same way. Sometimes the middle arrow will point a different way, like this. You should always choose the button that matches the way the MIDDLE arrow is pointing. You will see the word MIDDLE to remind you.	E reads screen, points to the arrows, and demonstrates touching arrow button.

Ages 12	SCRIPT	Examiner's Actions
Transition to practice items	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Remember; put your finger back on Home Base after you answer.	E reads screen; then touches and holds button to continue.
Practice Items set 1	4 practice items	
More practice, if less than 3 out of 4 correct on set 1	Let's practice some more. If the MIDDLE arrow is pointing this way, choose this button.	E reads screen and demonstrates touching arrow button.
	If the MIDDLE arrow is pointing this way, choose this button.	E demonstrates touching arrow button.
Transition to more practice items	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Remember; put your finger back on Home Base after you answer.	E reads screen; then touches and holds button to continue.
Practice Items set 2	4 practice items	
More practice, if less than 3 out of 4 correct on set 2	Let's practice some more. If the MIDDLE arrow is pointing this way, choose this button.	E reads screen and demonstrates touching arrow button.
	If the MIDDLE arrow is pointing this way, choose this button.	E demonstrates touching arrow button.
Transition to more practice items	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Remember; put your finger back on Home Base after you answer.	E reads screen; then touches and holds button to continue.
Practice Items set 3	4 practice items	
Test ends, if less than 3 out of 4 correct on set 3		
Test Items Introduction	Now you're ready to do this without me. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Remember; put your finger back on Home Base after you answer.	E reads screen; then touches and holds button to continue.
Test items	20 items (arrows)	

16.8.5. Dimensional Change Card Sort Test

Description

This measure assesses the ability of the examinee to remain focused upon a relevant, stated dimension; size or color, and to switch attention between these dimensions as instructed. This is also considered a measure of higher cognitive functions. The ability to remain focused upon a relevant and salient stimulus and ignore an irrelevant stimulus is required on a daily basis. Both speed and accuracy of response is required. The relevant dimension that the participant is to attend to is indicated by a cue word (e.g., “shape” or “color”) that appears on the screen for all participants and that, for young

children ages 3-11, is also spoken by a prerecorded audio file. There are practice items. There is an automatic discontinuation rule if examinees are unable to complete 3 of 4 practice items correctly. There are 30 test items for all examinees.

There is a timed component. The examiner does not prompt the participant; the program will move to the next item automatically after 10 seconds, if the participant has not responded.

Instructions

For this measure you will need:

iPad

Home Base

This table outlines the item content read as well as the actions for the examiner.

Table 6. NIH Toolbox DCCS 8-11 Script and Examiner’s Response

8 - 11 year 11 months old instructions	SCRIPT	Examiner
Title Screen	NIH Toolbox DCCS 8-11	E touches and holds button to continue
Home Base Intro	We're going to play a matching game with colors and shapes. But first we are going to learn about Home Base. This is your Home Base. Put your finger on the Home Base and wait for the next picture.	Reads screen and points to Home Base; then touches and holds button to continue.
SHAPE intro	We'll play the SHAPE game first. In the SHAPE game, choose the picture that's the same SHAPE as the picture in the middle of the screen. If it's a BOAT, choose this picture.	E points to BOAT, then demonstrates use of button.
	If it's a RABBIT, choose that picture.	E points to RABBIT, then touches and holds button to continue.
Transition	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Put your finger back on Home Base after you answer.	E reads screen, then touches and holds button to continue.
Shape Practice Set 1	4 items sorted by shape	
More practice, if less than 3 out of 4 correct on Set 1	Let's practice that some more. In the SHAPE game, choose the picture that's the same SHAPE as the picture in the middle of the screen. If it's a BOAT, choose this picture.	E chooses BOAT.
	If it's a RABBIT, choose that picture.	E chooses RABBIT.

