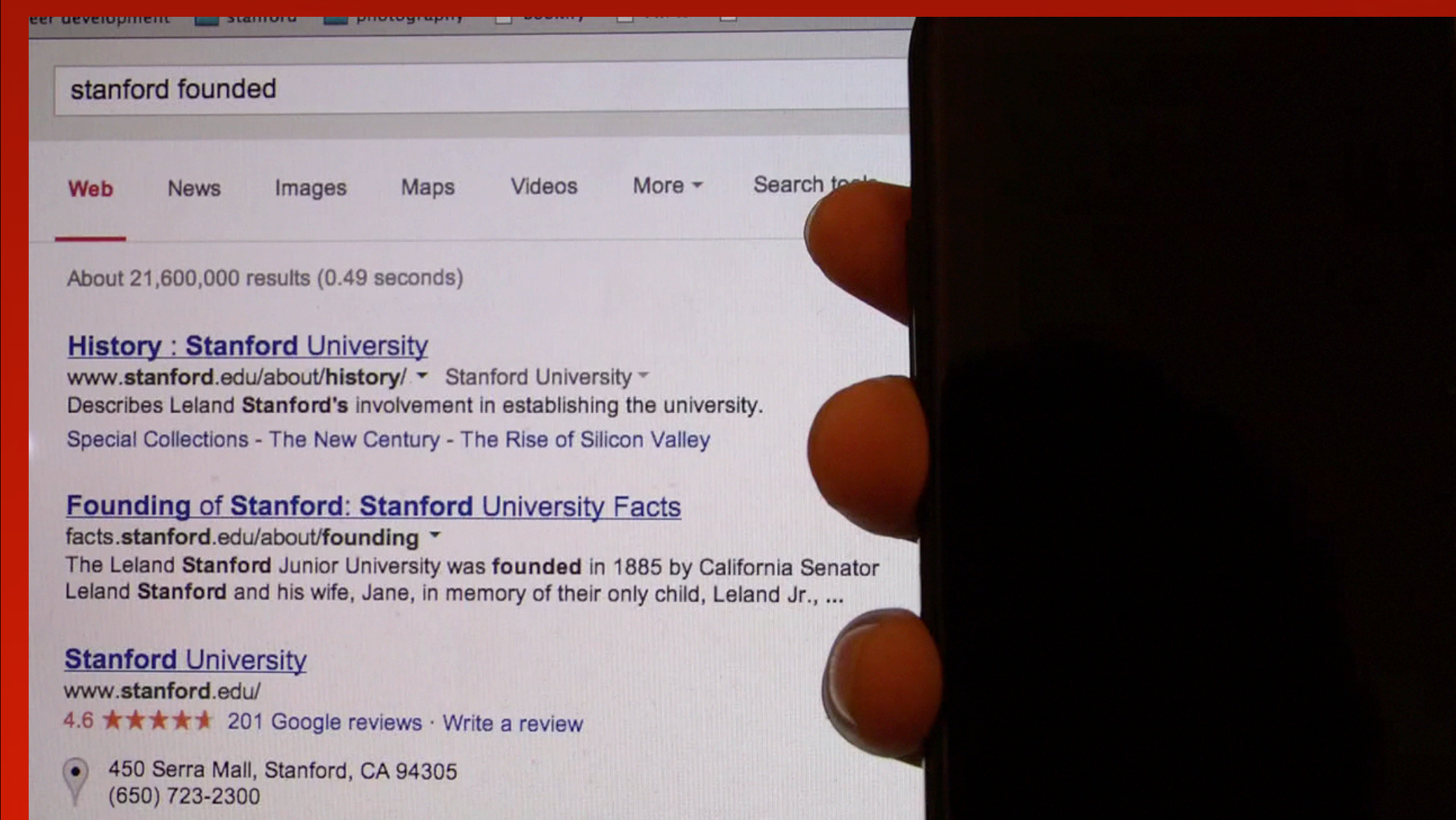


# TWITCH CROWDSOURCING: CROWD CONTRIBUTIONS IN SHORT BURSTS OF TIME

Rajan Vaish, Keith Wyngarden, Jingshu Chen,  
Brandon Cheung, Michael S. Bernstein

*twitch@cs.stanford.edu*





# MORE TIME, FEWER USERS

Crowdsourcing campaigns that cannot motivate participants will fail.

Lack of time is a primary reason experts do not contribute to sites such as Wikipedia.

Even small time requirements can deter users.

Taraborelli, D., Mietchen, D., Alevizou, P., and Gill, A. Expert participation on Wikipedia: barriers and opportunities. Wikimania 2011.

Luther, K. and Bruckman, A. Leadership in online creative collaboration. Proc. CSCW '08, (2008).

Ross, L. and Nisbett, R.E. The person and the situation: Perspectives of social psychology. Mcgraw-Hill, 1991

Nielsen, J. 1993. Usability engineering. Morgan Kaufmann.

# DOWNTIME? CHECK YOUR PHONE.



People spend short bursts of time habitually checking their phones.

CAN WE MOBILIZE  
CROWD PARTICIPATION  
IN **SHORT BURSTS OF TIME?**



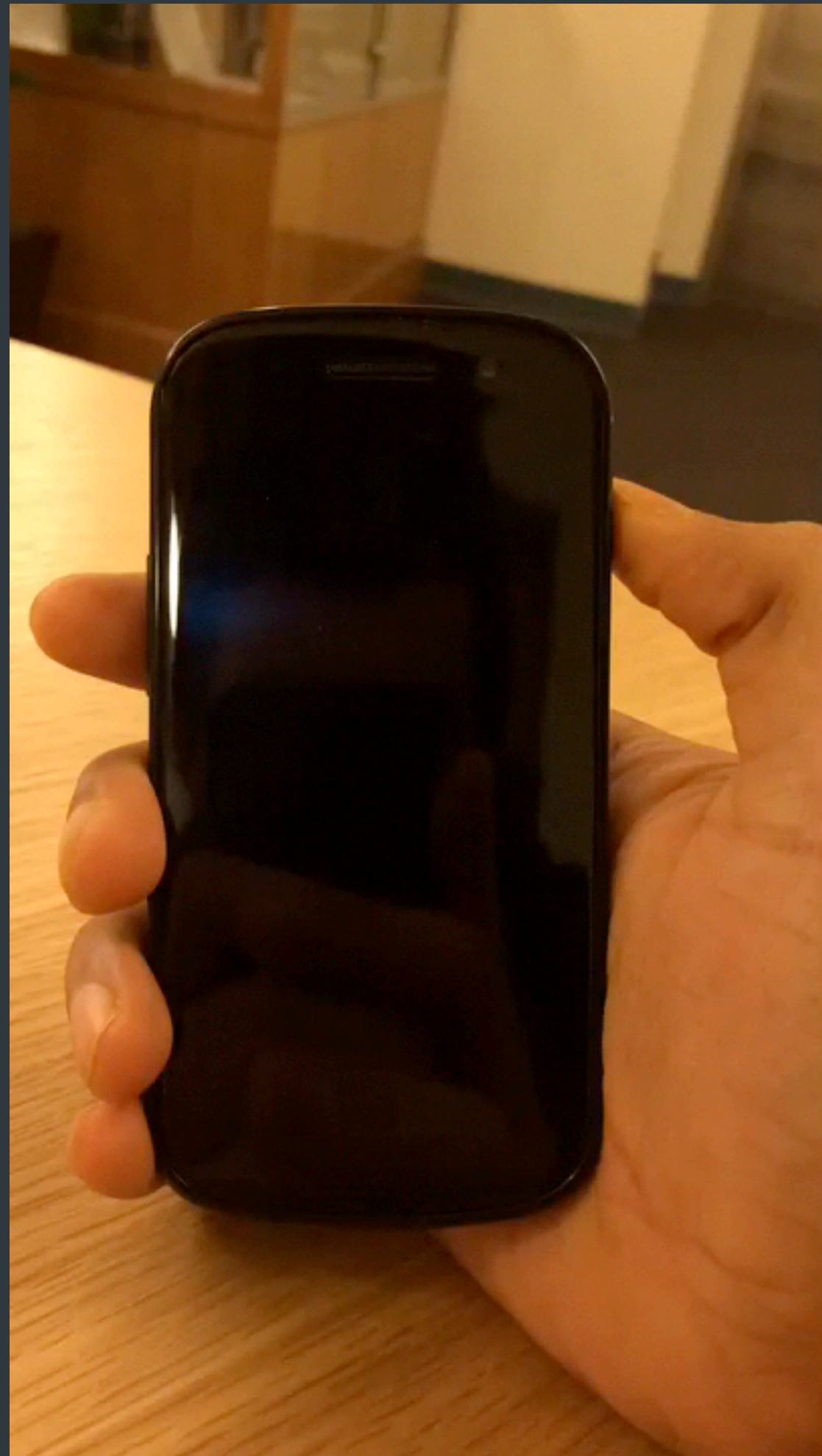
# TWITCH CROWDSOURCING

Quick volunteer crowd contributions in short bursts of time via mobile phone



# UNLOCK: A CAPTCHA FOR YOUR PHONE

Standard slide-to-unlock



Twitch Crowdsourcing





# MOBILE CROWDSOURCING

Applications such as mClerk allow the crowd to participate from their phones.

However, these tasks require roughly 30 seconds.

Gupta A., et. al. mClerk: Enabling Mobile Crowdsourcing in Developing Regions. Proc. CHI'12.

Eagle, N. txteagle: Mobile Crowdsourcing. Proc. IDGD'09.

Yan, T. et.al. mCrowd - A Platform for Mobile Crowdsourcing. Proc. SenSys '09, (2009).

Narula, P., et.al. MobileWorks: A Mobile Crowdsourcing Platform for Workers at the Bottom of the Pyramid. Proc. HCOMP '11.



# POSSIBLE TWITCH APPLICATIONS

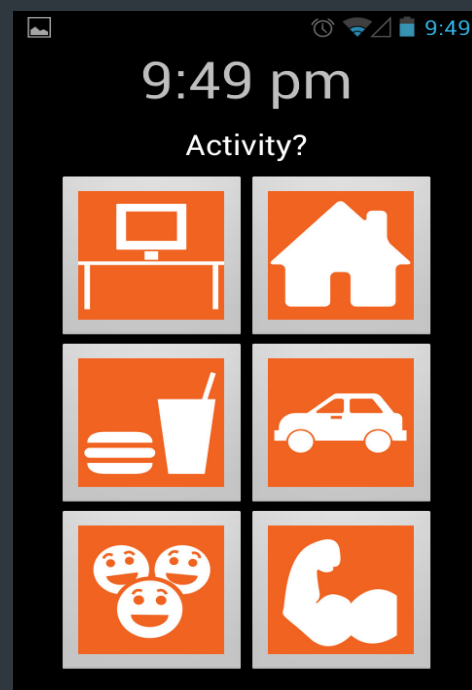
- Map human activity in the world
- Survey a population
- Micro-tutor a student
- Find the best images on the web
- Extract structure from the web
- Filter the news

# THREE DESIGN GOALS

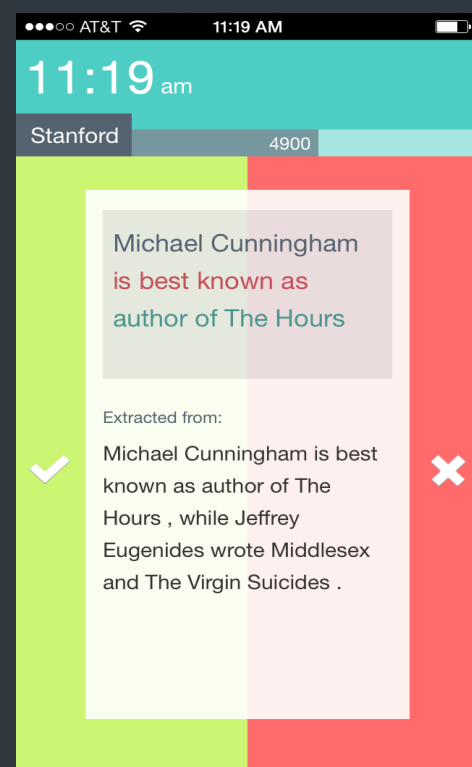
- Understand human behavior
- Supplement artificial intelligence
- Capture subjective opinions



# TWITCH APPLICATIONS



Census



Structuring the Web



Photo Ranking

# TWITCH APPLICATIONS



Census



# MAPPING HUMAN ACTIVITIES

Despite progress in understanding static elements of our physical world - we lack an understanding of human activity.

Yan, T., et.al. mCrowd - A Platform for Mobile Crowdsourcing. Proc. SenSys '09.

Froehlich, J., et al. UbiGreen: Investigating a Mobile Tool for Tracking and Supporting Green Transportation Habits. Proc. CHI'09.

# MAPPING HUMAN ACTIVITIES

Census creates a human-centered equivalent of Google Street View, populated with peoples' activities

Yan, T., et.al. mCrowd - A Platform for Mobile Crowdsourcing. Proc. SenSys '09.

Froehlich, J., et al. UbiGreen: Investigating a Mobile Tool for Tracking and Supporting Green Transportation Habits. Proc. CHI'09.

