

Developing Apps to Measure Cognition

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CSD



Speech Tech Humor

<https://twitter.com/BGT/status/987246997928333312>



Attention Test

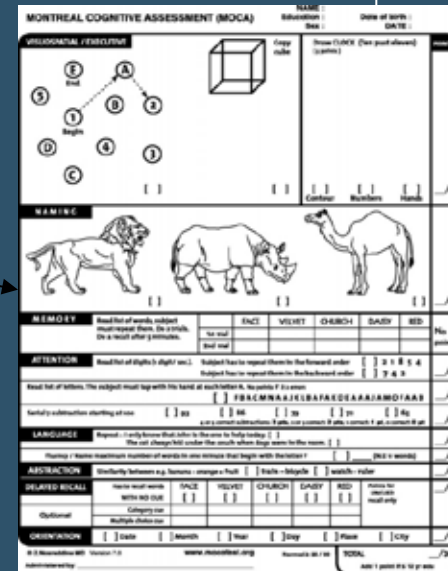
<https://youtu.be/Ahg6qcgoy4>



Cognitive Assessment Methods

Traditional Assessment of Cognitive Domains?

-MMSE, SLUMS, MOCA



The image shows a portion of the Montreal Cognitive Assessment (MOCA) form. It includes sections for 'Visuospatial / Perceptual', 'Naming', 'Memory', 'Attention', 'Language', 'Abstraction', 'Delayed Recall', and 'Orientation'. Each section contains specific instructions and a grid for recording scores. For example, the 'Naming' section shows three animals (lion, rhinoceros, camel) with corresponding boxes for naming them. The 'Memory' section includes a list of words to be recalled. The 'Attention' section features a digit span test. The 'Language' section includes a sentence completion task. The 'Abstraction' section asks for similarities between objects. The 'Delayed Recall' section asks for the category of a word. The 'Orientation' section asks for date, month, year, day, place, and city.

Functional Cognitive Assessment?

-EFPT, MET, Kettle Test

Structured Observation?

-during ADL/IADL, etc



Assessment Measures

Traditional Assessments

Often focused on cognitive
domain/impairment

Timely to administer

Reliability issues

Time to score and administer

Capturing qualitative info difficult

Storage, transport, set up, etc.



Wouldn't it be nice if...

There was an assessment that:

- Consistent test delivery

- Automated administration and scoring

- Captured qualitative info

- Allowed therapist to better observe performance

- Captured speed of processing

- Provided immediate feedback



iPad based Cognitive Assessments



Development and Research

Idea to Implementation was >2 years

Developer

Human Behavior

Norming

Research

MGH Institute Health Professions

Duquesne University

Nazareth College



STAC

The Standardized Touchscreen
Assessment of Cognition

iPad based
Assessment of Cognitive Domains
Auto generating report
Qualitative and Quantitative



FSTAC

The Functional Standardized Touchscreen
Assessment of Cognition

iPad based
Assessment of common
IADL/Functional tasks
Auto generating report
Links Functional tasks to Cognitive
Domains



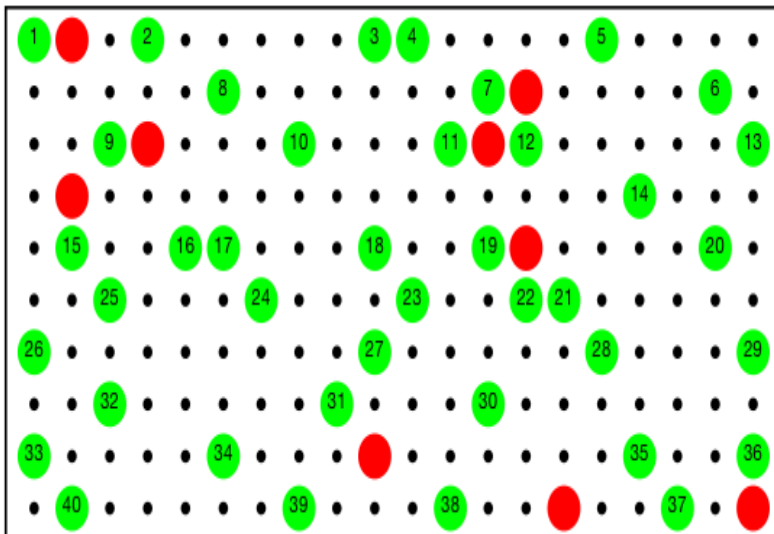
Letter Cancellation Comparison

STAC

Captures:
Approach
Organization
Time as factor
Omissions/Errors
Quadrants

WMZWGHJSPWWBNVAWQOIT
DALNVWDFHJLNWMBGDWH
GXWMHDAWSDGMMWBNDSRW
SMGPSHFLNBVXZDFGW LKJ
EWTFWWDEFWXBWMSDHGWB
TAWDVAWSDFWPVWWXVPLN
WGKGIHJBVWCSRTYWSBXW
KHWNOTYUWP IGW FUGJSTR
WZUYPWREQMBNKLJHWDSW
CWRUYUDZWCFVWAQMCRWTM

