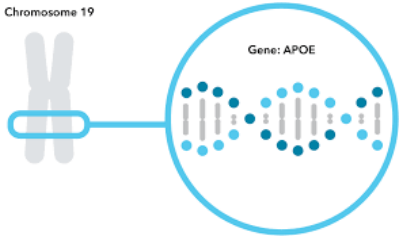
Smartphone-Based Assessments for Alzheimer's Disease Risk Detection & Prevention

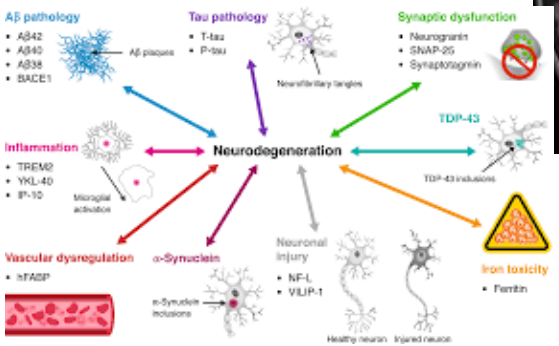
Rhoda Au, Ph.D.

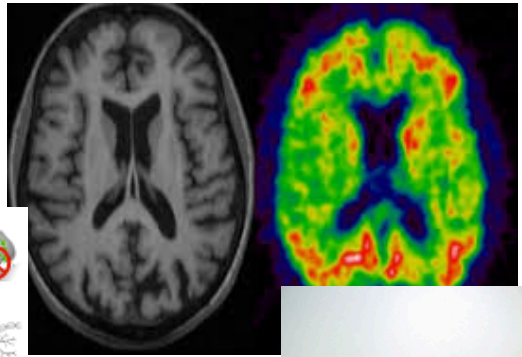
2020 Spring ADRC Meeting

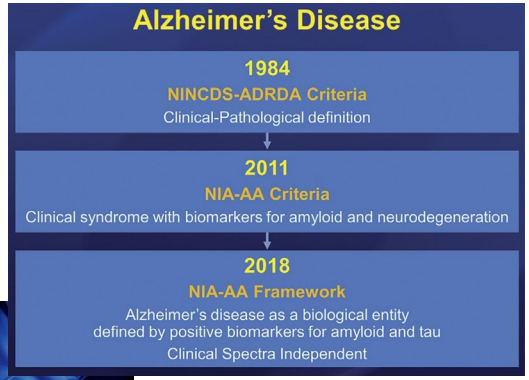
May 1, 2020

What We Keep Doing









23andme.com; Molinuevo, J.L., Ayton, S., Batrla, R. et al. Acta Neuropathol (2018) 136: 821;
Petersen RC, Neurology Aug 2018, 91 (9) 395-402

What We Keep Finding

THE LANCET
Neurology
Volume 10, Issue 9, September 2011, Pages 785-796

Articles

Neuropathologically defined subtypes of Alzheimer's disease with distinct clinical characteristics: a retrosp

Melissa E M
Petersen MD

Front Aging Neurosci. 2019 Aug 20;11:211. doi: 10.3389/fnagi.2019.00211. eCollection 2019.

Topographical Heterogeneity of Alzheimer's Disease Based on MR Imaging, Tau PET, and Amyloid PET.

Jeon S[1], Kang JM[2], Seo S[3], Jeong HJ[4], Funck T[1], Lee SY[3], Park KH[5], Lee YB[5], Yeon BK[2], Ido T[4], Okamura N[6], Evans AC[1], Na DL[7,8], Noh Y[5,9].

Neurology. 2019 Aug 20;93(8):e778-e790. doi: 10.1212/WNL.0000000000007967. Epub 2019 Jul 18.

Cognitive heterogeneity in probable Alzheimer disease: Clinical and neuropathologic features.

Qiu Y[1], Jacobs DM[1], Messer K[1], Salmon DP[1], Feldman HH[2].

What Keeps Happening

SUBSC

THE SCIE

Drug

STAT

MEDICINE

In Shocking Reversal, Biogen to Submit Experimental Alzheimer's Drug for Approval

The decision contradicts an earlier one to halt studies of the therapy, which followed a series of failed drugs that targeted diseased brain protein