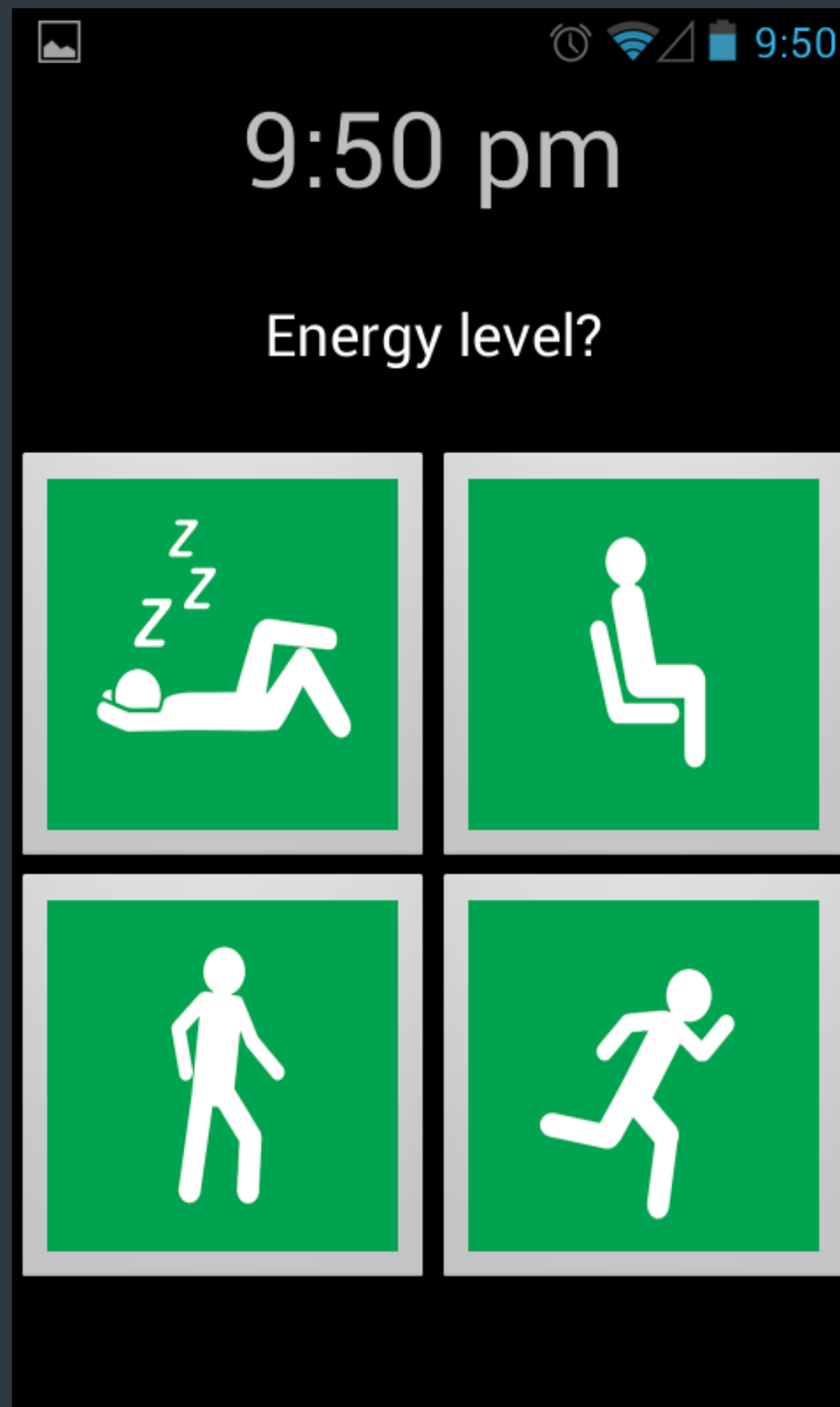


# CENSUS: HOW MANY PEOPLE AROUND?



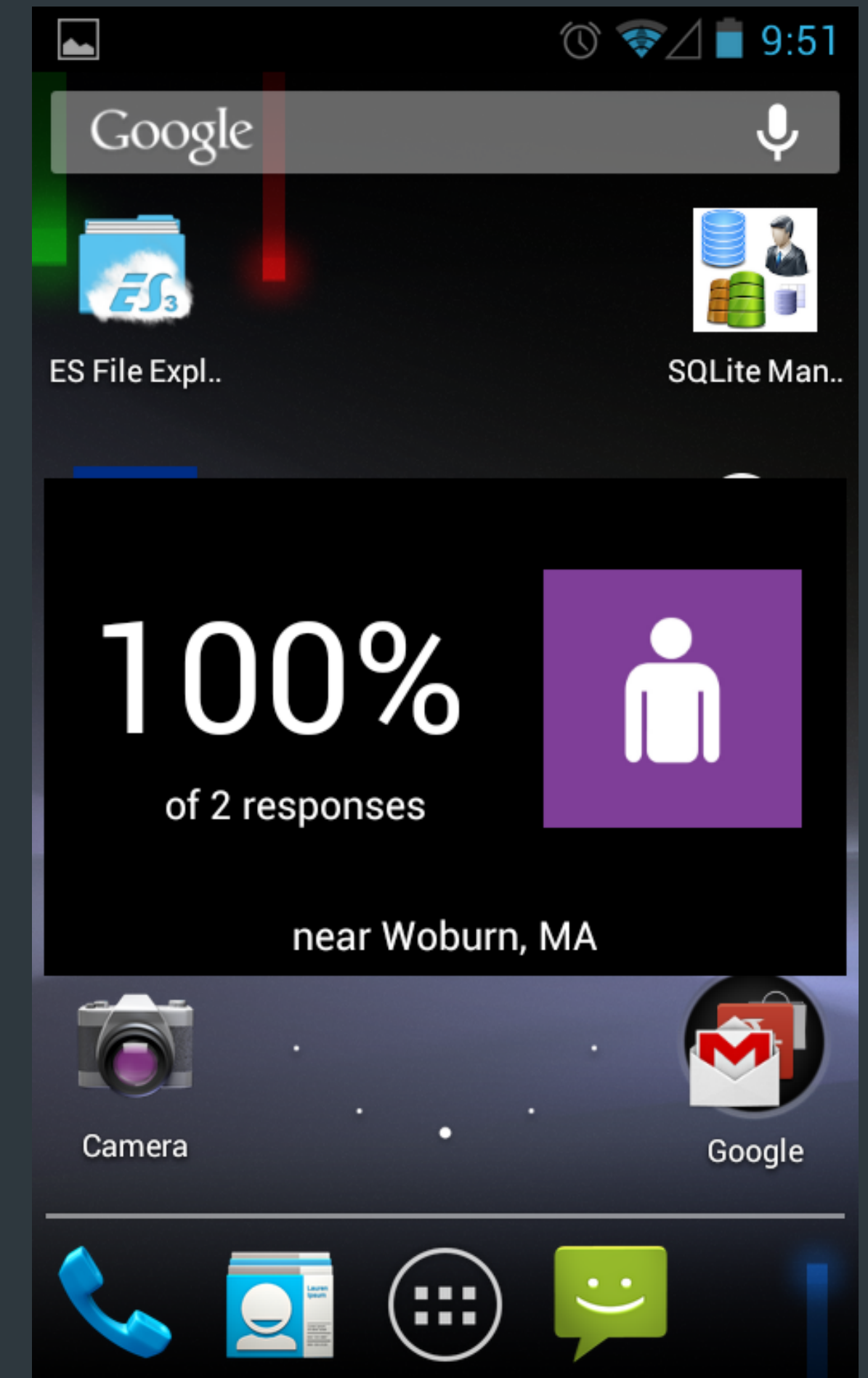
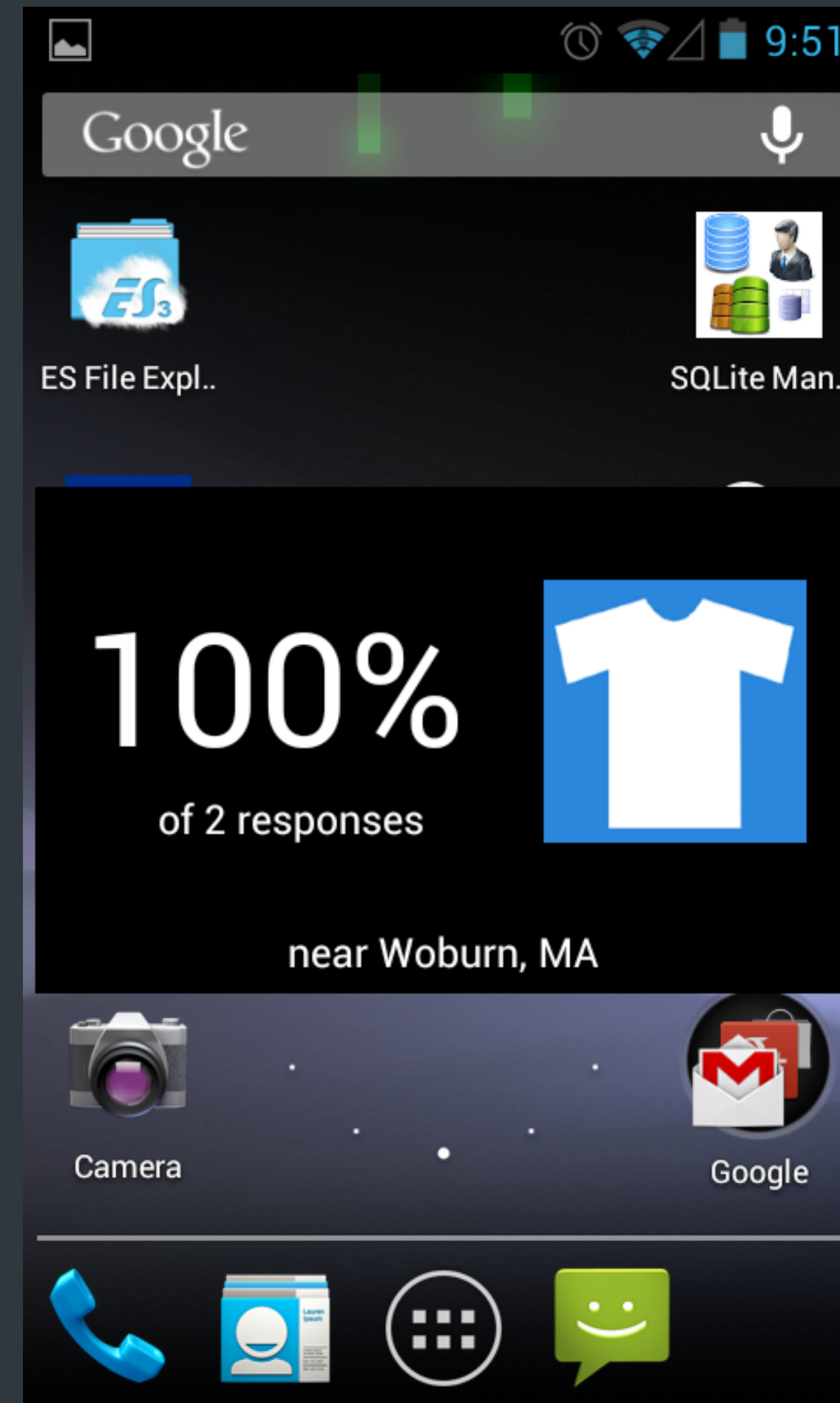
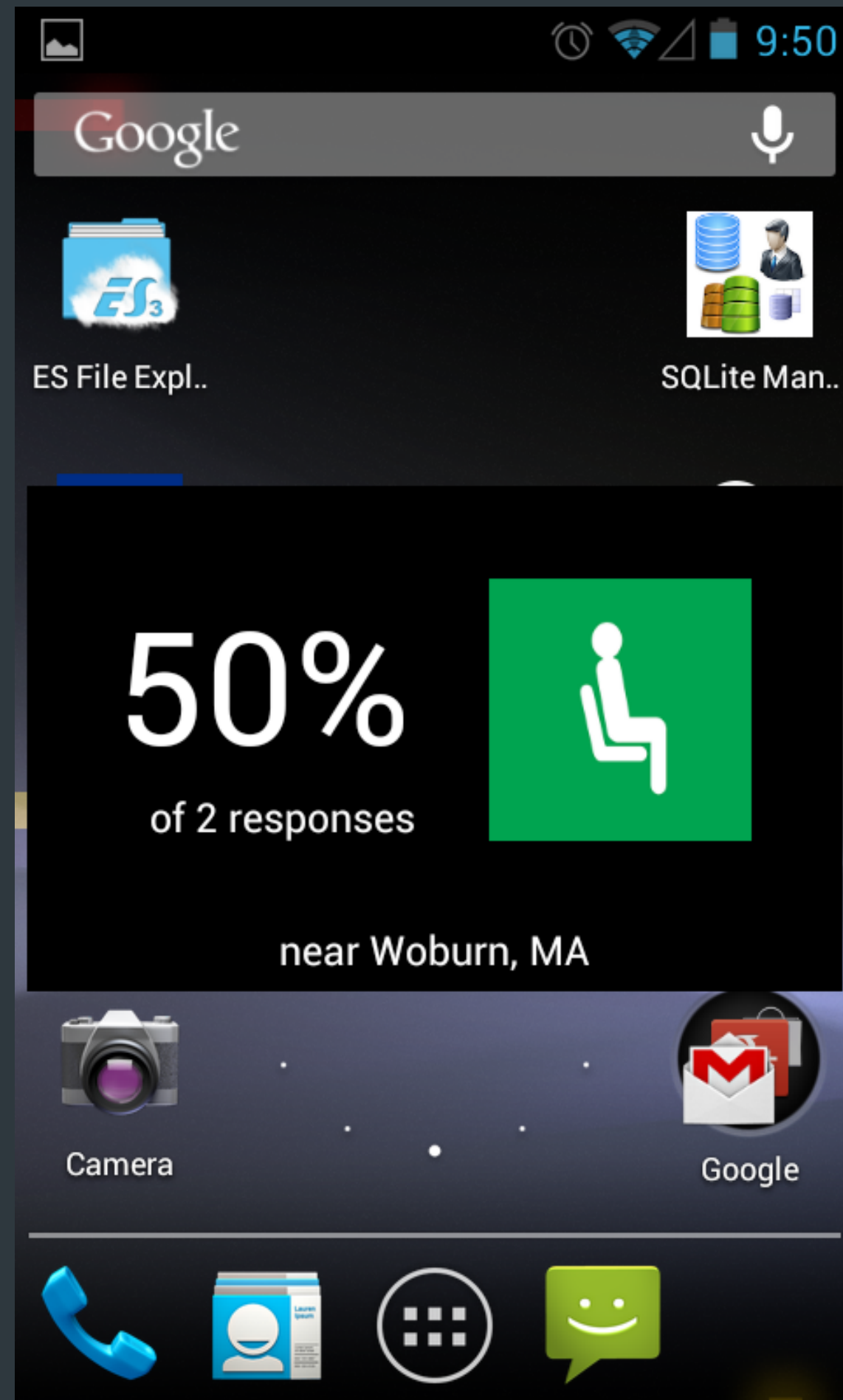
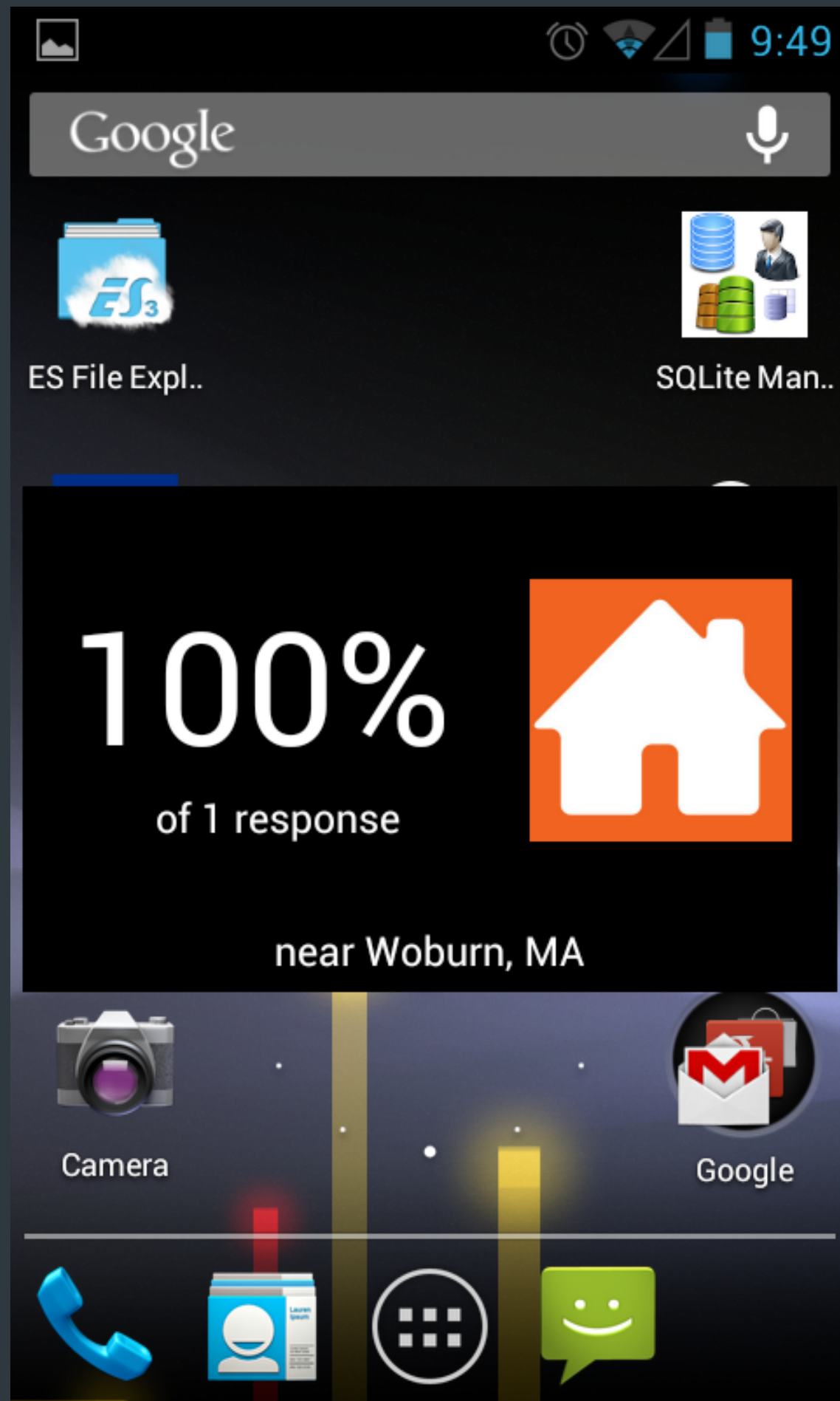