8 - 11 year 11 months old instructions	SCRIPT	Examiner
Transition	<p>Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Put your finger back on Home Base after you answer.</p>	E reads screen, then touches and holds button to continue.

Shape Practice Set 2	4 items sorted by shape	
More practice, if less than 3 out of 4 correct on Set 2	Let's practice that some more. In the SHAPE game, choose the picture that's the same SHAPE as the picture in the middle of the screen. If it's a BOAT, choose this picture.	E chooses BOAT.
	If it's a RABBIT, choose that picture.	E chooses RABBIT.
Transition	<p>Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Put your finger back on Home Base after you answer.</p>	E reads screen, then touches and holds button to continue.
Shape Practice Set 3	4 items sorted by shape	
Test ends, if less than 3 out of 4 correct on Set 3		
COLOR intro	We can also match by COLOR. In the COLOR game, choose the picture that's the same COLOR as the picture in the middle of the screen. If it's BROWN, choose this picture.	E points to, then chooses, BROWN picture.
	If it's WHITE, choose that picture.	E points to, then chooses, WHITE picture.
Transition	<p>Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Put your finger back on Home Base after you answer.</p>	E reads screen, then touches and holds button to continue.
Color Practice Set 1	4 items sorted by color	
More practice, if less than 3 out of 4 correct on Set 1	Let's practice some more. In the COLOR game, choose the picture that's the same COLOR as the picture in the middle of the screen. If it's WHITE, choose this picture.	E chooses WHITE picture.

	If it's BROWN, choose that picture.	E chooses BROWN picture.
Transition	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Put your finger back on Home Base after you answer.	E reads screen, then touches and holds button to continue.
Color Practice Set 2	4 items sorted by color	
More practice, if less than 3 out of 4 correct on Set 2	Let's practice some more. In the COLOR game, choose the picture that's the same COLOR as the picture in the middle of the screen. If it's WHITE, choose this picture.	E chooses WHITE picture.
	If it's BROWN, choose that picture.	E chooses BROWN picture.
Transition	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Put your finger back on Home Base after you answer.	E reads screen, then touches and holds button to continue.
Color Practice Set 3	4 items sorted by color	
Test ends, if less than 3 out of 4 correct on Set 3		
Test item intro	Now we're going to play both games together. Remember, if you see and hear the word SHAPE, you choose the picture that's the same SHAPE as the picture in the middle of the screen. If you see and hear the word COLOR, you choose the picture that's the same COLOR as the picture in the middle of the screen. Remember, put your finger back on Home Base after you answer.	E reads screen, then touches and holds button to continue.
Transition	Now you try.	E reads screen, then touches and holds button to continue.
	Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Put your finger back on Home Base after you answer.	
Test items	30 mixed items	

Table 7. Dimensional Change Card Sort Test Instructions

Ages 12+	SCRIPT	Examiner
Title Screen	NIH Toolbox DCCS 12+	E touches and holds button to continue
Home Base Intro	We're going to play a matching game with colors and shapes. But first we are going to learn about Home Base. This is your Home Base. Put your finger on the Home Base and wait for the next picture.	E reads screen and points to Home Base; then touches and holds button to continue.

Ages 12+	SCRIPT	Examiner
SHAPE intro	We'll play the SHAPE game first. In the SHAPE game, choose the picture that's the same SHAPE as the picture in the middle of the screen. If it's a BOAT, choose this picture.	E points to BOAT, then demonstrates use of button.
	If it's a RABBIT, choose that picture.	E points to RABBIT, then touches and holds button to continue.
Transition	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Put your finger back on Home Base after you answer.	E reads screen, then touches and holds button to continue.
Shape Practice set 1	4 items sorted by shape	..
More practice, if less than 3 out of 4 correct on set 1	Let's practice that some more. In the SHAPE game, choose the picture that's the same SHAPE as the picture in the middle of the screen. If it's a BOAT, choose this picture.	E chooses BOAT.
	If it's a RABBIT, choose that picture.	E chooses RABBIT..
Shape Practice set 2	4 items sorted by shape	
More practice, if less than 3 out of 4	Let's practice that some more. In the SHAPE game, choose the picture that's the same SHAPE as the picture in the middle of the screen. If it's a BOAT, choose this picture.	E chooses BOAT.