Done



Traditional

ø a s f t n x t w l
k b r c d h ø m y r
a ø p u m i g h d c
n i t r ø c j l n v
c u g a o w p h k d
c h b z n e k d s p
k u l n g f y c e s
k a z k t m ø q k i
o r d h k n ø x u t
r t a k j v g s n i
y ø f z k h f t ø i
j m g t v w a l s j
d n v u t y r e z l

W M Z W G H J S P W	W B N V A W Q O I T
D A L N V W D F H J	L N W M V B G D W H
G X W M H D A W S D	G W M W B N D S R W
S M G P S H F L N B	V X Z D F G W L K J
E W T F W W D E F W	X B W M S D H G W B
T A W D V A W S D F	W P V W W X V P L N
W G K G I H J B V W	C S R T Y W S B X W
K H W N O T Y U W P	I G W F U G J S T R
W Z U Y P W R E Q M	B N K L J H W D S W
C W R Y U D Z W C F	V W A Q M C R W T M

Done

Key Points

- 200 letters on page
- 10 targets/quadrant
- Auditory cue
- Can de-select if error
- Tracks sequence of taps
- Times out after 15 seconds of inactivity
- Score based on %correct/time
- Provided with a raw and percentile score
- Provided with a visual of the tasks


Letter Cancellation Subtest



STAC Report

Components of Report

1. Cognitive Domain
2. Test Description
3. Correct Response
4. Patient Response
5. Response Time

 STAC Standardized Touchscreen Assessment of Cognition		Last Name O.	First Name T.	Middle Initial L.
D. [redacted] Age 10/5/1974 41		Patient ID # N/A		
Gender Male	Diagnosis Concussion		iPad Rating 1 - very comfortable with an iPad	
Date of Assessment 3/15/2016	Start Time 8:28 AM	Education Level High School	Time to Complete 16 minutes	Total Test Time % 49%
Provider [redacted] Slp		Discipline Ccc Slp	Version A	Help provided None

Cognitive Domain	Test Item Description	Correct Answer	Patient Response	Response Time	Raw Score	%
Orientation	Last Name	O.	O.	55.57	6/6	81%
	First Name	T.	T.			
	Age	41	41			
	Location	Mt Pleasant	Mt Pleasant			
	Date	3	3			
	Time	8:34 AM	08:40 AM			
Language Confrontation Naming	Picture Naming	Feather	Feather	15.51	3/3	63%
		House	House			
		Spoke	Spoke			
Immediate Recall	Auditory presentation of 3 words.	Apple	apple	9.38	3/3	59%
		Bird	bird			
		Pencil	pencil			
Language Word Fluency	Type as many animals as possible in 90 seconds.	(Any animal, spelled correctly, only unique responses are scored.)	cat dog horse chicken deer bird dolphin fish otter chameleon snake lizzard turkey skunk fox moose elk bat	90 seconds fixed	17	91%

T. O.
Patient ID # N/A

STAC Version A
www.cognitive-innovations.com

Date of assessment
3/15/2016

Demo and Hands On STAC



FSTAC



FSTAC - Test Components

Cognitive Components

General Knowledge
Functional math
Auditory & Visual attention
Auditory & Visual Short term memory
Working memory
Language/Reading
Language Auditory Comprehension
Visual/Spatial
Executive Function (Flexibility, Org, Prob solving)
Insight/Awareness of performance

Functional Components

Money ID/Valuation
Medication management
Safety
Cash management: paying and making change
Grocery shopping - Organization, planning
Story listen and recall
Bill pay over phone
Appointment rescheduling
Handling normal distractions
Recalling tasks to do in a day



FSTAC: Key Features

- Functional tasks
- Cognitive categories
- Distractors built in
- Tasks for later
- Pre/Post test questions
- Auditory and written instructions
- Training videos for some tasks



Money Identification and Valuation

Functional Task:

Person identifies US currency by name and value

Cognitive Area Assessed:

1. General Knowledge



25 Cents

Functional Task:

Person makes 25 cents in multiple coin combinations.