# TWITCH ACTIVITY TASKS





# INSTANT FEEDBACK







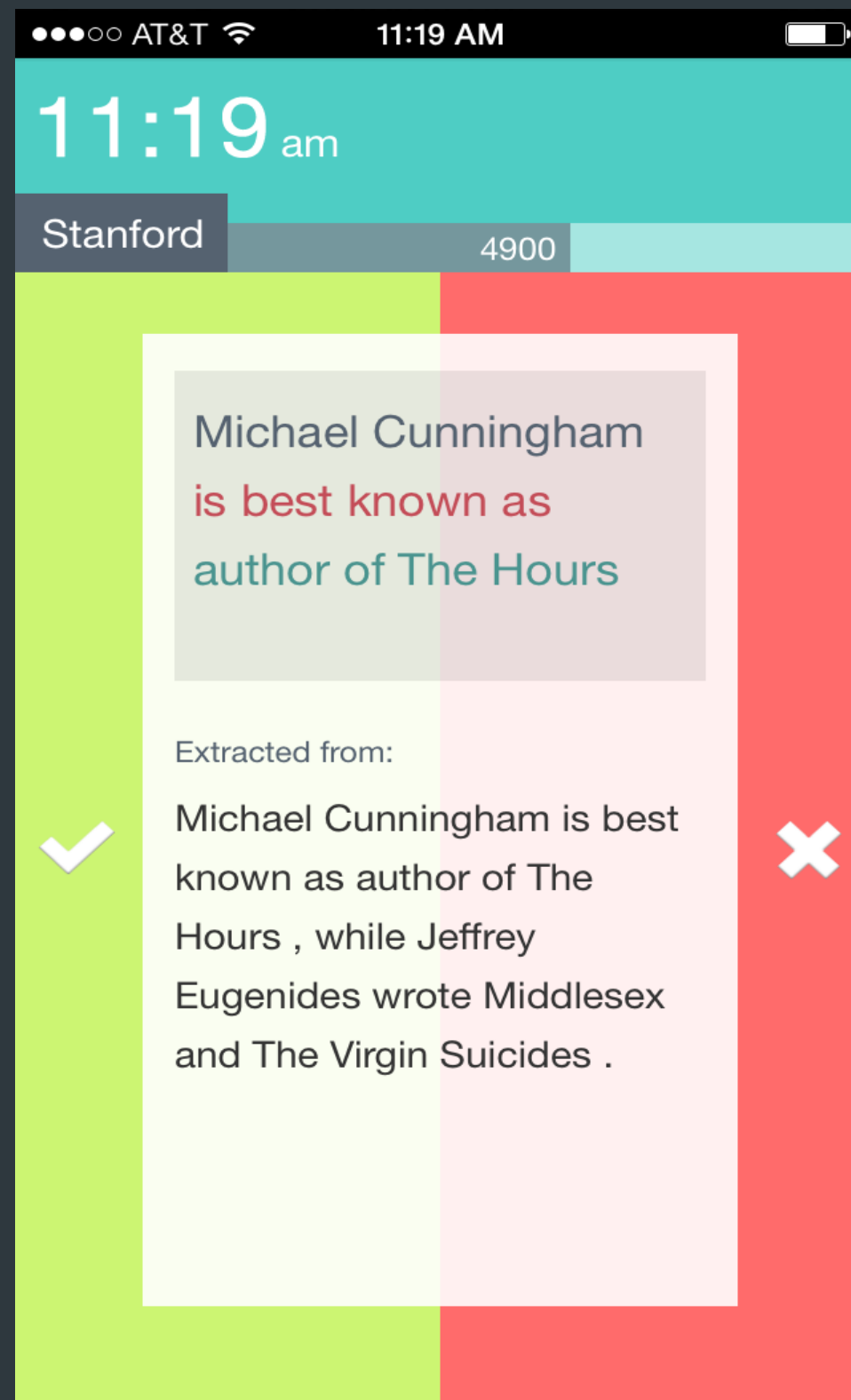


# ACTIVITY MAP



World

# TWITCH APPLICATIONS



## Structuring the Web (STW)



# FACTUAL QUERIES REQUIRE STRUCTURED DATA

← → ↻ 🔍 the largest state in the us

Google Web Images Maps Shopping

About 1,590,000,000 results (0.62 seconds)

[List of U.S. states and territories by area](#)  
[en.wikipedia.org/wiki/List\\_of\\_U.S.\\_states\\_and\\_territories\\_by\\_area](http://en.wikipedia.org/wiki/List_of_U.S._states_and_territories_by_area)  
US states by water area. US states by water per total area, land area, and water area. The area of  
You visited this page on 6/9/13.

[List of U.S. states and territories by population](#)  
[en.wikipedia.org/wiki/List\\_of\\_U.S.\\_states\\_and\\_territories\\_by\\_population](http://en.wikipedia.org/wiki/List_of_U.S._states_and_territories_by_population)  
This is a list of U.S. states by population (with in for comparison) as of April 1, 2010, the date of th

← → ↻ 🔍 stanford founded

Google Web Images Maps Shopping More Search tools

40 personal results. 23,000,000 other results.



**November 11, 1885**  
Stanford University, Founded

Feedback / More info

[History : Stanford University](#)  
[www.stanford.edu/about/history/](http://www.stanford.edu/about/history/)  
Describes Leland Stanford's involvement in establishing the university.  
The New Century - Changing Times, Campus - Special Collections

[Founding of Stanford: Stanford University Facts](#)  
[facts.stanford.edu/about/founding](http://facts.stanford.edu/about/founding/)  
The **Founding** of the University. On Oct. 1, 1891, **Stanford** University opened its doors after six years of planning and building. In the early morning hours, ...

[Stanford Computer Science](#)  
[www-cs.stanford.edu/](http://www-cs.stanford.edu/)  
Founded in 1965, the **Stanford** Computer Science (CS) Department continues to lead the world in computer science research and education. Throughout the ...



**Stanford University**

Directions

The Leland Stanford Junior University, commonly referred to as Stanford University or Stanford, is an American private research university located in Stanford, California, on an 8,180-acre campus near Palo Alto. Wikipedia

**Address:** 450 Serra Mall, Stanford, CA 94305  
**Acceptance rate:** 6.6% (2012)  
**Founded:** November 11, 1885  
**Phone:** (650) 723-2300

Fader, A., et.al. Identifying relations for open information extraction. Proc. EMNLP '11.  
Freebase. <http://www.freebase.com/>



# STRUCTURED DATA REQUIRES VERIFICATION

Algorithms guess facts by reading the web, but they are noisy.  
Could people verify facts on topics they care about?

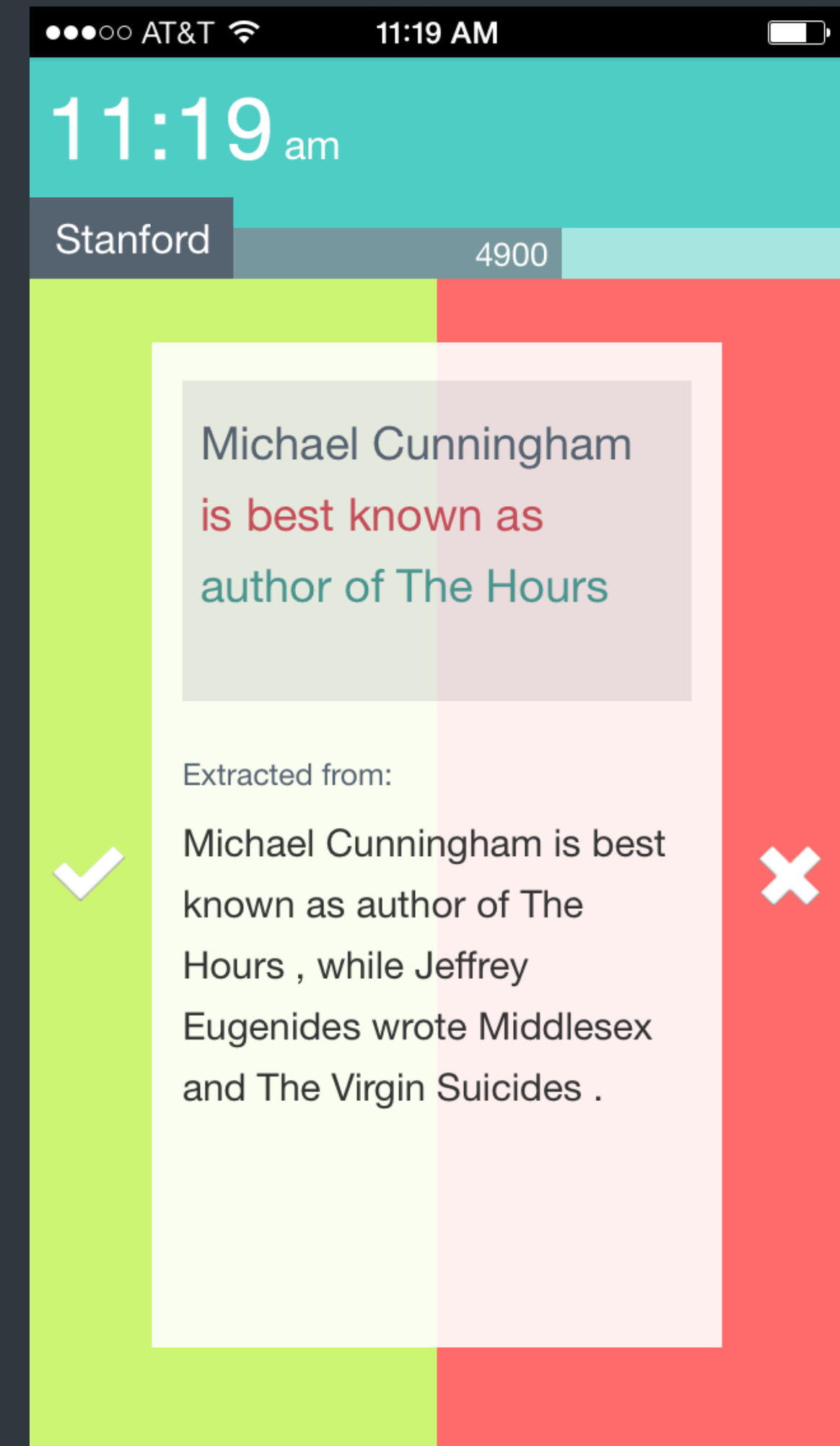
# STRUCTURING THE WEB



ReVerb:  
Open Information Extraction Software



```
$ echo "Michael Cunningham is best known as author of The Hours" |  
  ./reverb -q | tr '\t' '\n' | cat -n  
1  stdin  
2  1  
3  Michael Cunningham  
4  is best known as  
5  author of The Hours  
..  
12 0.99999999997341693
```