correct on set 2		
	If it's a RABBIT, choose that picture.	E chooses RABBIT.
Shape Practice set 3	4 items sorted by shape	
Test ends, if less than 3 out of 4 correct on set 3		
COLOR intro	We can also match by COLOR. In the COLOR game, choose the picture that's the same COLOR as the picture in the middle of the screen. If it's BROWN, choose this picture.	E points to, then chooses, BROWN picture.
	If it's WHITE, choose that picture.	E points to, then chooses, WHITE picture.
Transition	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Put your finger back on Home Base after you answer.	E reads screen, then touches and holds button to continue.
Color Practice set 1	4 items sorted by color	.
More practice, if less than 3 out of 4 correct on set 1	Let's practice some more. In the COLOR game, choose the picture that's the same COLOR as the picture in the middle of the screen. If it's WHITE, choose this picture.	E chooses WHITE picture.
	If it's BROWN, choose that picture.	E chooses BROWN picture.

Transition	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Put your finger back on Home Base after you answer.	E reads screen, then touches and holds button to continue.
Color Practice set 2	4 items sorted by color	
More practice, if less than 3 out of 4 correct on set 2	Let's practice some more. In the COLOR game, choose the picture that's the same COLOR as the picture in the middle of the screen. If it's WHITE, choose this picture.	E chooses WHITE picture.
	If it's BROWN, choose that picture.	E chooses BROWN picture..
Transition	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going! Put your finger back on Home Base after you answer.	E reads screen, then touches and holds button to continue.
Color Practice set 3	4 items sorted by color	
Test ends, if less than 3 out of 4 correct on set 3		

Test item intro	Now we're going to play both games together. Remember, if you see the word SHAPE, you choose the picture that is the same SHAPE as the picture in the middle of the screen. If you see the word COLOR, you choose the picture that is the same COLOR as the picture in the middle of the screen. Remember, put your finger back on Home Base after you answer.	E reads screen, then touches and holds button to continue.
Transition	Now you try. Keep your eyes on the star. ★ Answer as fast as you can without making mistakes. If you make a mistake, just keep going. Put your finger back on Home Base after you answer.	E reads screen, then touches and holds button to continue.
Test items	30 mixed items	

16.8.6. *Picture Sequence Memory Test*

Description

This is a measure of episodic memory. The examinee is asked to recall a sequence of pictures that are presented with accompanying descriptions. The order is not based upon previously learned information. The examinees are first taught how to move pictures on the touch screen. This is another more demanding task, and it may be uncomfortable for some examinees. There is a practice item. Please reassure participants that we do not expect them to get all sequences correct.

You should remind the examinees to “watch the screen,” when pictures are being presented. Remind the examinees not to touch the screen during presentation.

Read the instructions on the screen verbatim. All the instructions are on the screen.

You may move the pictures for the examinees if they can indicate which picture they want moved where. You should say the equivalent of “You point to the picture you want to move, then point to the grey box where you want to move it. I’ll move it there for you.”

When the participant has responded to the test items, he/she will be asked (via a written message) “Are you finished?” If the examinee responds in the affirmative the examiner, NOT THE PARTICIPANT responds by touching the “YES” button.

Materials

iPad only

Instructions

There are three different sets (forms) of test items for this measure: forms A, B, and C. We will use form A.

For all participants, a demonstration sequence shows participants how to move the pictures on the screen. The test sequences differ in length for participants of differing ages.

Participants respond by dragging pictures from the yellow box on the screen into the gray boxes on the screen. They may verbalize the picture labels as they move the pictures. If, however, verbalizing the picture labels seems to interfere with the participant’s performance, the examiner should **say**: “You don’t need to say the words/labels.” If participants indicate that saying the labels helps them, the examiner may reassure them that they may say the labels if they wish.