By Matthew Herper, STAT on October 22, 2019

ds Between Us

Eli Lilly's Exp

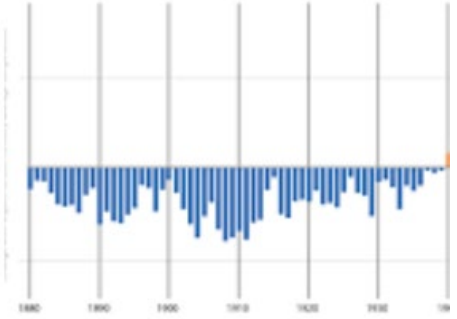
By PAM BELLUCK NOV. 23, 2016

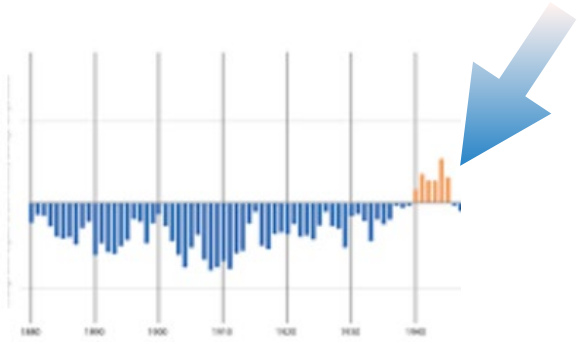
Business

Chinese Alzheimer's Drug to Launch Global Trials Amid Skepticism

Bloomberg News
December 29, 2019, 4:00 AM EST

What We Can Do Differently





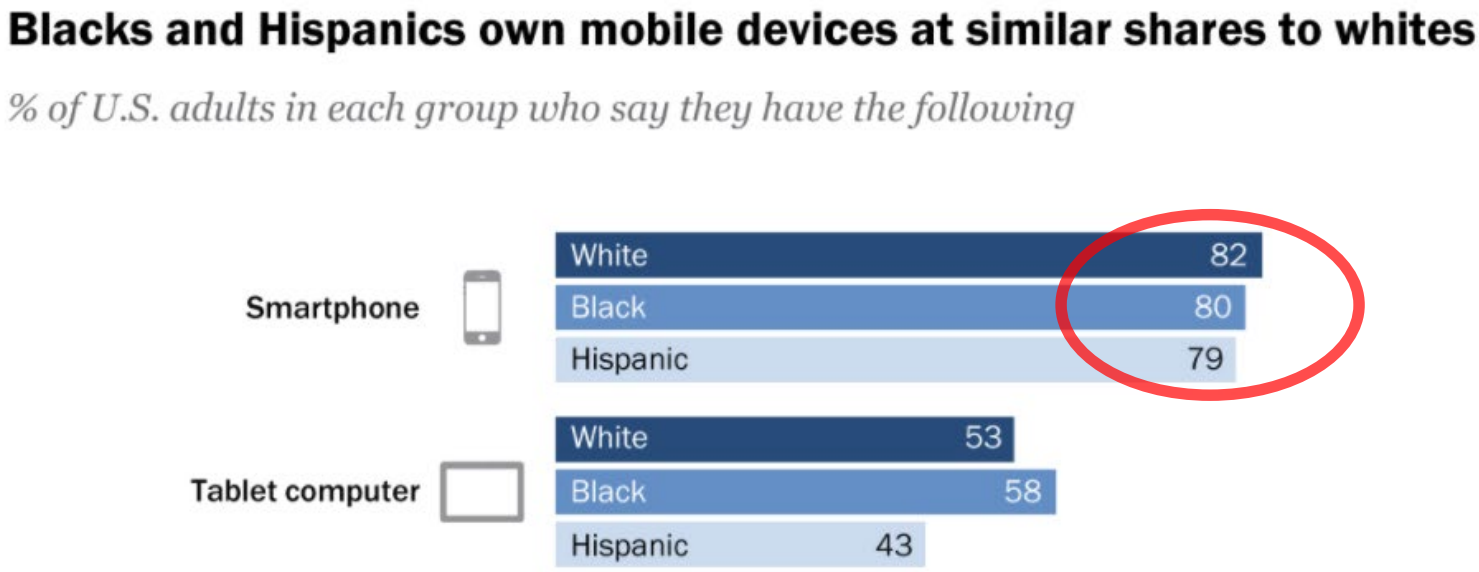
Why Smartphones?

331,002,651 people in U.S.

275,660,000+ have a smartphone

83.3%

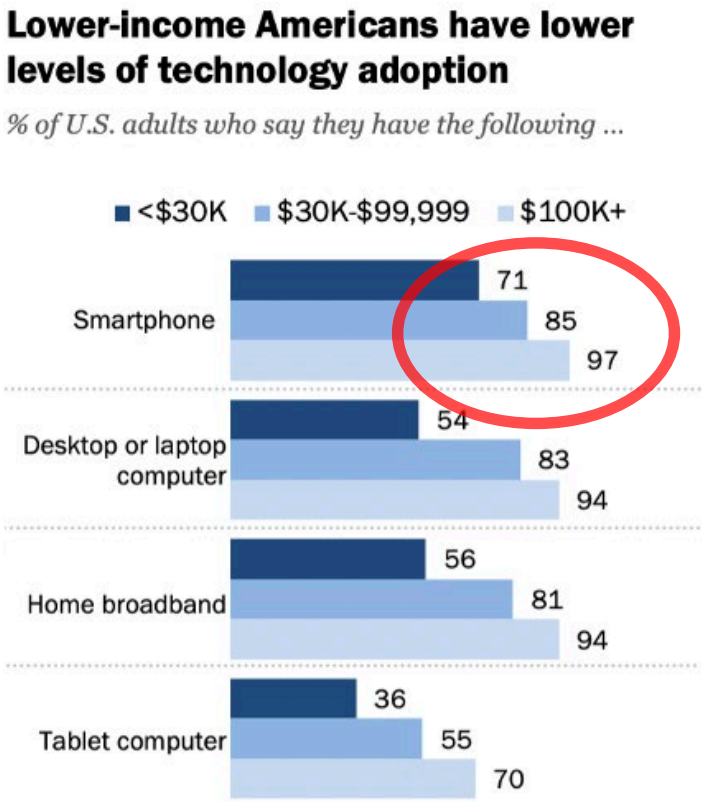
What About the Racial Disparity Divide?