# STRUCTURING THE WEB



Source text: “Stanford has 27 ACM fellows”

Extraction format: {Subject} {Relationship} {Object}

Extraction: {Stanford} {has} {27 ACM fellows}

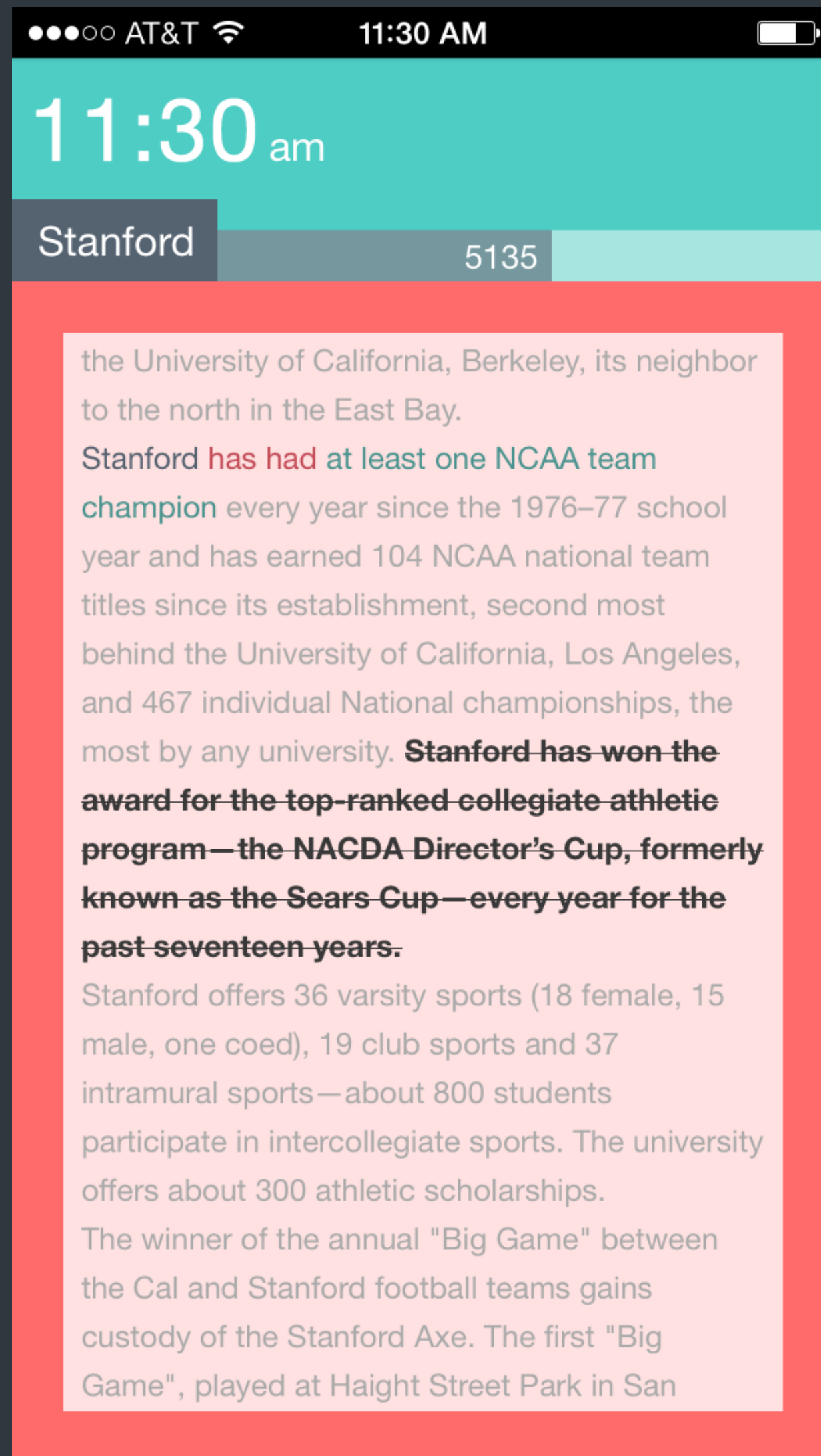
ReVerb Confidence Score: 0.94



Verifying a web extraction animates a new branch onto the knowledge graph



# STRUCTURING THE WEB



Source text: “Jr. , who died of typhoid two months before his 16th birthday .”

Extraction format: {Subject} {Relationship} {Object}

Extraction: {Jr.} {died of} {typhoid two months}

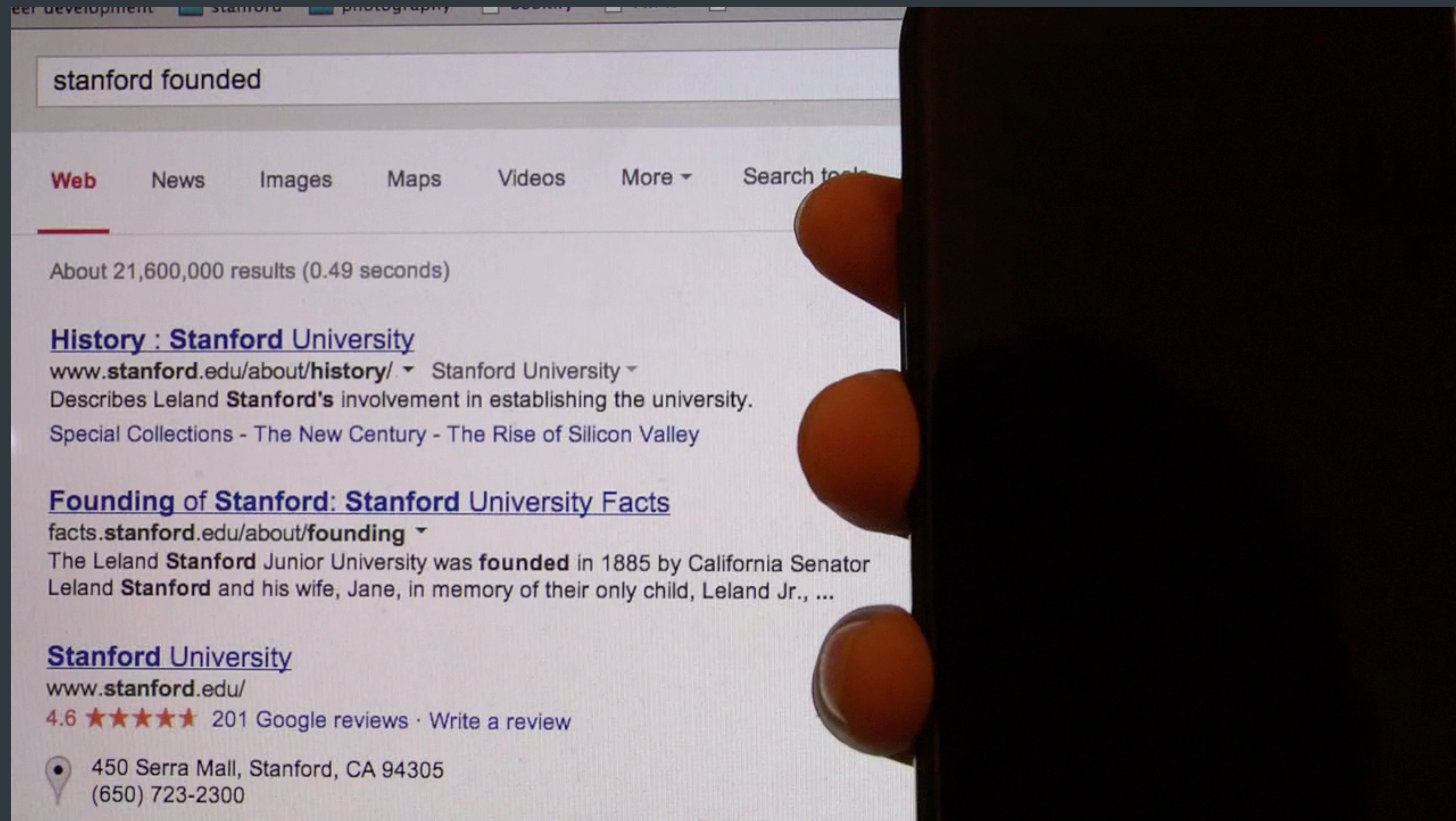
ReVerb Confidence Score: 0.63



Rejecting the extraction shows how far the user is in the article



# STRUCTURING THE WEB DEMO



The vision: to be able to eventually contribute towards factual query results.



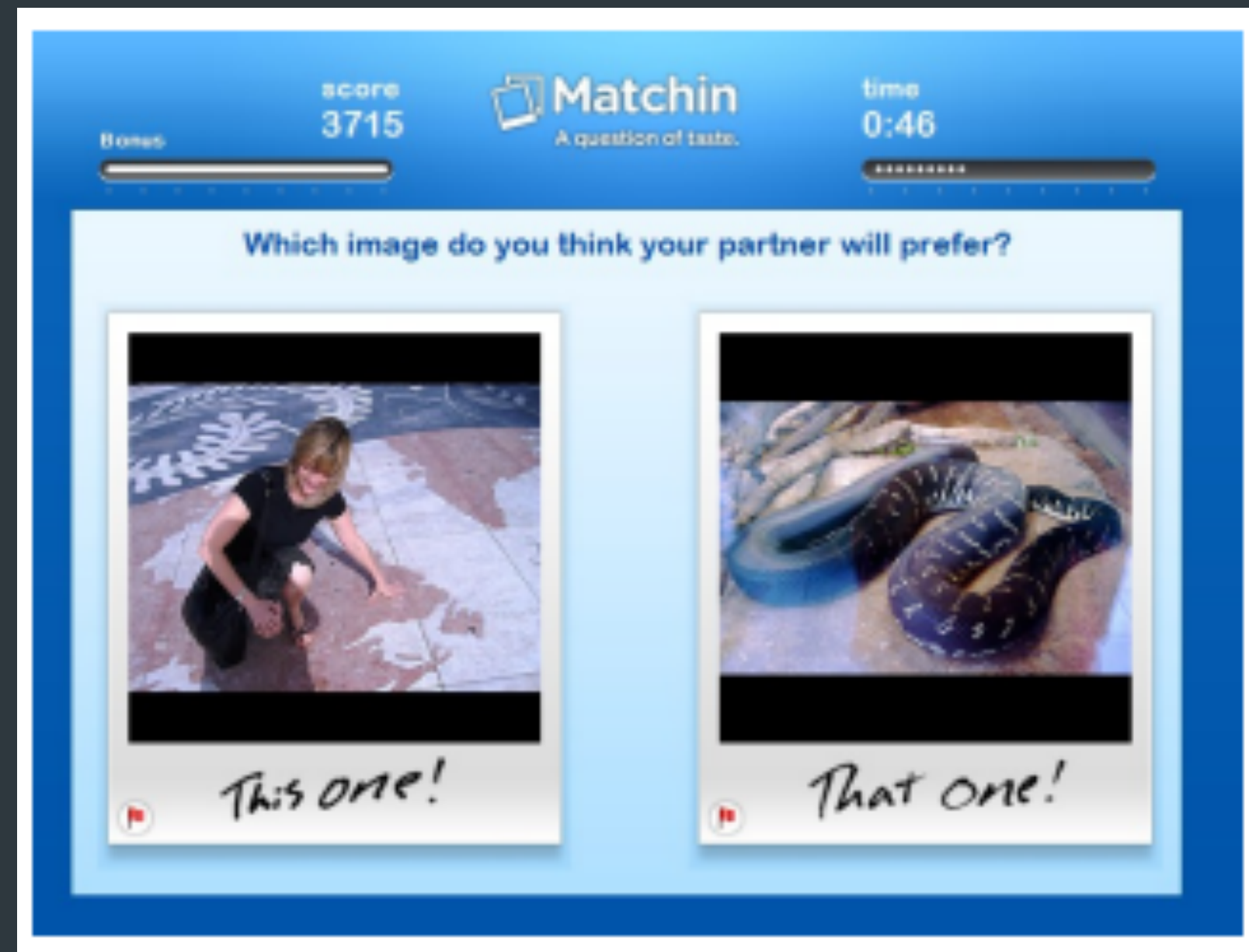
# TWITCH APPLICATIONS



## Photo Ranking



# COMPUTER VISION AND PHOTOGRAPHY



Matchin: photo ranking

The screenshot shows the iStockphoto website. On the left is a large image of a sunset over a green field. On the right, the photo is titled "spring sunset" with file number #9712604. A table lists various size options with their respective pixel dimensions, DPI, file sizes, and prices in credits and USD. Below the table, there are license options, including "Standard" and "Extended" licenses, and checkboxes for "Multi-Seat (unlimited)", "Unlimited Reproduction / Print Runs", and "Items for Resale (limited run)".