If participants look away from the screen while the pictures are being presented, the examiner should **remind them to**: Watch the screen.

Additionally, examiners should not allow participants to touch the screen while the pictures are being presented. If participants try to touch the screen while pictures are being presented or while the examiner is giving instructions, **say**: “Do not touch the screen until I tell you that it is your turn.”

If necessary, **remind participants to**: “Wait until I tell you it is your turn (to touch the screen).”

If the participant has difficulty dragging the pictures across the screen during the demonstration sequence, practice sequences, or the actual test sequences, he/she may point and the examiner should move the pictures in the way the participant indicates. The examiner should ensure the participant completely understands how the process will work and should say something like the following to the participant: “You point to the picture you want to move, then point to the grey box where you want to move it. I’ll move it there for you.”

Picture Sequence Memory Test Instructions Age 8+

The test begins with a Title Screen: NIH Toolbox PSM 8+ Form A, B or C. At the bottom of the screen is a button ***Touch and Hold Here to Continue***. Touch and hold that button to begin the test.

On the next screen, **read** the text: “Now we are going to play a memory game, but first I am going to teach you how to move the pictures on this screen.”

When finished reading, touch the button at the bottom of the screen that says ***Touch and Hold Here to Continue***.

The next screen begins the three-step demonstration sequence. If the steps are not followed, the Touch and Hold Here to Continue button will not be active.

Step 1: Moving Pictures from the Yellow Box to the Gray Boxes

Read the text above the yellow box on the screen and demonstrate the actions described. Say: **“Here you see some pictures in a yellow box. I want to show you how to move the pictures to the gray boxes. You can move pictures from this yellow box to the gray boxes, like this. Touch on the picture in the yellow box; then drag the picture you touched to the gray box where you want to move it. Now you try with this picture.”**

After the participant demonstrates understanding of this step, touch the button at the bottom of the screen that says ***Touch and Hold Here to Continue***.

Step 2: Moving Pictures from the Gray Boxes to the Yellow Box

Read the text above the yellow box on the screen and demonstrate the actions described.

Say: **“You can also move pictures from the gray boxes back to the yellow box, like this. Touch the picture you want to move. Then drag that picture to the yellow box. Now you move the other picture back to the yellow box.”**

After the participant demonstrates understanding of this step, touch the button at the bottom of the screen that says ***Touch and Hold Here to Continue***.

Step 3: Moving Pictures between the Gray Boxes

Read the text above the yellow box on the screen and demonstrate the actions described.

Say: **“You can also move the pictures from one gray box to another, like this. First, you touch the picture in one gray box. Then, drag that picture to the gray box where you want the picture to go. Now you try it; move the picture from here to here.”**

If the participant has difficulty dragging the pictures across the screen, during the demonstration sequence, practice sequences, or the actual test sequences, he/she may point and the examiner will move the pictures in the way the participant indicates. The examiner should ensure the participant completely understands how the process will work and can **say something like the following**: “You point to the picture you want to move, then point to the gray box where you want to move it. I’ll move it there for you.”

After the participant demonstrates understanding of this step, touch the button at the bottom of the screen that says *Touch and Hold Here to Continue*.

Introduction to the Practice Items

Read the screen: “**Now, we’re going to play the game. You will see some pictures on the screen. You should remember them and show them back to me in the same way you saw them on the screen.**”

When finished reading, touch the button at the bottom of the screen that says *Touch and Hold Here to Continue*.

The next screen begins the one practice sequence for these ages. The participant has four trials to complete the sequence. If the participant succeeds in four trials or less, the test sequences are presented.

If the participant fails all four trials of the practice sequence, the test is discontinued.

