Assessing the eCOA User Experience (UX) for Evaluating Virtual Functional Outcomes

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METHODOLOGIAL QUESTION

Evidence for using digital technologies to improve outcomes in health care is growing at a rapid rate. "Applied games" (computerized) have the potential to assess the impact of therapeutic interventions by improving engagement through both game-based and motivational dynamics. The Virtual Reality Functional Capacity Assessment Tool (VRFCAT) is an "applied" game-based tool to assess functional capacity. It is reliable, valid, and sensitive to changes in function across populations (Keefe et al., 2016; Atkins et al., 2018). Using a virtual environment, the VRFCAT assesses a subject's ability to complete instrumental activities associated with a shopping trip and has the potential to greatly enhance the delivery and impact of health care in individuals with varying levels of functional disabilities. Assessing and applying knowledge about User Experience (UX) was a fundamental part of this process, and a key step in refining the VRFCAT's ability to be utilized across various populations. UX on the VRFCAT and other game-based systems is an important aspect to help users (clinicians, researchers, subjects, therapeutic developers) achieve the suggested goals. To our knowledge, there are no guidelines or validated questionnaires for testing usability or satisfaction for "applied" game-based systems.

AIMS

To investigate the effectiveness of UX (usability evaluation and cognitive interviewing) methods as part of scale validation for the VRFCAT.

METHODS

651 participants (591 healthy control adults (HC), 72 individuals with subjective cognitive decline (SCD)) were enrolled.

Participants with SCD had total scores of ≥ 4 on the Mail-In Function Cognitive Screening Instrument (MCSFI).

UX methods included:

- **1 – 7 point questionnaires completed by subjects (higher scores indicating better experience)**
- **interviewers on overall computer usage**
- **participants experience with the 12 objectives of the VRFCAT**

VRFCAT USER EXPERIENCE (UX) QUESTIONNAIRE
Compared to real life, how well did the computerized VRFCAT task reflect your ability to select the appropriate bus?
Compared to real life, how well did the computerized VRFCAT task reflect your ability to find ingredients?
Compared to real life, how well do you think the task reflects your ability to shop for specific items at a grocery store?
Did the computerized instructions explain what you needed to do provide the information needed to complete the task
Did the computerized instructions explain what you needed to do during the grocery shopping task?
Did the computerized instructions explain what you needed to do to select the correct bus?
How familiar were you with making planning a meal based upon from a recipe?
How easy or difficult did you find it to follow the instructions?
How easy or difficult did you find it to use the computer controls?
How familiar are you with grocery shopping?
How familiar are you with using public transportation?
How pleasant or unpleasant did you find the computerized task?
How realistic or unrealistic did you find the tasks
How similar to real life would you rate the VRFCAT task of selecting the appropriate bus?
How similar to real life would you rate the VRFCAT task of shopping for specific grocery items?

VRFCAT AND SAMPLE DESCRIPTION

Interactive environment consisting of 4 scenes

1. Exploring the kitchen and creating a shopping list
2. Selecting and paying for the bus to a Grocery Store
3. Shopping and paying for groceries on the shopping list
4. Selecting and paying for the bus home

Objectives

1. Pick up the recipe on the counter.
2. Look for ingredients in cabinets and refrigerator.
3. Cross off the ingredients already in kitchen and pick up bus schedule.
4. Pick up wallet
5. Leave the apartment
6. Wait for the correct bus to the grocery store and then board it when it arrives.
7. Pay required bus fare using exact change.
8. Select a grocery store aisle to begin shopping.
9. Shopping for items on list in correct quantities.
10. Pay for groceries using exact change.
11. Wait for the correct bus home and then board it when it arrives.
12. Pay required bus fare using exact change.

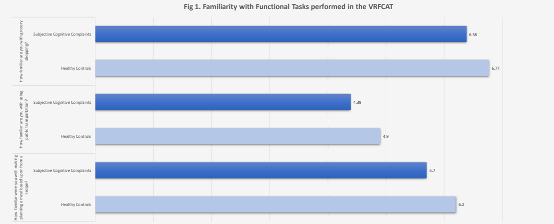
		AGE GROUP			
		Age 20 - 54	> 54 years	SCD	Total
Female	Count	134	170	50	354
	% within SEX	37.90%	48.00%	14.10%	100.00%
Male	Count	120	153	22	295
	% within SEX	40.70%	51.90%	7.50%	100.00%
TOTAL	Count	254	323	72	649
	% within SEX	39.10%	49.80%	11.10%	100.00%

		AGE GROUP			
		Age 20 - 54	> 54 years	SCD	Total
College degree e.g. Bachelor's degree	n	51	39	13	103
	%	49.50%	37.90%	12.60%	100.00%
Doctorate or Professional degree (e.g. Ph.D., M.D., LL.D)	n	2	23	4	29
	%	6.90%	79.30%	13.80%	100.00%
High school diploma or equivalent	n	33	38	13	84
	%	39.30%	45.20%	15.50%	100.00%
Higher than college e.g. Master's degree	n	23	55	8	86
	%	26.70%	64.00%	9.30%	100.00%
Middle school or less	n	2	0	0	2
	%	100.00%	0.00%	0.00%	100.00%
Some college or Associate's degree	n	121	150	32	303
	%	39.90%	49.50%	10.60%	100.00%
Some High School	n	22	18	2	42
	%	52.40%	42.90%	4.80%	100.00%