Size	Pixels	Inches	Credits	\$ USD
<input type="radio"/> XSmall	353 x 340 px @ 72 dpi		199.60 KB	\$2.00
<input type="radio"/> Small	705 x 681 px @ 72 dpi		665.78 KB	\$8.00
<input type="radio"/> Medium	1410 x 1362 px @ 300 dpi		2.18 MB	\$13.00
<input checked="" type="radio"/> Large	2255 x 2180 px @ 300 dpi		5.36 MB	\$19.00
<input type="radio"/> XLarge	3488 x 3372 px @ 300 dpi		12.13 MB	\$21.00
<input type="radio"/> XXLarge	4500 x 4350 px @ 300 dpi		18.05 MB	\$27.00

License Options:  Standard  Extended

- Multi-Seat (unlimited) \$125.00
- Unlimited Reproduction / Print Runs \$200.00
- Items for Resale (limited run) \$200.00

iStockphoto: stock photography

Hacker, S. . et. al. Matchin: Eliciting User Preferences with an Online Game. Proc. CHI'09.  
iStockPhoto. <http://www.istockphoto.com>.



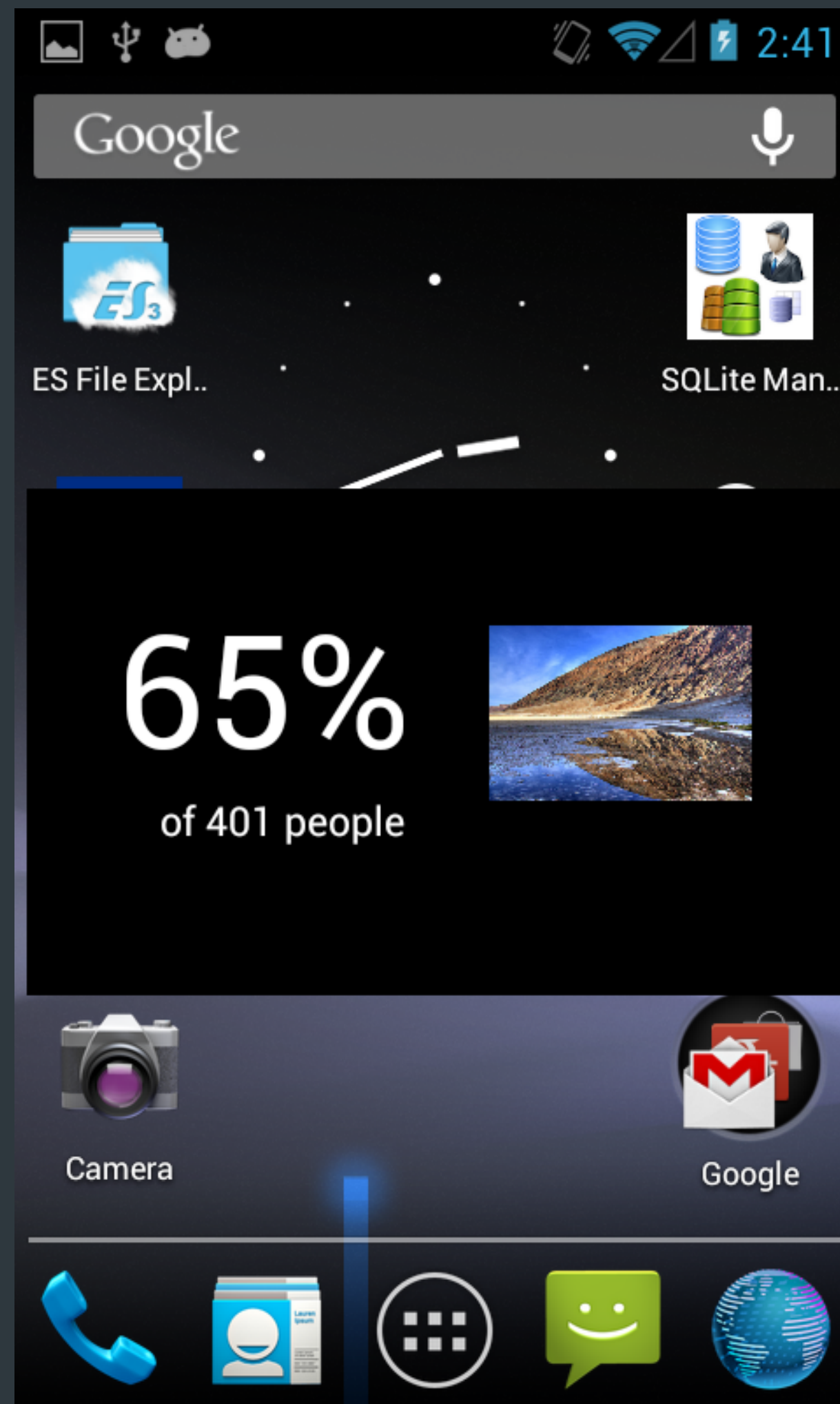
# PHOTO RANKING DEMO



Rank the photo you like better,  
every time you unlock your phone

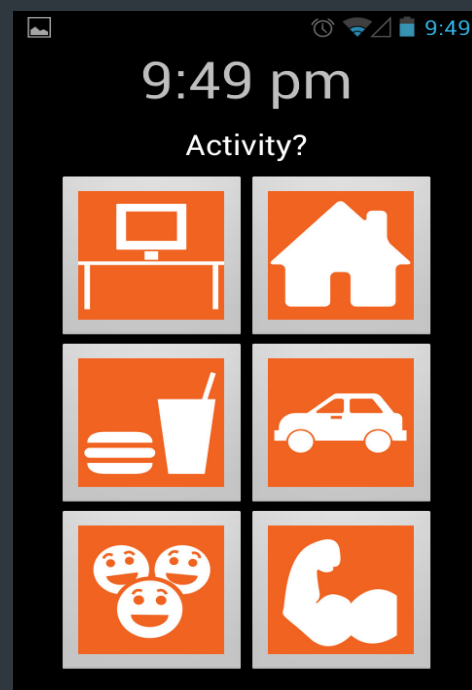