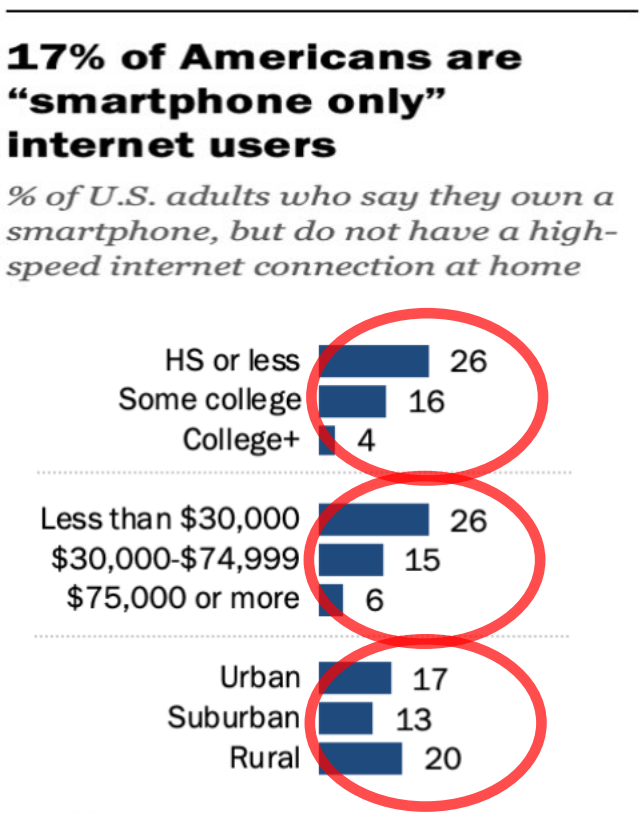


Source: Survey conducted Jan. 8-Feb. 7, 2019.

Pew Research Center

What About the Income Disparity Divide?





PEW RESEARCH CENTER

What About the Age Disparity Divide?

Older adults continue to adopt all forms of modern technology devices.

*Device adoption rates among adults ages 50 and older, **2017 (n=1,520)** and **2019 (n=2,597)***

Older adults tend not to be early adopters, although half bought a tech item in the past year.

Behavior towards new tech

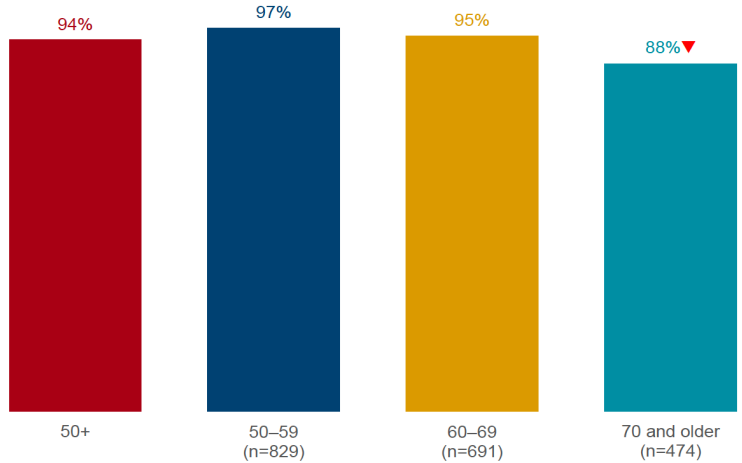
Base: Total Respondents (n=2,576)
Q. NEWTech13. Which of the following best d
make your life easier or better enters the mark

Most smartphone owners use their smartphones daily.

Smartphone owners reporting daily usage

- Nine in ten adults ages 50 and older who own smartphones use their smartphone daily.
- Among adults ages 50 and older who own smartphones, **those ages 50–59 were the most likely to report daily smartphone usage.**

Smartphone daily use rates among owners age 50+



50+,50-59, 60-69, and 70+ Base: Those who own a smartphone (n=1,994); Q. Tech1a How often do you currently use the following?

▲Statistically higher than both groups at the 95% confidence level
▼Statistically lower than both groups at the 95% confidence level

Ambulatory Research in Cognition (ARC)

The ARC app administers very brief cognitive tests up to four times per day for one week. Each test session takes less than 3 minutes.

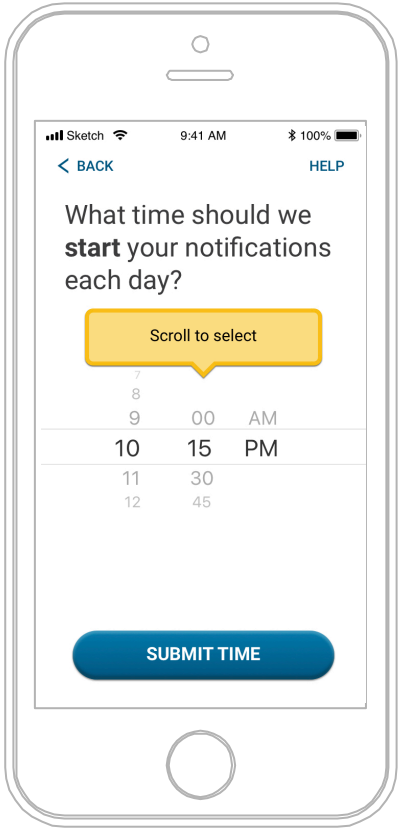
Participants use their personal smartphone, we call it BYOD (Bring Your Own Device).

The idea behind ARC is simple:

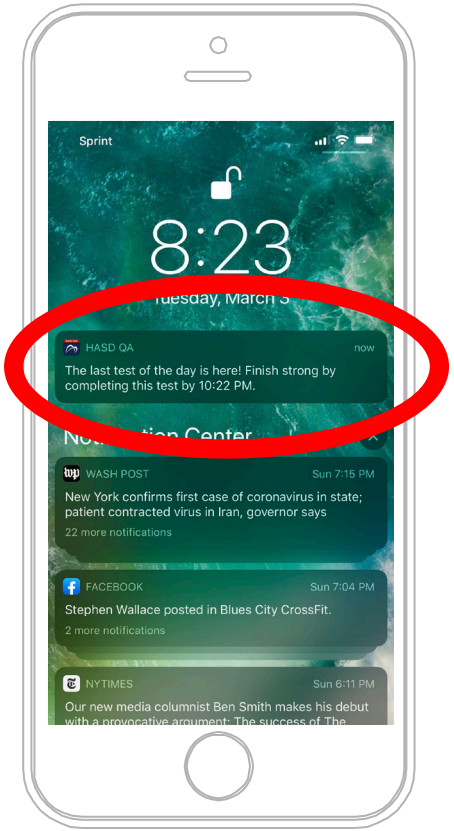
1. **Test often and everywhere.**
2. **Keep it short.**
3. **Combine the results.**

ARC Application
Setup and Notifications

Participants setup availability (wake and sleep times) for one week of testing.