Practice Sequence

Say: “**Now, you will see how to Go Camping.**” When finished reading, touch the button at the bottom of the screen that says *Touch and Hold Here to Continue*. As pictures are presented, an audio recording will say the appropriate labels:

After the pictures are presented and as the pictures are scrambled, an audio recording will say: “**That’s how to Go Camping. Now, you move the pictures in the same way you saw them on the screen.**”

When all pictures have been placed in gray boxes, a pop-up will appear on the screen, “**Are you finished?**” Ask this of the participant.

If participant says YES, touch and hold the YES button. If the participant says NO, touch any of the pictures and the pop-up will disappear. If no picture is moved out of a gray box, the pop-up will continue to be on the screen. The pop-up will close if a picture is moved back to the yellow box and will reappear each time all pictures have been placed in gray boxes.

Logic:

1. If participant gives correct response, Test Item will be presented.

2. If participant gives incorrect response, Go Camping will be repeated with an audio recording saying “Let’s try that again.” After the pictures are presented and as the pictures are scrambled, an audio recording will say: **“That’s how to Go Camping. Now, you move the pictures in the same way you saw them on the screen.”**
3. If participant gives incorrect response again, #2 above is repeated up to two additional times (or a total of 4 trials).
4. If participant fails all 4 trials, testing will be automatically discontinued.

“First, put up the tent. Then, go for a hike. Then, and catch a fish. And last, roast a marshmallow.”

Test Sequences

Participants ages 8+ will be presented with two trials: one with a 15-step sequence and the other with an 18-step sequence.

Read the screen: **“Now we are going to play the game with more pictures. This time you will see how to Play in the Park (Form A).”**

When finished reading, touch the button at the bottom of the screen that says ***Touch and Hold Here to Continue.***

Test Item (Trial 1): As the pictures are presented, an audio recording will say appropriate labels:

After the pictures are presented and as the pictures are scrambled, an audio recording will say: **“That’s how to Play in the Park. Now, you move the pictures in the same way you saw them on the screen.”**

When all pictures have been placed in gray boxes, a pop-up will appear on the screen, **“Are you finished?”** Ask this of the participant. If participant says YES, touch and hold the YES button. If the participant says NO, touch any of the pictures and the pop-up will disappear. If no picture is moved out of a gray box, the pop-up will continue to be on the screen. The pop-up will close if a picture is moved back to the yellow box and will reappear each time all pictures have been placed in gray boxes.

Read the screen: **“Now we’re going to do the same pictures with some more pictures added. Everyone is asked to do this more than once.”** When finished reading, touch the button at the bottom of the screen that says ***Touch and Hold Here to Continue.***

Test Item (Trial 2): As the pictures are presented, an audio recording will say appropriate labels:

After the pictures are presented and as the pictures are scrambled, an audio recording will say: **“That’s how to Play in the park (Form A); Go to the fair (Form B); Work on the farm (Form C).”**

Now, you move the pictures in the same way you saw them on the screen. When all pictures have been placed in gray boxes, a pop-up will appear on the screen, **“Are you finished?”** Ask this of the participant. If participant says YES, touch and hold the YES button. If the participant says NO, touch any of the pictures and the pop-up will disappear. If no picture is moved out of a gray box, the pop-up will continue to be on the screen. The pop-up will close if a picture is moved back to the yellow box and will reappear each time all pictures have been placed in gray boxes.

Logic:

Test will terminate after the two test sequences have been presented.

16.8.7. Picture Vocabulary Test

Description

This is a measure of understanding of single word vocabulary. The examinee must listen to a word, via audio recording, and pick which of 4 pictures goes with the word they heard. We are using this as a measure of premorbid skill, as vocabulary tends to remain constant over time, and is not a skill that is reported to change in association with diabetes.

Which items are presented to a specific examinee depends upon the demographic data (age or education) you entered. The test uses a variable-length computer adapted test procedure (CAT); some participants see fewer items than others. The specific words presented depend on the participant’s performance. The number of items presented depends on age and performance; for most participants, the measure will last approximately 5 minutes and will contain about 25 items. The computer will administer each item one by one, in an untimed fashion, until the test is completed.