# PHOTO RANKING

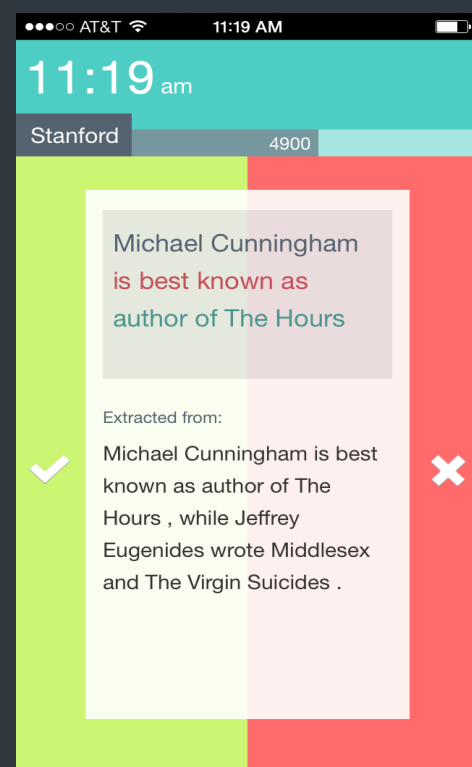




# TWITCH APPLICATIONS



Census



Structuring the Web



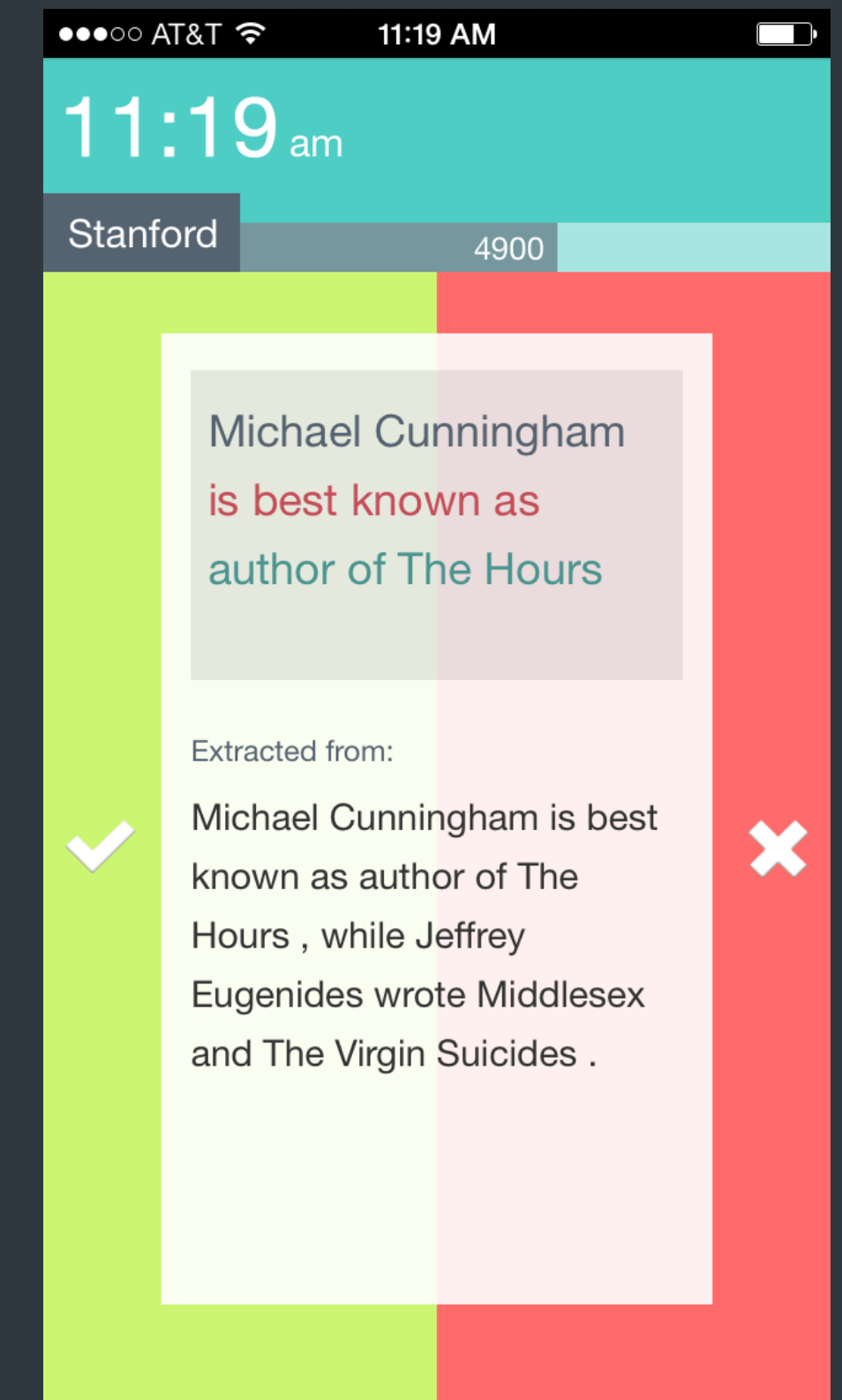
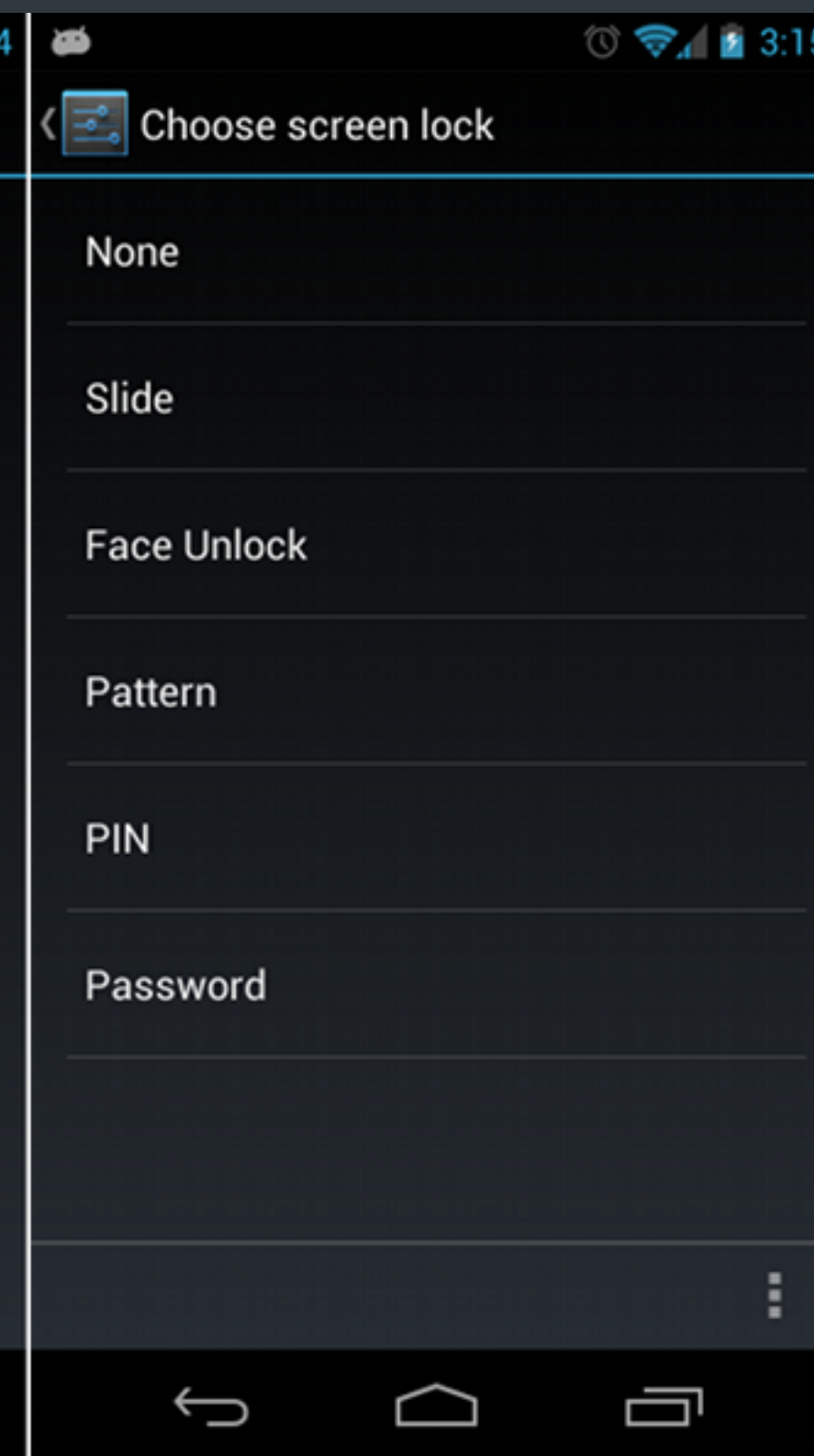
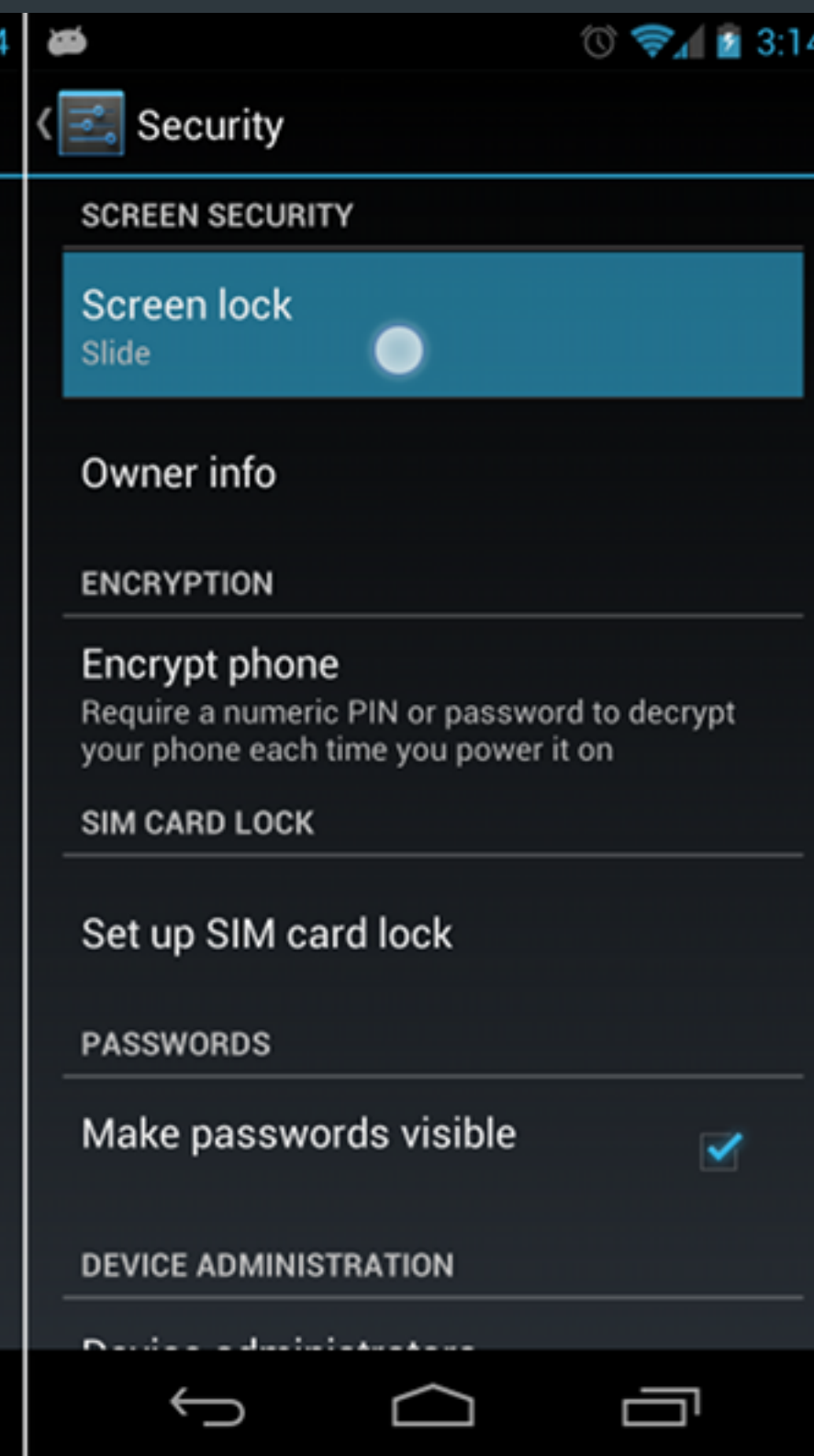
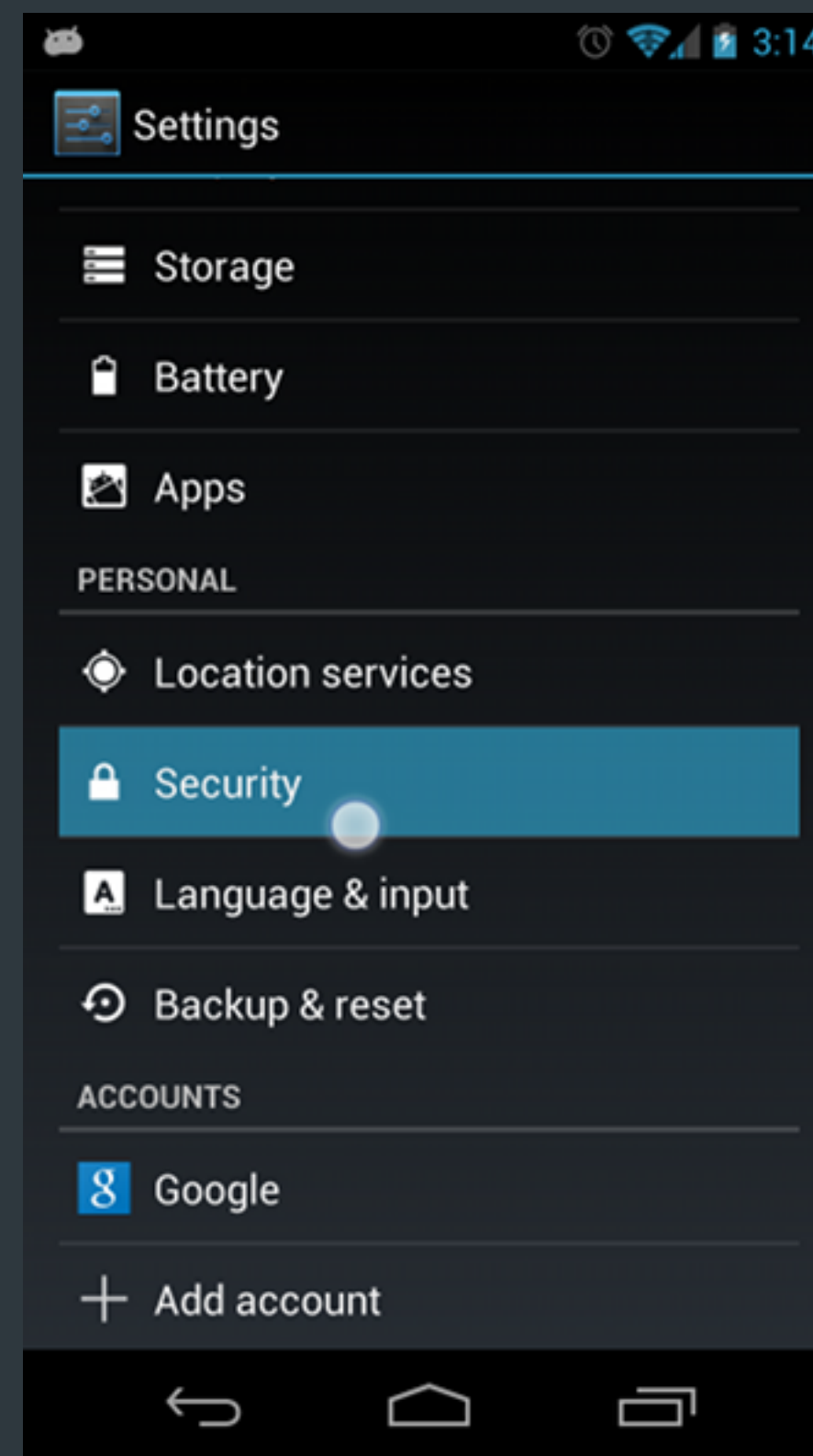
Photo Ranking

# IMPLEMENTATION

Twitch unlock screen is implemented as an Android home-screen replacement application. Twitch can replace or complement the user's password screen.



Default unlock screen



Twitch unlock screen



# EVALUATION

**Thesis:** Twitch Crowdsourcing enables tasks that can be completed in 1-2 seconds.

# EVALUATION METRICS

- Quick completion
- Low cognitive load
- Length of active engagement



# TWITCH DEPLOYMENT

- After initial trials, introduced to Stanford and MIT communities.
- Later deployed as a public app on Google Play, and collected data for a month.

# EVALUATION

We ran 3 different evaluation studies on:

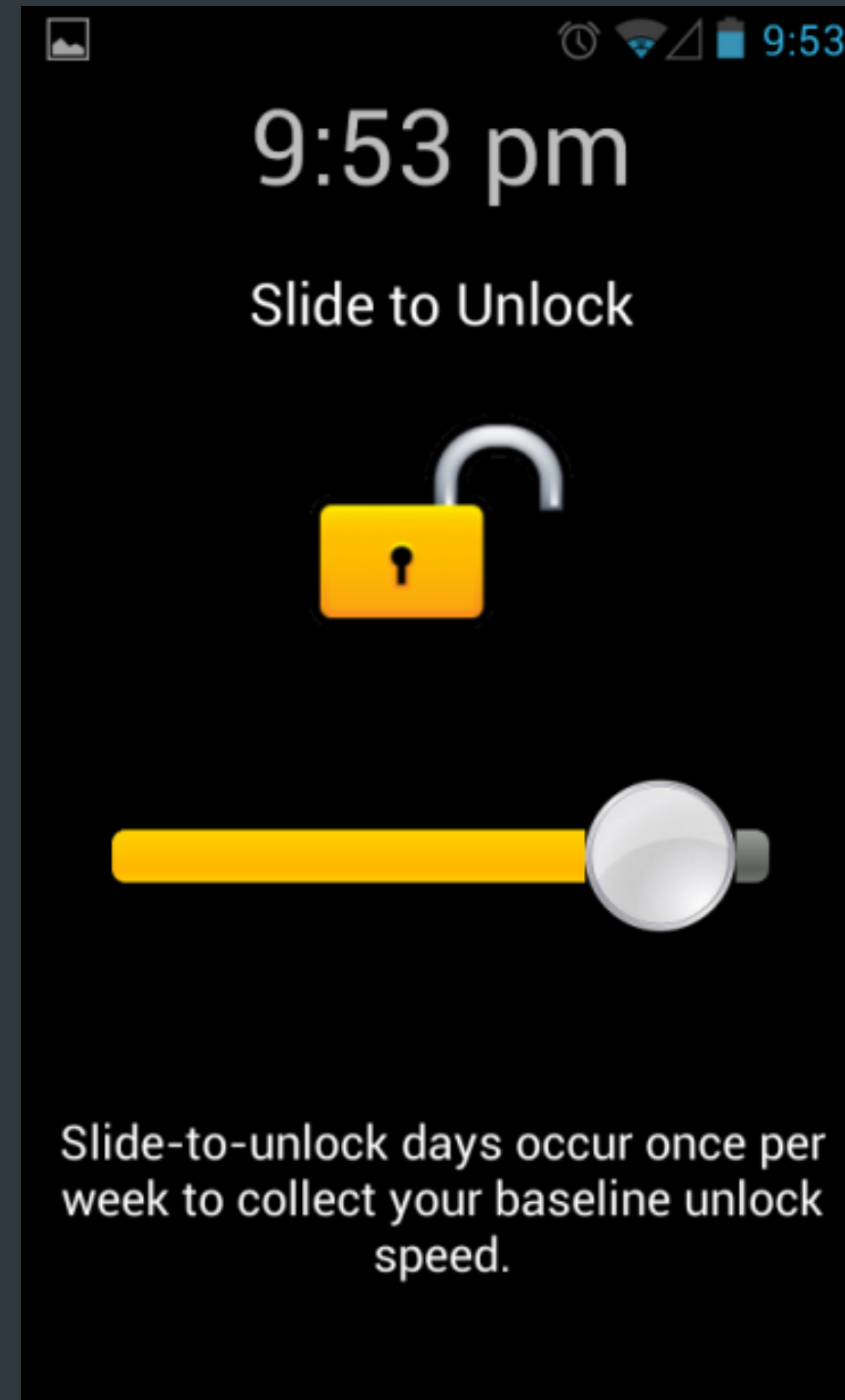
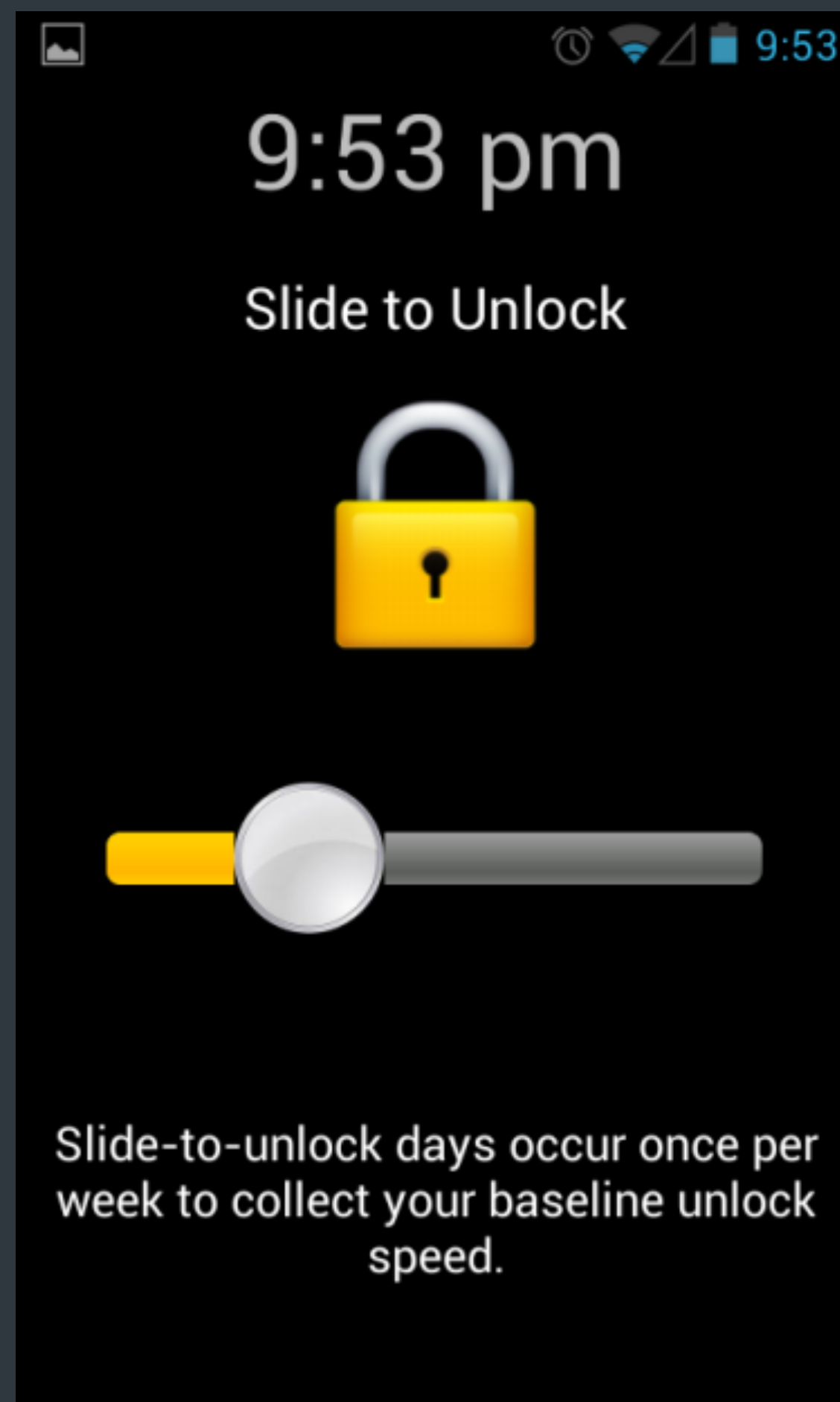
- Naturalistic Usage
- Speed
- Cognitive Load



# OVER 1,000 DOWNLOADS

- Our sample: 82 volunteer users from the first month
- 50% uninstall rate (standard for App store)
- 31 days of average active use for the remaining 50% of installs
  
- 11,000 Twitch tasks over one month (100,000 as of today)
- Users unlock their phone 37% of the time they press the unlock button

# CONTROL CONDITION: SLIDE-TO-UNLOCK

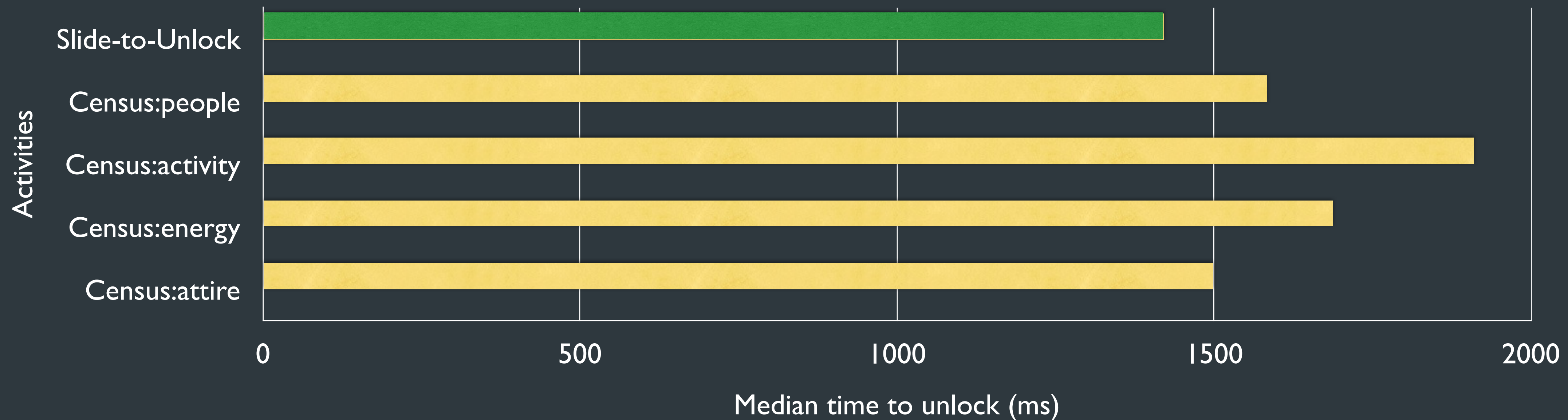


During weekends, users saw slide-to-unlock instead of twitch tasks.



# MOST TWITCH TASKS ARE EQUALLY FAST AS SLIDE TO UNLOCK

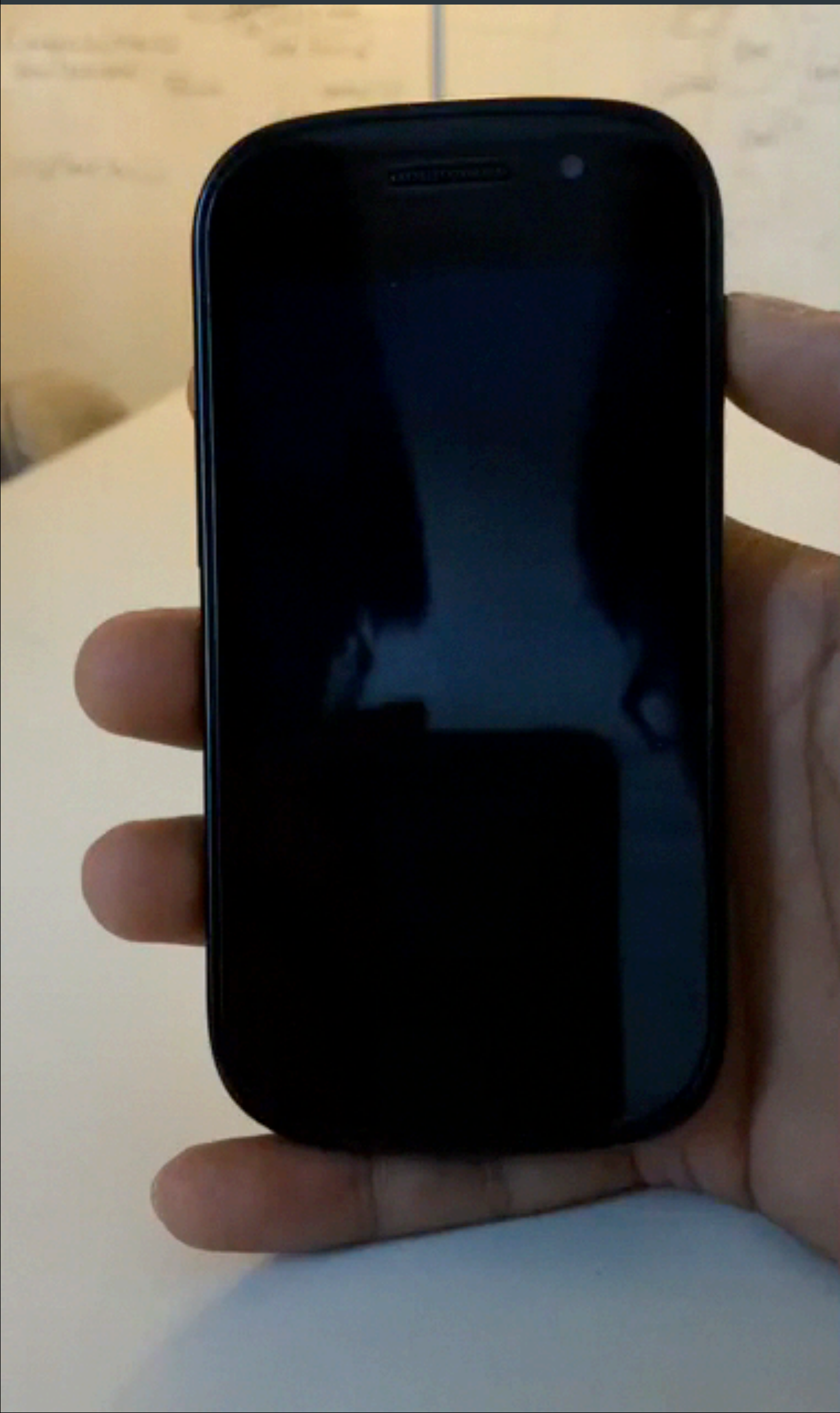
Field deployment Twitch unlock times (N=11,014)



Friedman test revealed a significant effect of Twitch activity on unlock time:  $\chi^2(4)=24.4$ ,  $p<.001$ .

Post-hoc paired Wilcoxon signed rank tests revealed that only **Census:activity** is slower than slide-to-unlock:  $p<0.05$ .

# COGNITIVE LOAD STUDY



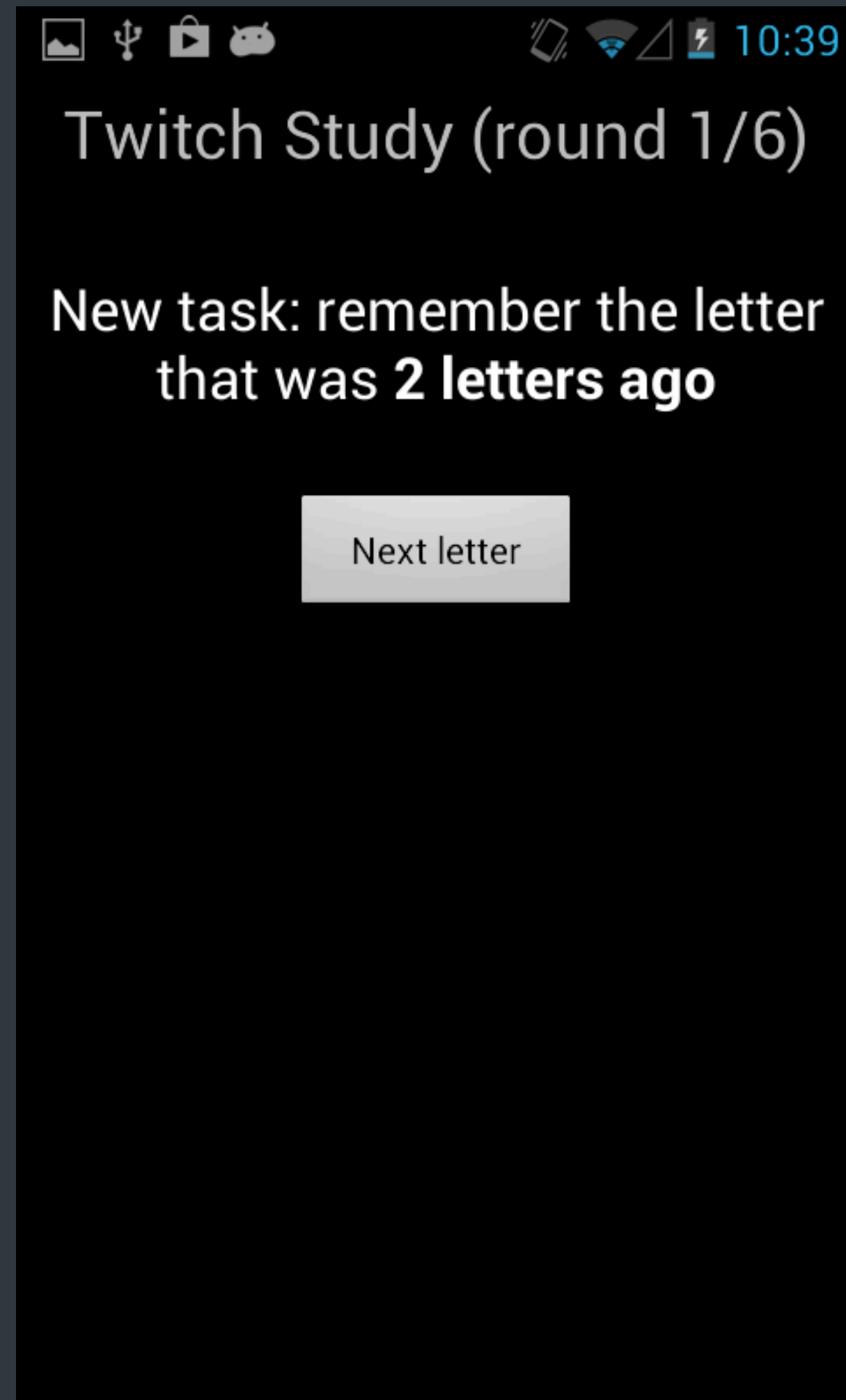
Do Twitch tasks decrease performance on a working memory task?