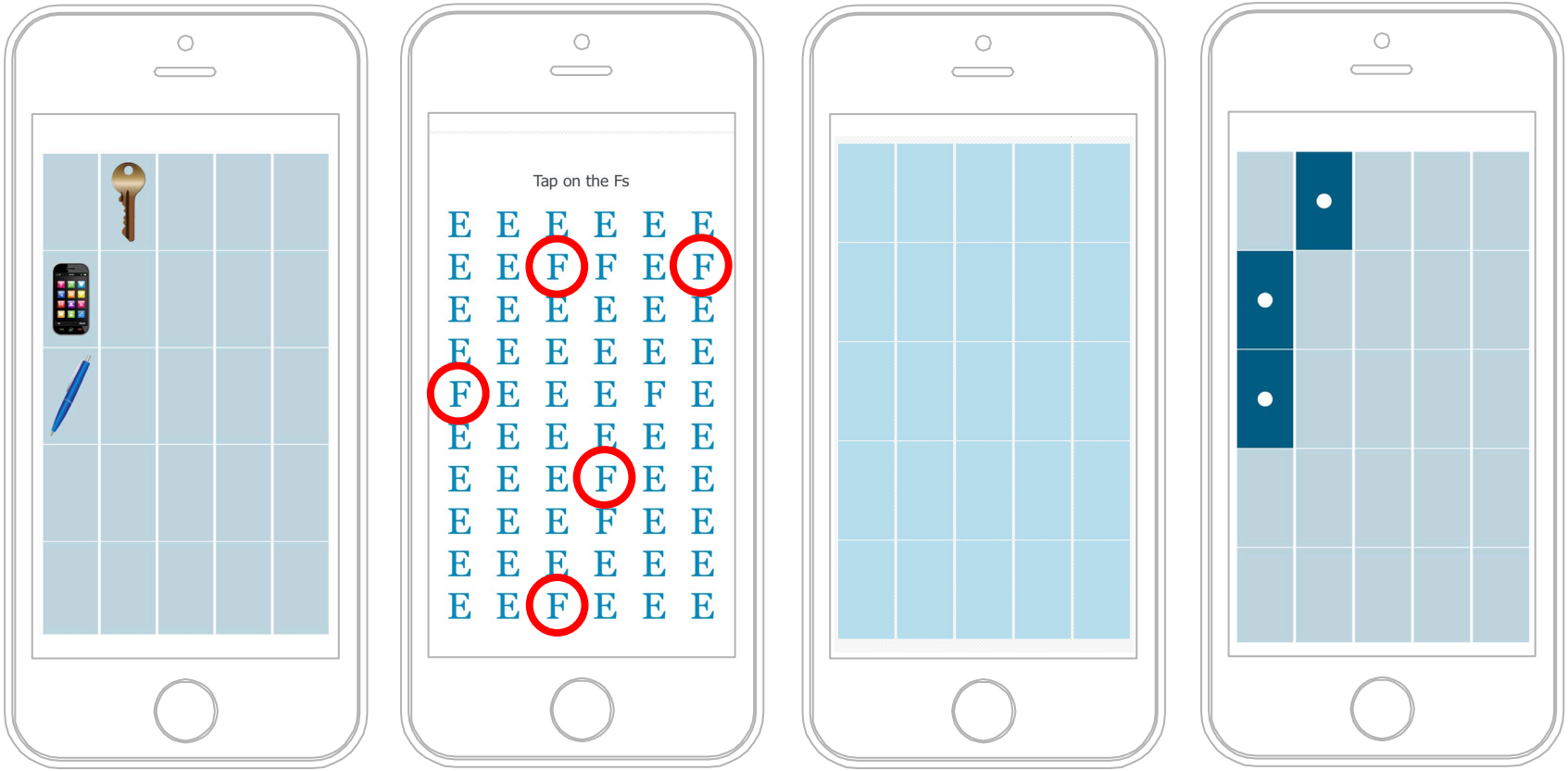


Get a notification that it is “Time to take a quick test”, tap on the notification and begin the test.



GRIDS Test (30-40 seconds)