This should be a relatively less stressful and easier test to administer; hence it is last in the sequence. Some examinees may need to be encouraged to “make their best guess.” Remind them that we do not expect them to be familiar with all the words presented, and that the testing is not helping us if they do. We are looking for a range of familiarity.

Instructions

General Instructions:

1. The opening/introductory instructions and the introductions to the test items are printed **on the iPad screen** and are read to the participants; all other instructions are pre-recorded.

2. Before beginning, make sure the volume is loud enough so that participants can hear the pre-recorded feedback and the presentation of the words.
3. If the participant says he/she does not understand the word after several repetitions, the examiner may say the word **one more time**.

Say: **“You are going to be asked the meaning of some words. For each item, you will hear a word and see four pictures on the screen. Touch the picture that you think best matches the meaning of the word that was said. If you are not sure, make your best guess. If you need to hear the word again, touch the button that has a picture of an EAR, also called the PLAY AGAIN button. After you touch a picture, you will hear a new word and see more pictures.”**

“You will keep hearing words and touching pictures until you are done. If you want to change your last answer, touch the button with the HAND that says GO BACK. The pictures you just saw will reappear and you will hear the word again. Touch your choice, and then more words and pictures will appear. Tell me when you are ready to start.”

When participant is ready, touch the button that says *Touch and Hold Here to Continue*.

Practice item 1:

An audio recording says: **“Let’s try one for practice: Banana. Touch the picture of Banana.”**

If correct, the audio recording says: **“That’s right!”** The program will automatically go to the next practice item.

If incorrect, the Banana picture will light up and an audio recording will say: **“This is a banana. Let’s try again.”**

The examiner should allow the participant up to three chances to answer this practice item correctly.

After three unsuccessful attempts by the participant, the examiner should touch the picture of the banana and say: **“This is a banana.”** The next practice item will appear automatically.

Practice item 2:

An audio recording says: **“Let’s try another one: Spoon. Touch the picture of Spoon.”**

If correct, an audio recording says: **“That’s right!”**

If incorrect, the Spoon picture will light up and an audio recording will say: **“This is a spoon. “Let’s try again.”**

The examiner should allow the participant up to three chances to answer this practice item correctly.

After three unsuccessful attempts by the participant, the examiner should touch the picture of the spoon and say: **“This is a spoon.”**

The introduction to the test items will appear automatically.

Read: **“Now, you’re going to do some more. Remember, you will hear a word and then you will see four pictures. One of the pictures will show what the word means. Touch that picture and you will hear a new word and see four more pictures. Again, touch the picture that shows what the word means. If you don’t know, make your best guess. Any questions?”**

When participant is ready, the examiner touches button that says *Touch and Hold Here to Continue*.

An audio recording will introduce the word they are to find. (The items will continue in this format until the test is completed.)

16.9. COMPLETING AND SAVING THE ASSESSMENT

When the testing is completed you will need to enter your password to save it.

Please thank the participant for giving good effort, completing all the testing and being a good sport.

If you have concerns about an examinee, e.g., you do not think, based upon your assessment of what they could complete during testing, that they are safe to take care of themselves (e.g., get on a bus to go home), drive themselves home, or the testing suggests that they are confused (tests need to be discontinued) please contact the PI at your site, and call Dr. Greta Wilkening (303-803-5693). Please document that you’ve made this call. If you think an examinee is unsafe to leave, please keep them with you until the PI and/or Dr. Wilkening and you have consulted and have an agreed upon safety plan. If they are with a family member or friend who can assure their safety but you have concerns about their capacity to care for themselves in the future please document this, and contact the site PI.