Cognitive Area

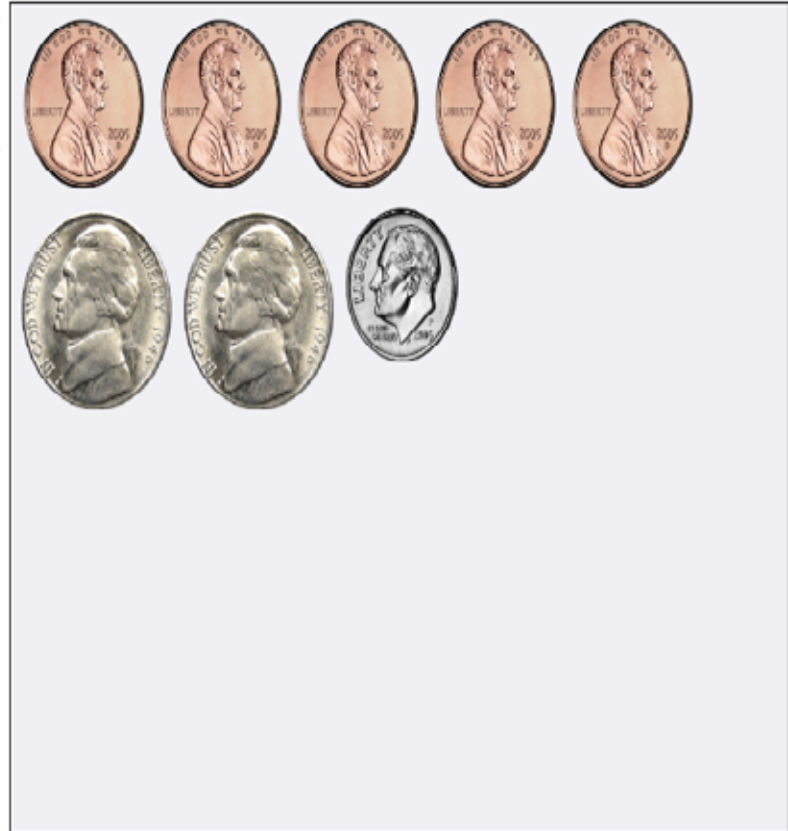
Assessed:

1. Functional Math
2. Executive Function
- Mental Flexibility

Previous answers

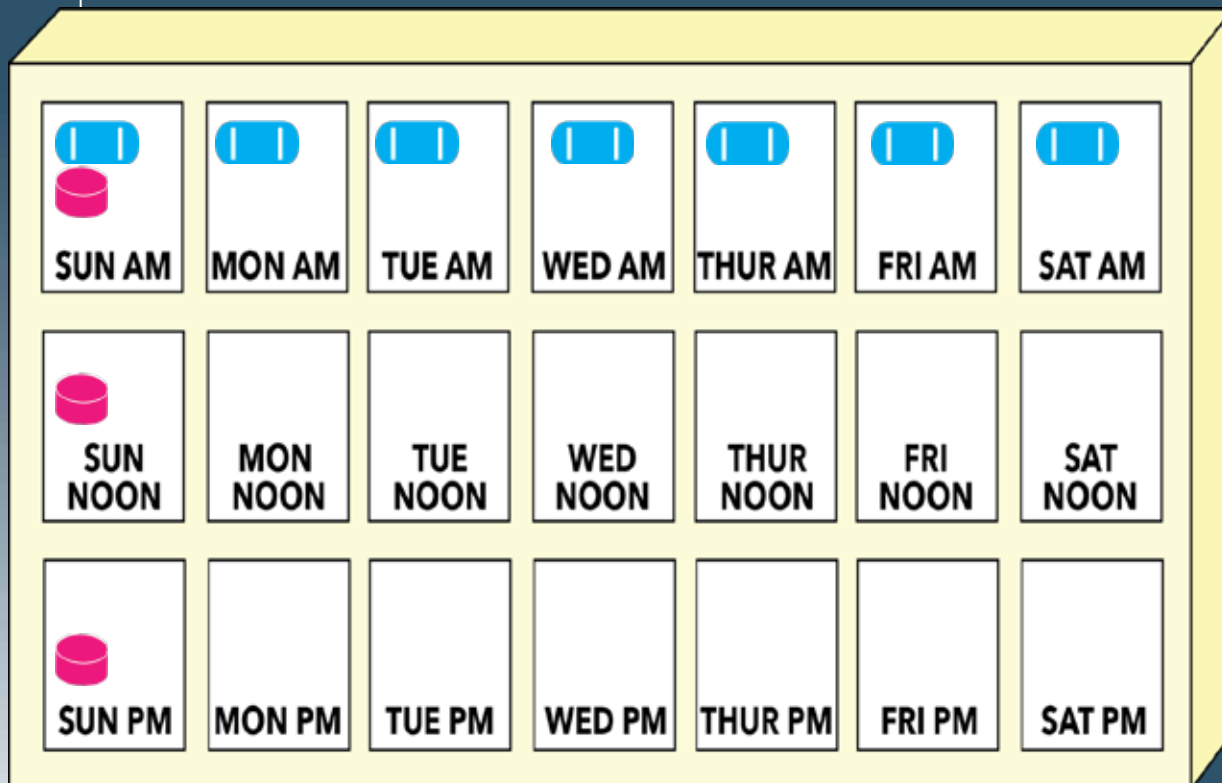


How many ways can you make 25 cents with the coins below?
Touch the coins to add up to 25 cents, and press 'done'



Done





Medication Management

Functional Task:

Person sorts 3 medications into a pill box.

Cognitive Area Assessed:

1. General Knowledge
2. Safety
3. Visual/Aud Attention
4. Language/Reading/Aud Comp
5. Executive Fxn - Organization

Key Features

1. 3 distractors built in.
 - a. Voicemail for later task
 - b. Task to complete later in grocery store
 - c. Safety question



Grocery Shopping

Functional Task:

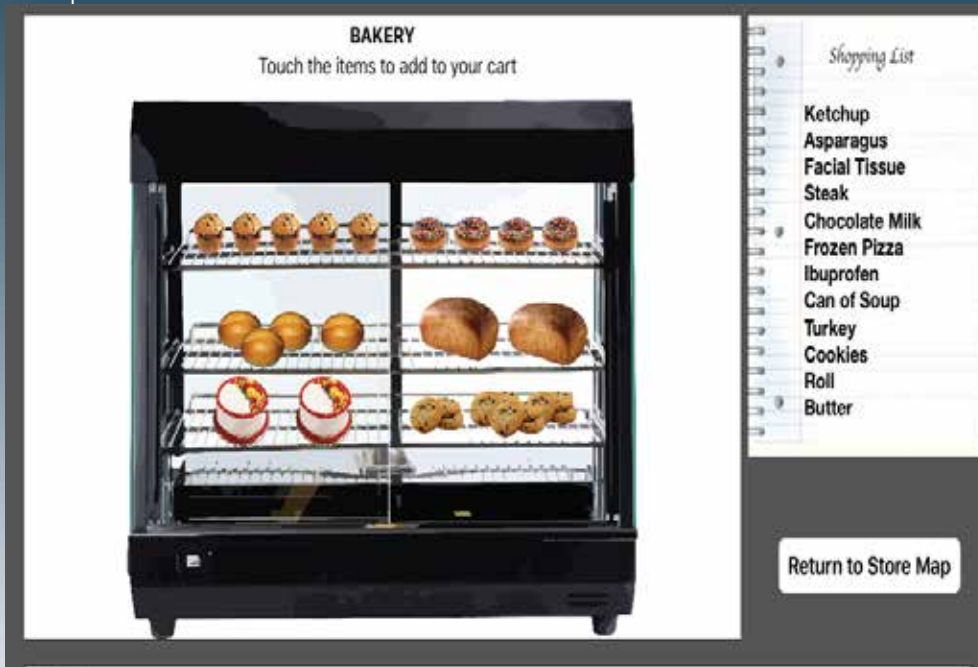
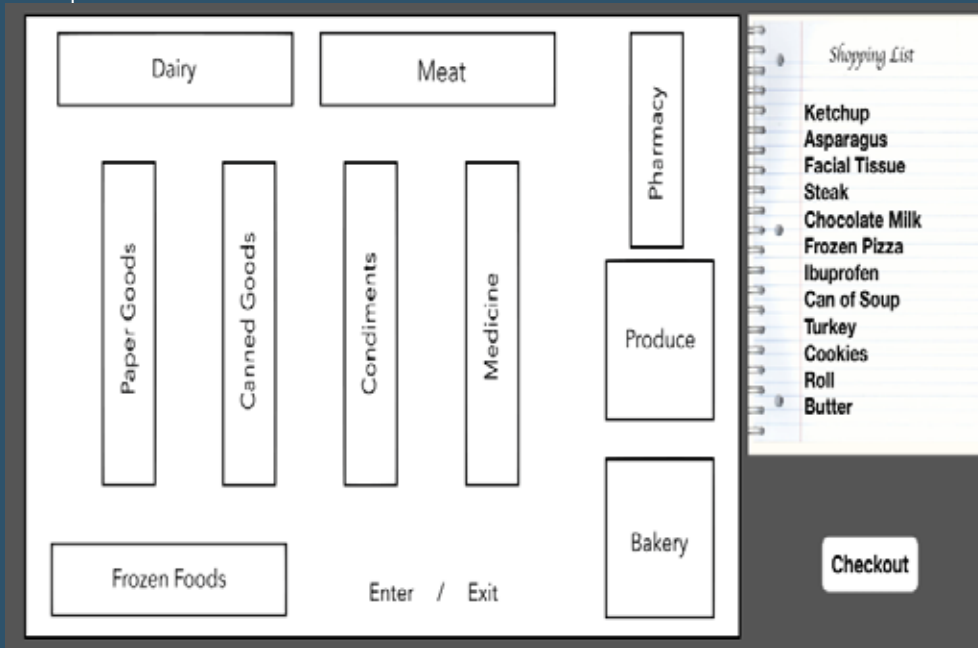
Person given a list of items to obtain at the store. Instructed to use the shortest distance when navigating the store.