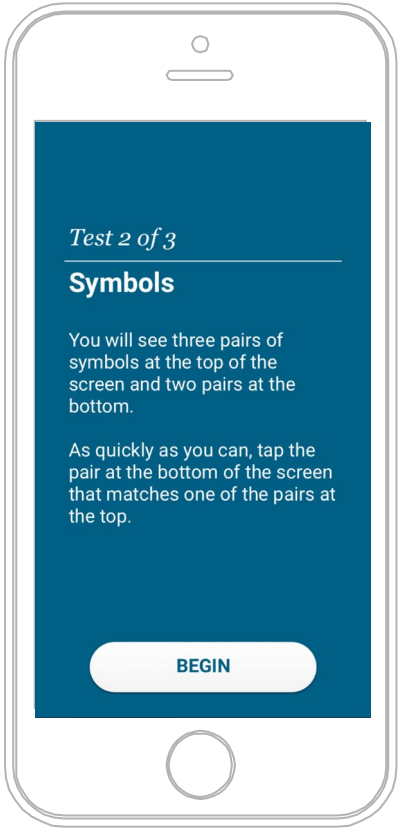
Spatial Working Memory



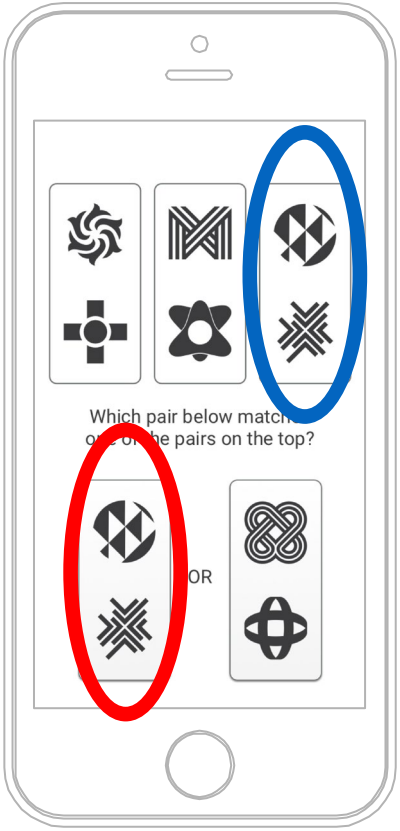
SYMBOLS Test (20-40 seconds)

Processing Speed

SYMBOLS Test Participants are asked Which pair below matches one of the pairs on top?



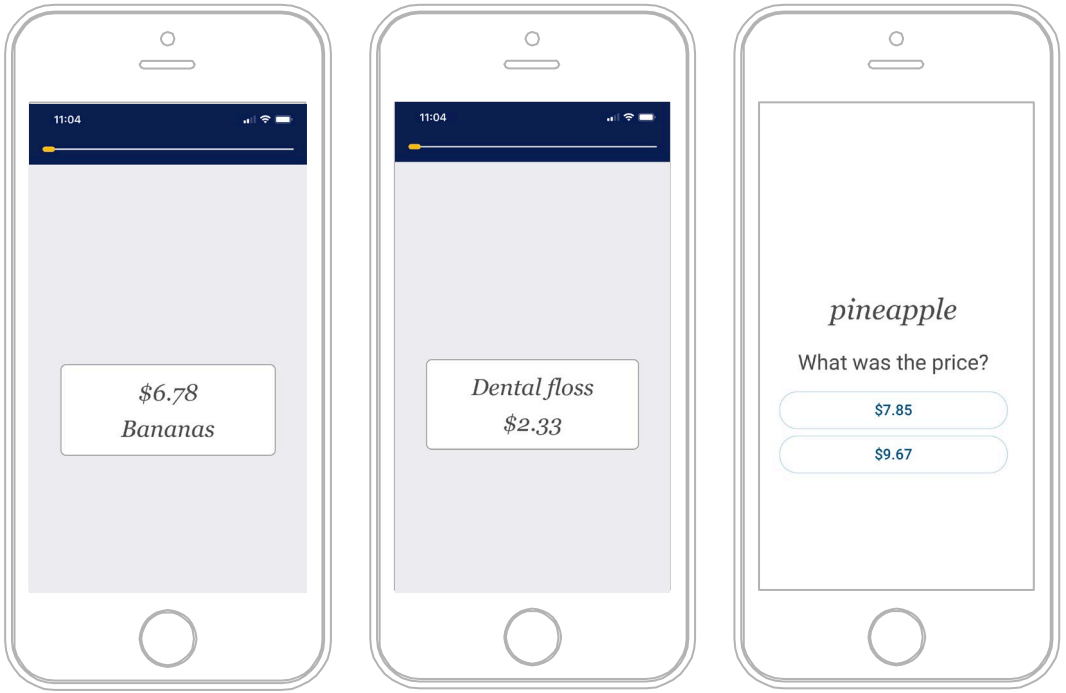
SYMBOLS Test Participants complete 12 items as quickly as possible. Primary outcome: Number correct and response time.



PRICES Test (60 seconds)

Associate Memory

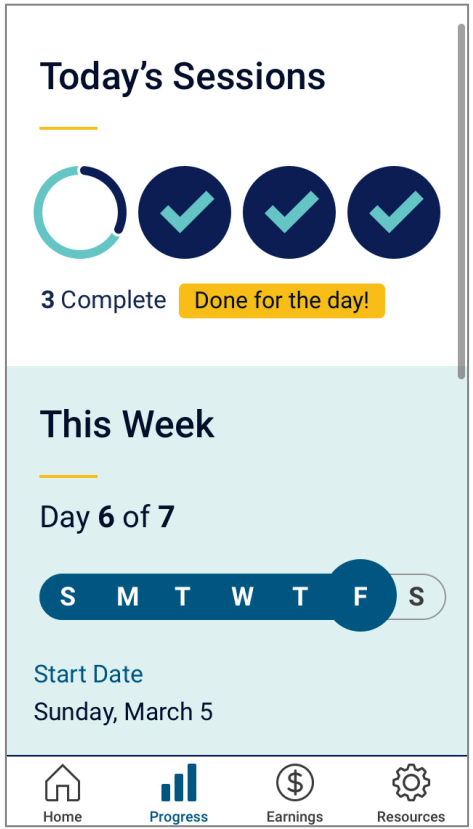
- **Test Parameters:**
  - 10 Price-Item pairs per test.
  - 3s presentation
  - Primary Outcome: Percent Errors