16.10. ADDITIONAL INFORMATION

Helpful Hints

- 1) Wipe the keyboard and screen with antibacterial wipes between examinees.
- 2) Once the testing batteries we are using have been loaded on the iPad you DO NOT need Wi-Fi to administer the tests and should turn it off during testing.
- 3) If you are carrying the iPad and the keyboard together TURN OFF Bluetooth using the Settings icon. The keyboard is exquisitely sensitive and you can easily put in an

incorrect passcode repeatedly if you keep Bluetooth turned on. This will lock the iPad. Trust me, you don't want that to happen.

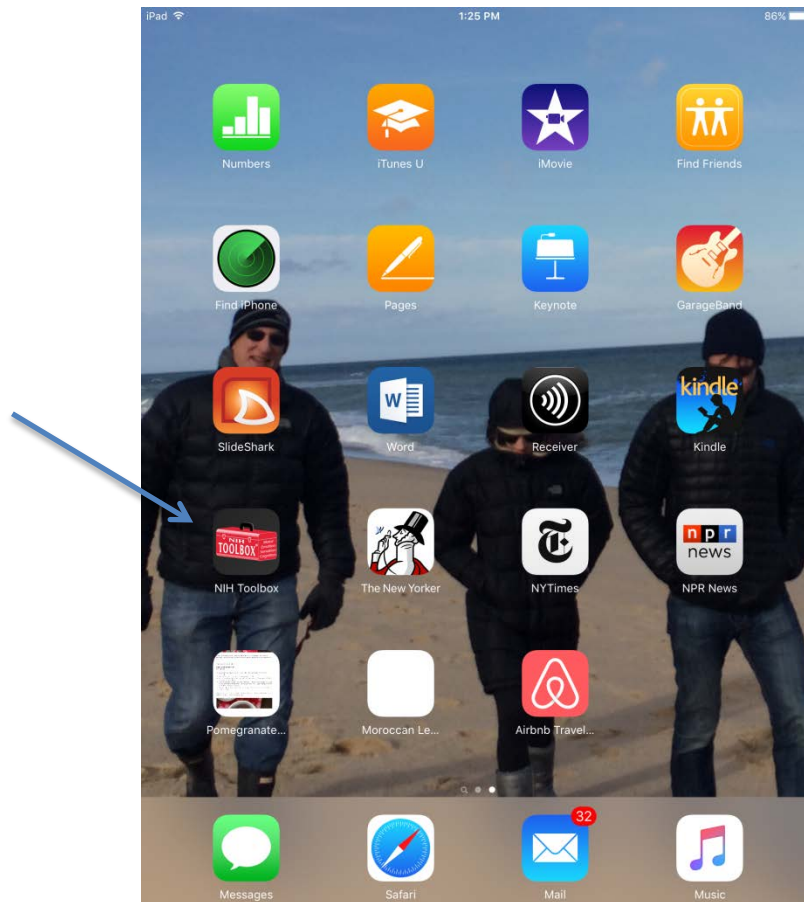
- 4) Bluetooth must be on for the keyboard to operate. Turn it on (see below) once you are in the testing room.
- 5) Sometimes the program does not move from item to item as fast as you (I) think it should. It is probably not stuck. The pacing is for people who have neurologic disease and is purposefully slow. Don't panic right away. As I've used the program I've gotten somewhat, albeit not entirely, comfortable with the process.

16.11. NAVIGATING THE IPAD

- 1) Turn on the iPad by depressing and holding the button on the top right corner (the bottom is where there is a round button in the center).
- 2) The apple icon will appear. Let the iPad go thru start-up. It will transition to the lock page or go black if you get busy doing something else. If it is black depress the round button, or quickly depress the button at top (don't hold it down this time). The lock page will appear. Swipe from left to right at the bottom and the Passcode page will show up. Initially you will use the Password that has been set up for you. This can be changed (confer with your colleagues who will also be testing patients as to what the password will be). Enter the password and the Home Screen will open.

- 3) Locate the appropriate icon to open NIH Toolbox program.