Cognitive Area Assessed:

1. Visual/Aud Memory
2. Working Memory
3. Language - Reading/Aud Comp
4. Visual/Spatial
5. Executive Function - Organization

Key Features

1. Text message to obtain an item not on list.
2. Prescription pick up at Pharmacy that was cued in Medication Management subtest.
3. Background Supermarket Sound



Appointment Reschedule

Functional Task:

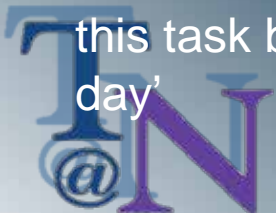
Person listens to audio message from Doctor's office about switching appointment time.

Cognitive Area Assessed:

1. General knowledge
2. Auditory attention
3. Short term memory - Aud
4. Working memory
5. Language
6. Visual/Spatial

Key features

1. Person has to remember to complete this task before 'end of day'



Yes I can

No, I have a conflict

Repeat the audio

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
6 Breakfast with Suzie 9:00AM	7	8 Doctor's Appointment 10:00AM	9	10	11	12
13	14	15	16 Dinner with Len 6:00PM	17	18	19
20	21 Breakfast with Larry 9:00AM	22	23	24 Red's Birthday 11:00AM	25	26
27	28	29	30	31		

Bill Payment by Phone

Functional Task:

Person uses phone to call phone company and pay current bill with credit card.


Cognitive Area Assessed:

1. General knowledge
2. Aud/Visual Attention
3. Working memory
4. Language - Reading/aud comprehension
5. Visual/Spatial

Key Features

1. Phone sounds/realistic phone feel





Total Due:
\$49.31


Payment Due Date
May 1, 2016

Account No.
018082202

John Smith
223 Old St.
Anytown NY, 12345

TEL COM COMMUNICATIONS

Phone payments: Dial 1-800-284-2713



4124 0193 1940 0594


4124 GOOD THRU LAST DAY OF 09/21

John Smith

VISA

1234567890*

#



Better Deal

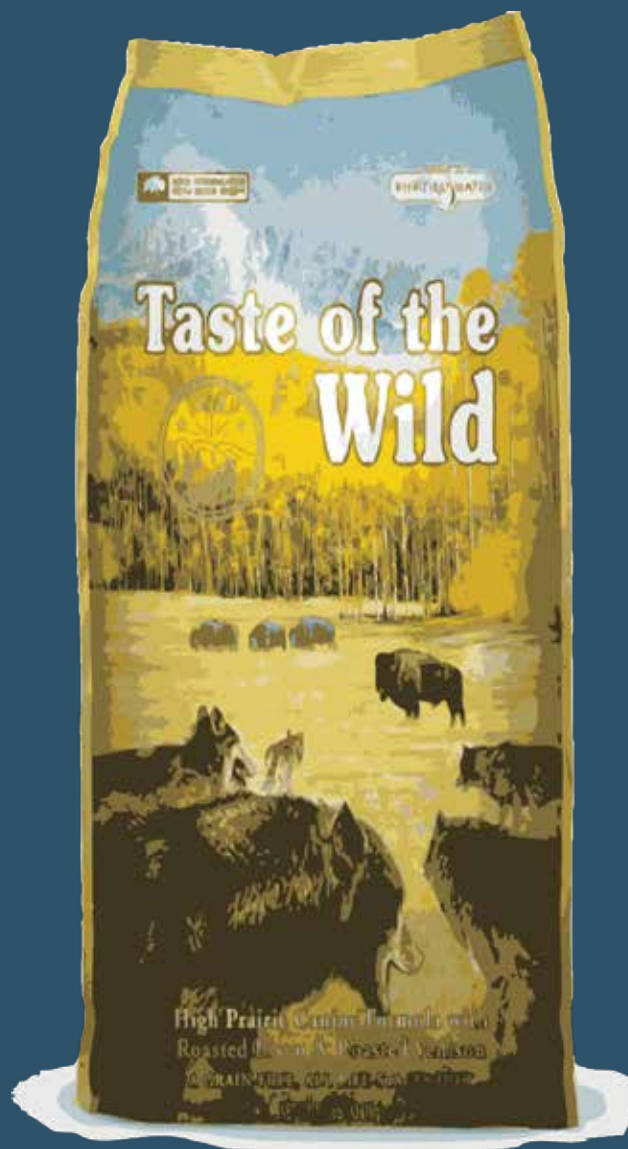
Functional Task:

Person selects the item that is the better price per unit.

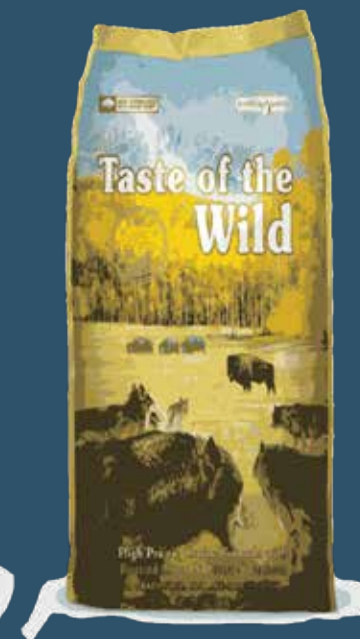
Cognitive Area

Assessed:

1. Functional math
2. Language - Reading
3. Executive function mental flexibility and problem solving.



20lb Bag
\$19.99



10lb Bag
\$10.99



Report Overview

FSTAC Sample Report

Organized by
Functional Task
Includes:
Test Item and
Description
Correct Response
Patient Response
Raw Points
Passing/Failing
Passing Criteria



FSTAC
Functional Standardized Task Assessment of Cognition

Last Name		First Name		Middle
DOB	Age	Patient ID:		
Gender	Diagnosis		iPad Rating	
Date of Assessment	Start Time	Education Level	Raw Score/Total	Tasks Passed
Provider		Discipline	Total Test Time	

Task #	Test Item & Description	Correct Answer	Patient Response	Points	Passing	Passing Criteria
1	Money Identification Person asked to identify 8 pieces of US currency by name.	Nickel		*/8	X OR ✓	All 8 properly identified
		Quarter				
		Penny				
		Dime				
		Twenty Dollars				
		Ten Dollars				
		Five Dollars				
		One Dollar				
2	Money Valuation Person asked to identify 8 pieces of US currency by value.	5 cents		*/8	X OR ✓	All 8 properly identified
		10 cents				
		1 cent				
		25 cents				
		1 dollar				
		5 dollars				
		10 dollars				
		20 dollars				
3	25 Cent Task Provide with coins, patient asked to touch the combination that adds up to \$.25. Repeats until exhausted or 5 attempts	1q		*/5	X OR ✓	4 choices selected (based on norm)
		2d/1n				
		2d/5p				
		1d/2n/5p				
		1d/3n				
4	Medication Management Patient asked to sort 3 medications into a pill box. **3 distractors built in (remember to pick up script, emergency phone number, listen to voicemail)	Correct placement of all pills.	See visual of patient response at end of report.	*/7	X OR ✓	All pills sorted correctly
		Points based on 7 days in week, with 1 point given for each day.				

Last, First
MRN# 12345767

FSTAC

Date of Assessment
3/8/2013

Benefits of STAC and FSTAC

1. Evaluate a person's function/interaction in a cognitively demanding task
2. Observe strategies used during the assessment
3. Observe breakdowns in realtime that affect performance
4. Immediate access to a report that provides quantitative and qualitative information
5. Gain practice efficiencies which may allow intervention sooner