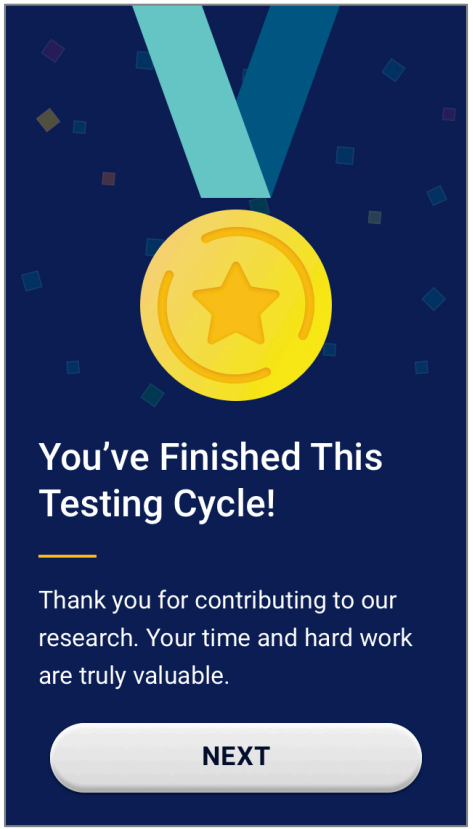


Study Phase

Recall Phase

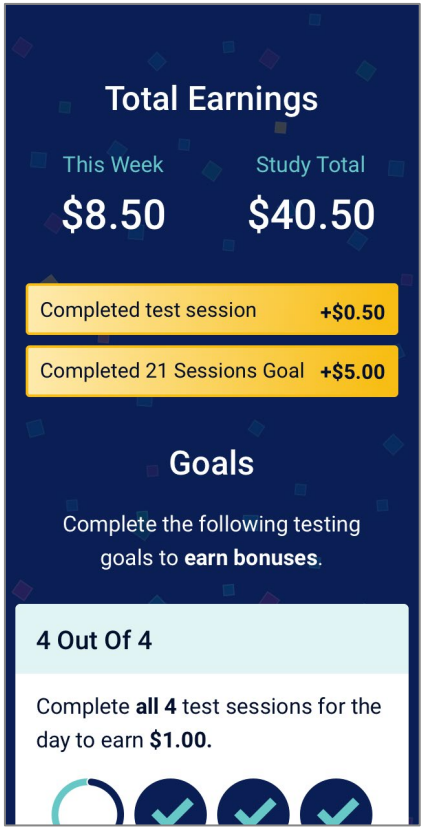
Adherence: User Progress

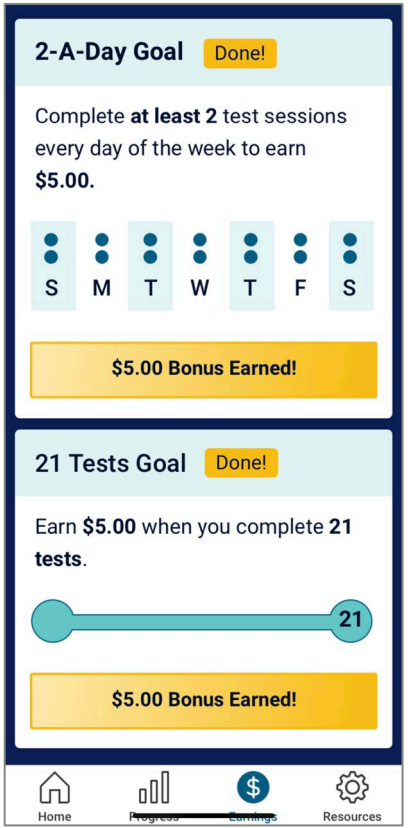




Adherence Strategies cont'd

- Gamification
  - Badges, Achievements, Confetti, etc
- Reimbursement
  - $0.50 per test completed.
  - Bonuses for streaks and overall completion rates. Up to $30 per "visit".