RESULTS

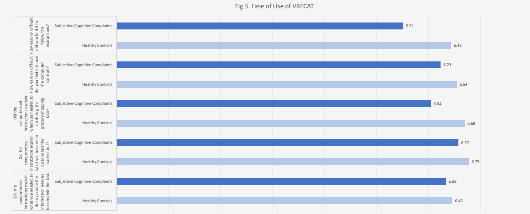
PARTICIPANTS FAMILIARITY WITH FUNCTIONAL TASKS

Fig 1. Familiarity with Functional Tasks performed in the VRFCAT



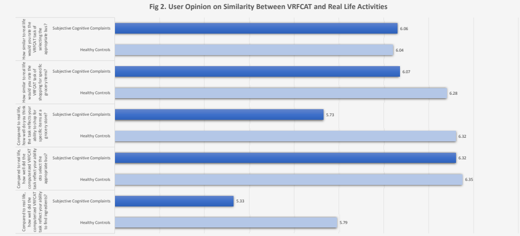
EASE OF USE OF VRFCAT

Fig 3. Ease of Use of VRFCAT



PARTICIPANTS VIEWS ON VRFCAT AND REAL LIFE ACTIVITIES

Fig 2. User Opinion on Similarity Between VRFCAT and Real Life Activities



- 75.78% (HC) and 64.00% (SCD) of subjects found the VRFCAT to be pleasant.
- 95.50% (HC) and 70.00% (SCD) found the instructions easy to understand.
- As the VRFCAT represents real life activities, when asked how realistic did the subject find the task, 86.16% (HC) and 78.00% (SCD) found the tasks completely realistic, with 0.06% (HC) and 0.00% (SCD) group reporting the task was unrealistic.
- Significant differences were observed in mean scores for difficulty using the computer controls (HC = 6.54, SD = 0.95; SCD = 6.23, SD = 1.33, $p < 0.001$), familiarity with shopping at a grocery store (HC = 6.77, SD = 0.77; SCD = 6.38, SD = 1.39, $p = 0.002$) and comparing the task to real life and the subject's ability to shop at the grocery store (HC = 6.32, SD = 1.78); SCD = 5.73, SD = 1.81, $p = 0.002$).

CONCLUSIONS

- This study identifies a user-centered design approach implemented in assessing UX to inform scale refinement, revisions and validation.
- As a result of this study, a version of the VRFCAT for MCI and SCD has been developed and is undergoing a large validation study at Duke and USC.
- Adopting UX research methodologies will help ensure that game-based and virtual assessments satisfy usability evaluation, and meet the needs of users.

DISCLOSURES AND CONTACT INFORMATION

Disclosures: A Khan currently and in the last 3 years has received funding from NIMH, and is an employee at VeraSci. A.S. Atkins currently or in the past 3 years has received funding from the NIMH and NIA, and is an employee of VeraSci. DU, RB, DB, AV, HS, AH and HD are full-time employees of VeraSci. RK is co-founder and CEO of VeraSci and currently or in the past 3 years has received investigator-initiated research funding support from the Department of Veteran's Affair, Feinstein Institute for Medical Research, GlaxoSmithKline, National Institute of Mental Health, National Institute on Aging, Novartis, Psychogenics, Research Foundation for Mental Hygiene, Inc., and the Singapore National Medical Research Council. Currently or in the past 3 years he has received honoraria, served as a consultant, speaker, or advisory board member for Abbvie, Acadia, Aeglea, Akebia, Akili, Alkermes, ArmaGen, Astellas, Avanir, AviNeuro/ChemRar, Axovant, Biogen, Boehringer-Ingelehim, Cerecor, CoMentis, Critical Path Institute, FORUM, Global Medical Education (GME), GW Pharmaceuticals, Intracellular Therapeutics, Janssen, Lundbeck, Lysogene, MedScape, Mentis Cura, Merck, Minerva Neurosciences Inc., Mitsubishi, Monteris, Moscow Research Institute of Psychiatry, Neuralstem, Neuronix, Novartis, NY State Office of Mental Health, Otsuka, Pfizer, Regenix Bio, Reviva, Roche, Sangamo, Sanofi, Sunovion, Takeda, Targacept, University of Moscow, University of Texas Southwest Medical Center, and WebMD. Dr. Keefe receives royalties from versions of the BAC testing battery, the MATRICS Battery (BACS Symbol Coding), and the Virtual Reality Functional Capacity Assessment Tool (VRFCAT). He is also a shareholder in VeraSci. and Sengenix. Philip Harvey, Ph.D, has received Grant/Research Support from Takeda, Stanley Medical Research Foundation. He is a consultant for Alkermes, B-I, Lundbeck, Merck, Otsuka Digital Health, Sanofi, Sunovion, Takeda, Teva.

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