Figure 9. NIH Toolbox Program Icon



- 4) To go back to the home page press the round key at the bottom middle.
- 5) To darken screen, but not turn off the iPad briefly depress the button in the upper right corner or the round button in the bottom middle.
- 6) To turn off the iPad, press and hold down the button on the upper right. You will see a power icon, and the words “slide to power off.” Slide your finger from left to right. It takes a little time for the iPad to turn itself off. When you come back you will need to start at # 1 above, depressing and holding the bottom on the top right corner.
- 7) The plug in to charge the iPad is hard to see in the case we are using. It is located below the round button on the edge of the case. Lift the flap (it’s hard, be strong), and you’ll find it.

16.12. USING THE BLUETOOTH WIRELESS KEYBOARD

Setting up Bluetooth Wireless Keyboard

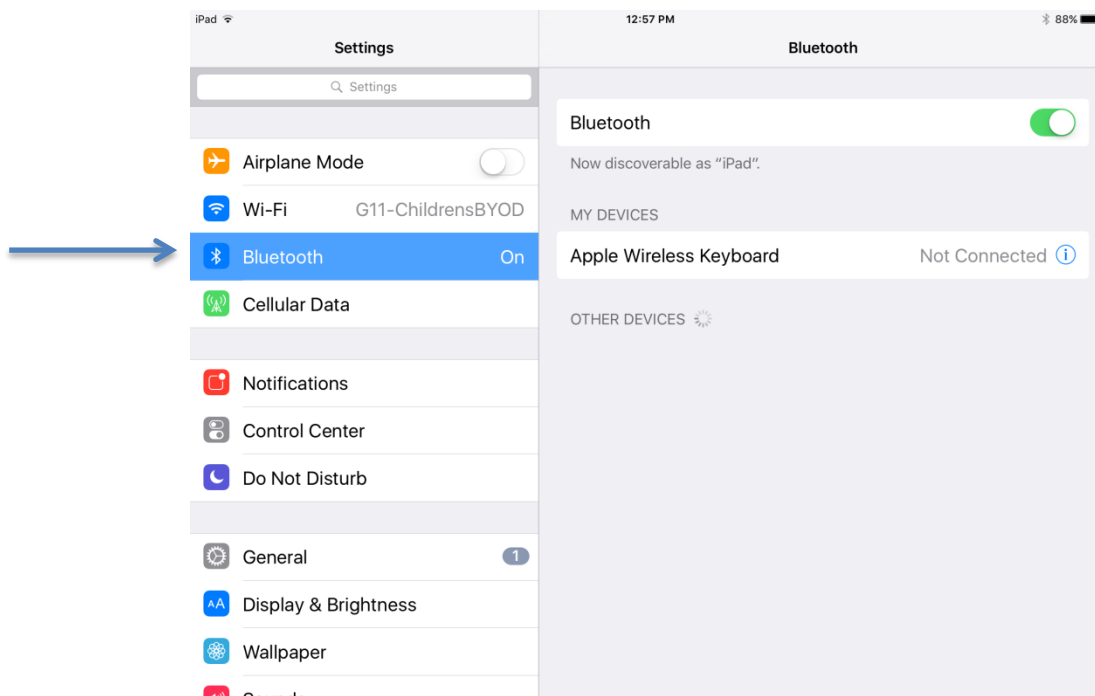
- 1) In the home page tap on the settings icon

Figure 10. Settings Icon



- 2) Turn on Bluetooth

Figure 11. Bluetooth Selection



- 3) Make sure the keyboard is in discovery mode by pressing the round button at the top right end of the keyboard and the small green light to the left of the button begins flashing.
- 4) Select the Keyboard when it appears on the My Devices list on the iPad.
- 5) To turn off the external keyboard, press the round button at the top right end of the keyboard, move at least 15 meters from the iPad with the keyboard, or touch the “information” button on the iPad and touch “forget this device.” I have found it easier and more reliable to turn off Bluetooth on the iPad.