BOSTON UNIVERSITY

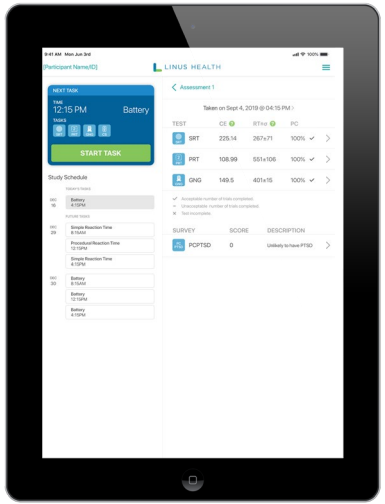
Linus Health Platform

BOSTON UNIVERSITY Alzheimer's Disease Center

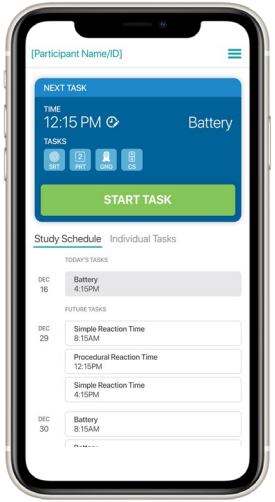
LINUS HEALTH

ECOSYSTEM

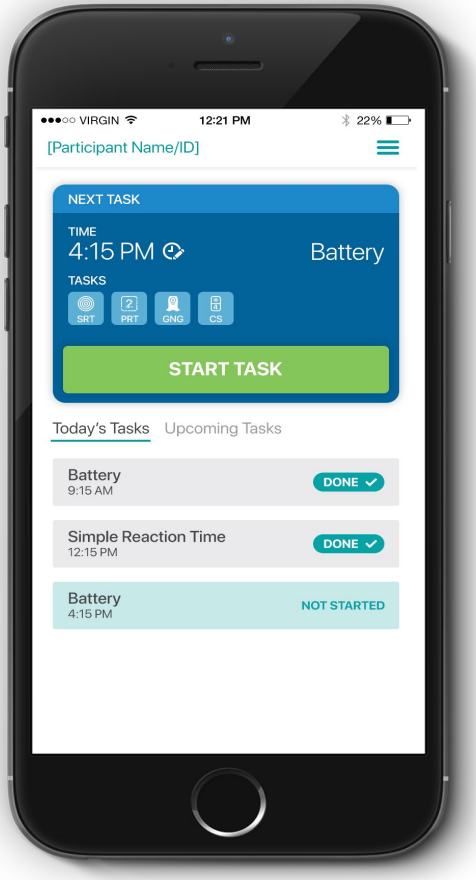
SPONSOR

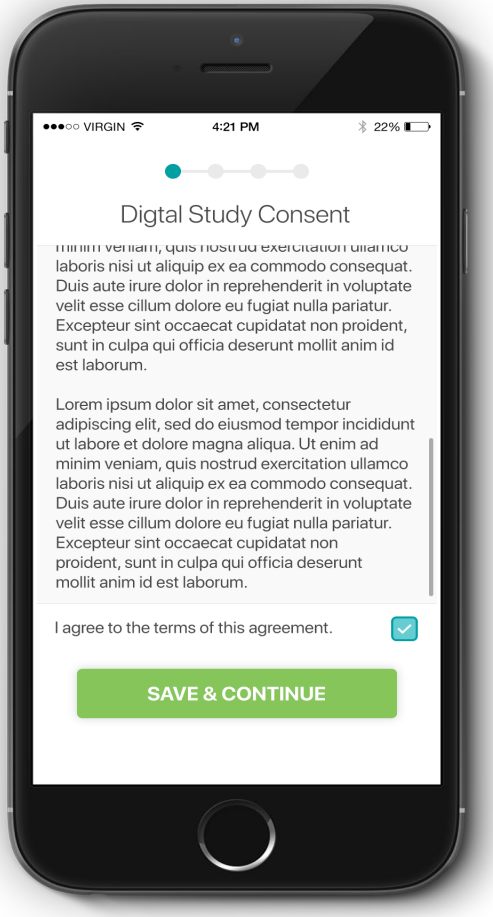


TEST ADMINISTRATOR



END USER


●●●○○ VIRGIN
12:21 PM
22%
[Participant Name/ID]
NEXT TASK
TIME
4:15 PM
Battery
TASKS
SRT
PRT
GNG
CS
START TASK
Today's Tasks
Upcoming Tasks
Battery
9:15 AM
DONE
Simple Reaction Time
12:15 PM
DONE
Battery
4:15 PM
NOT STARTED


●●●○○ VIRGIN
4:21 PM
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Digtal Study Consent
laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.
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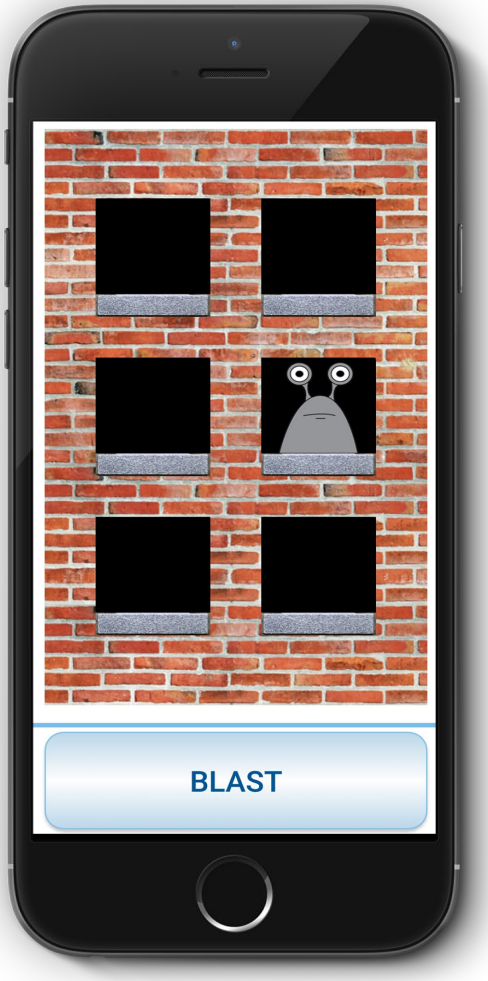
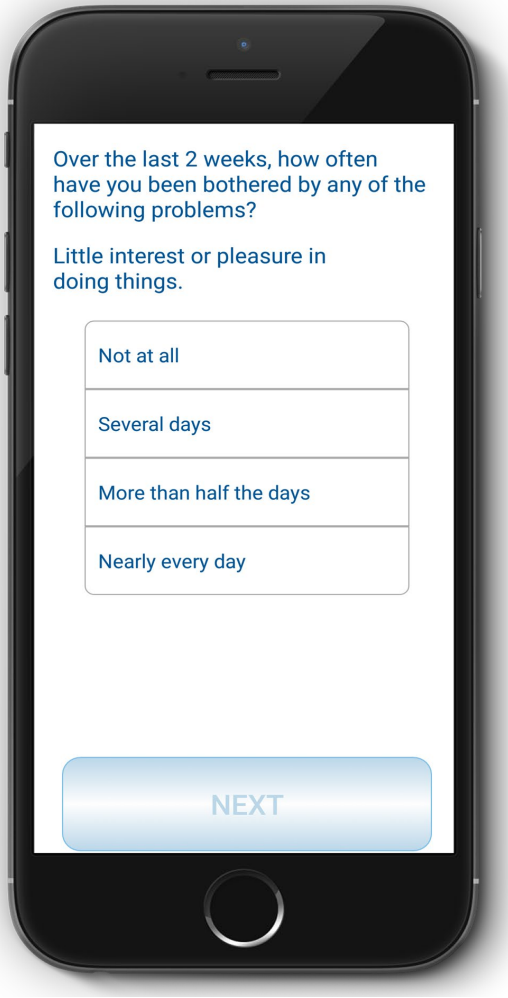
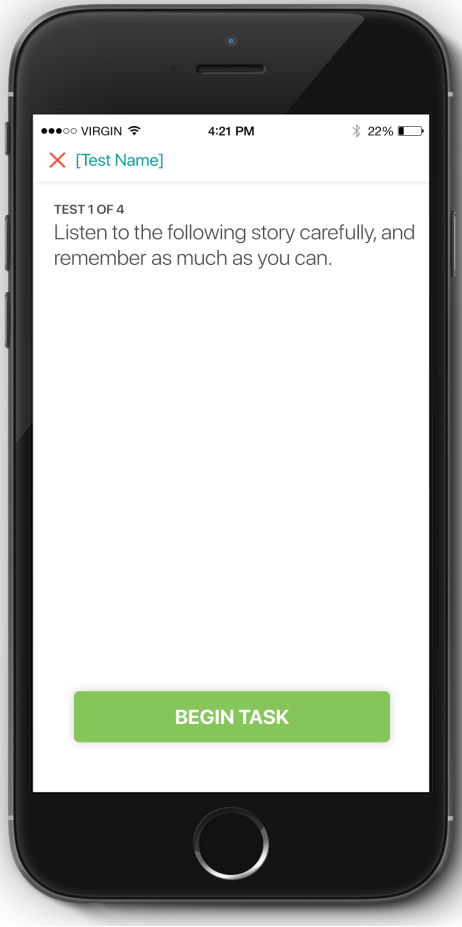
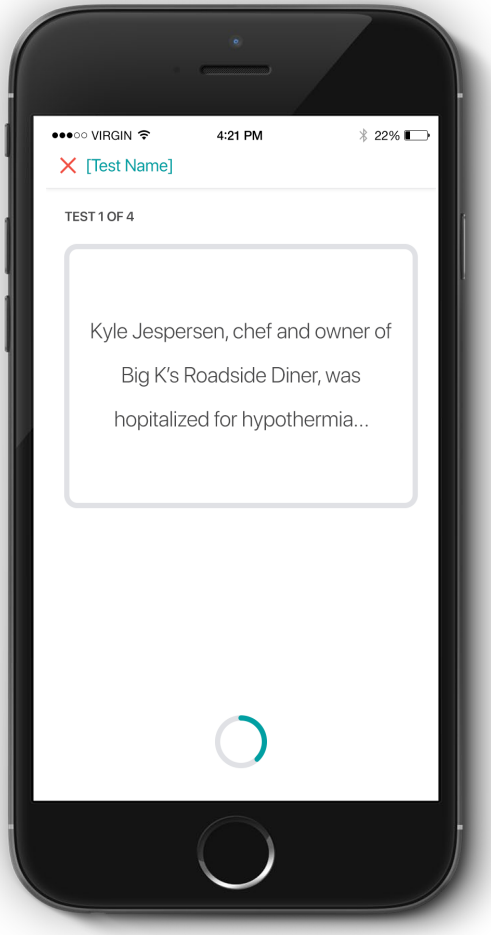
I agree to the terms of this agreement.
SAVE & CONTINUE

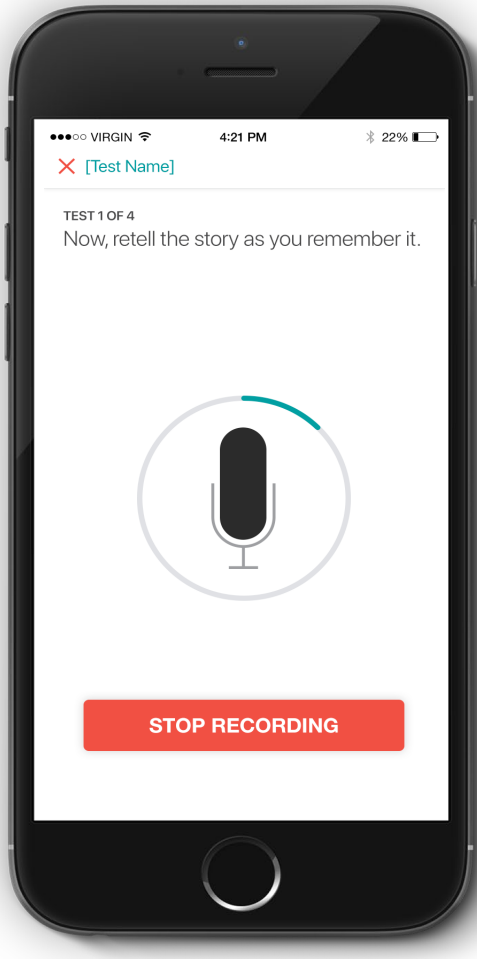

BLAST


In the next section you will be asked a series of questions. Please base your answers on how you have been feeling over the past two weeks.
NEXT


Over the last 2 weeks, how often have you been bothered by any of the following problems?
Little interest or pleasure in doing things.
Not at all
Several days
More than half the days
Nearly every day
NEXT


VIRGIN
4:21 PM
22%
[Test Name]
TEST 1 OF 4
Listen to the following story carefully, and remember as much as you can.
BEGIN TASK


VIRGIN
4:21 PM
22%
[Test Name]
TEST 1 OF 4
Kyle Jespersen, chef and owner of Big K's Roadside Diner, was hopitalized for hypothermia...


VIRGIN
4:21 PM
22%
[Test Name]
TEST 1 OF 4
Now, retell the story as you remember it.
STOP RECORDING

Culture-Language Agnostic

Achieve World Wide Representativeness

Think Different, Be Different