Instrument: 2-back test

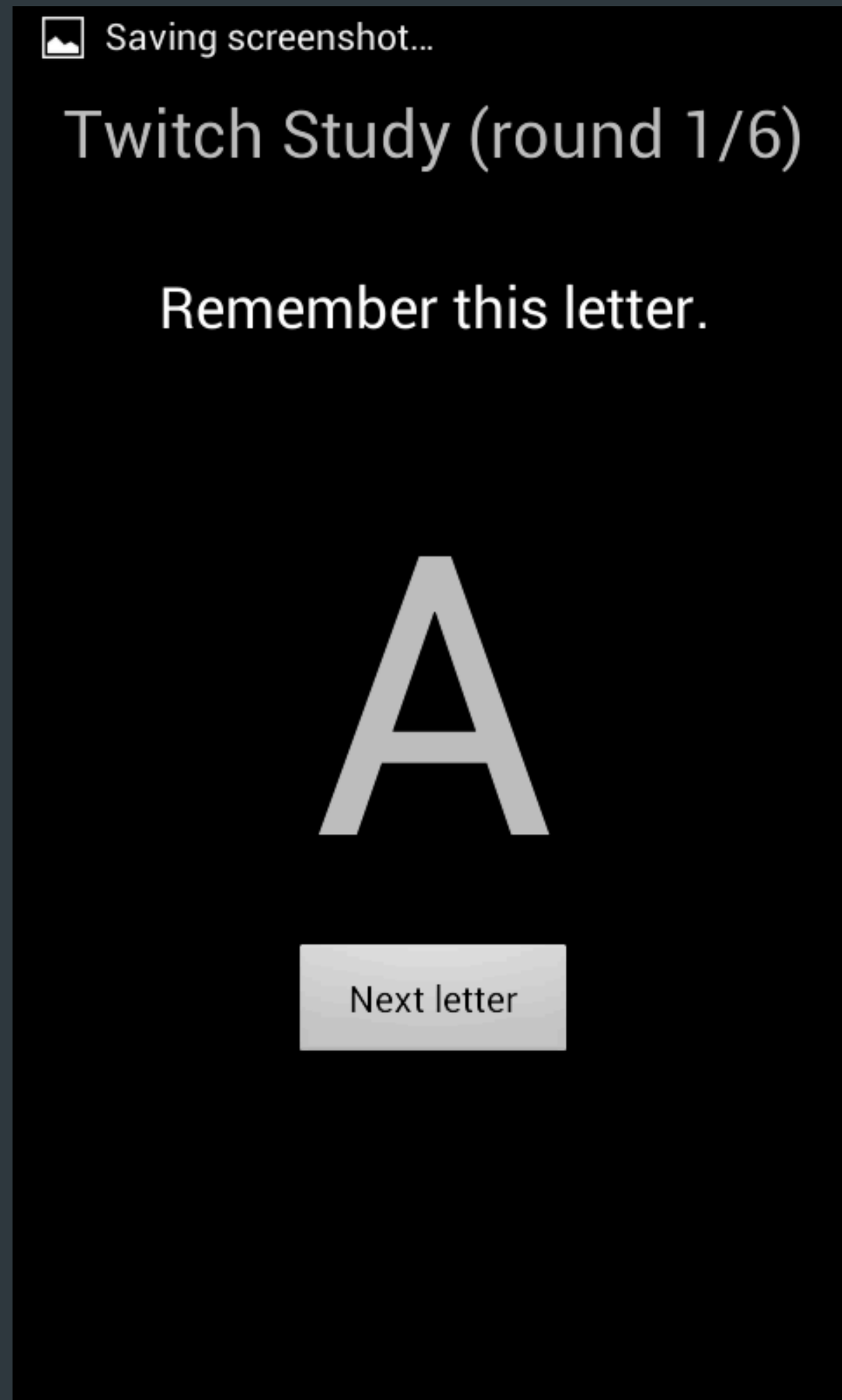
Ophir, E., et.al. Cognitive control in media multitaskers. PNAS 106, 37 (2009), 15583-7.



# COGNITIVE LOAD STUDY: WALKTHROUGH

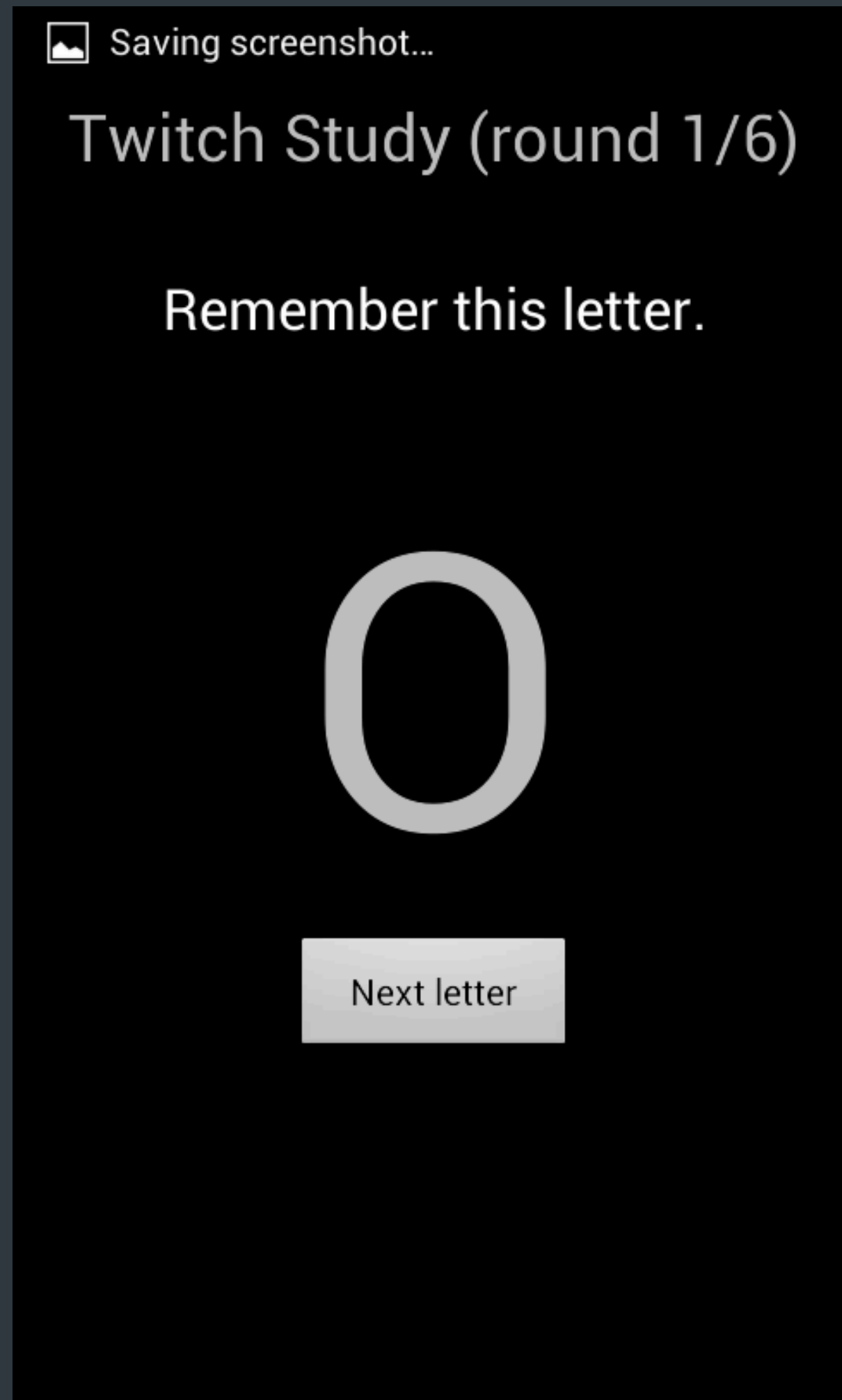


# COGNITIVE LOAD STUDY: WALKTHROUGH

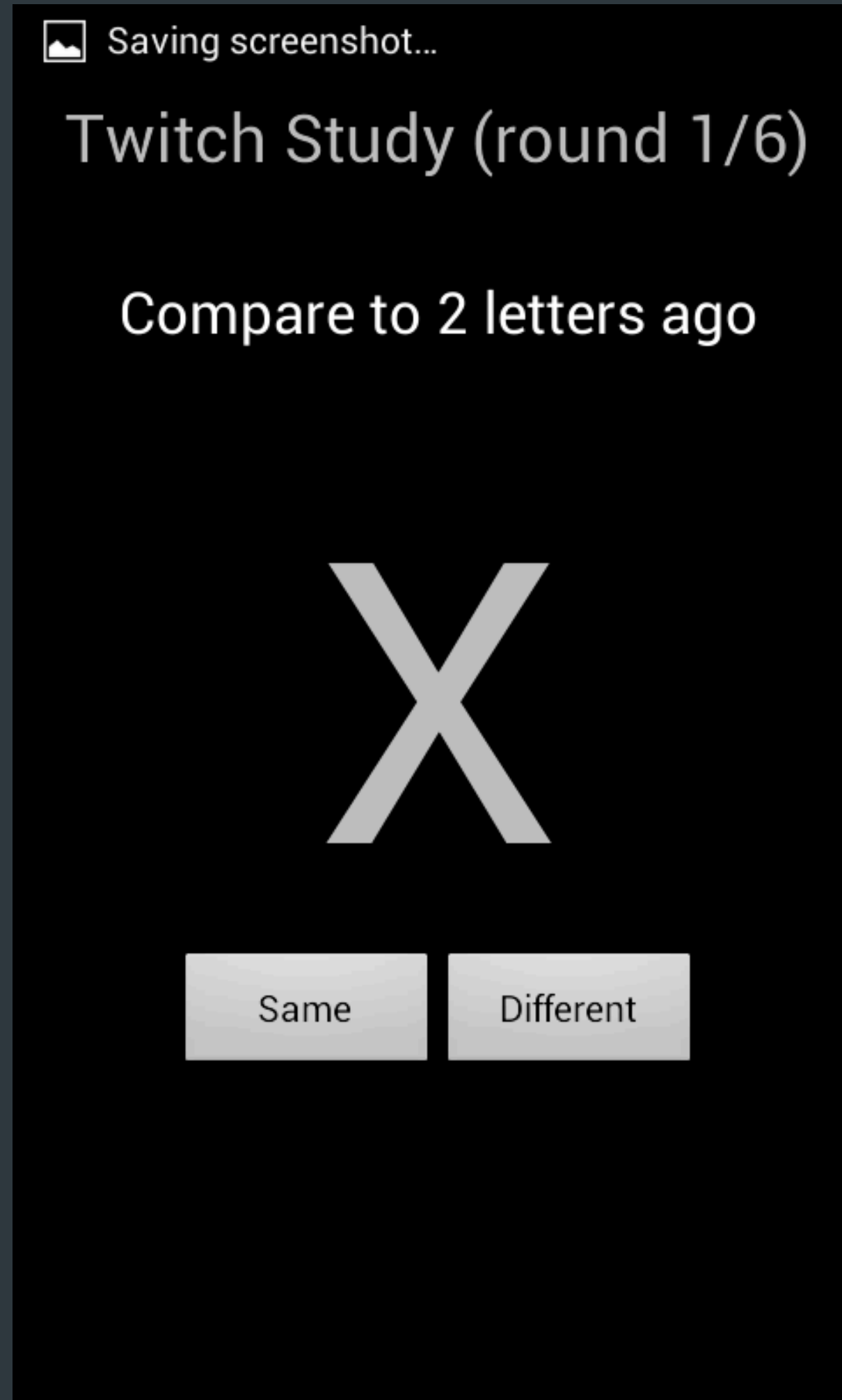




# COGNITIVE LOAD STUDY: WALKTHROUGH

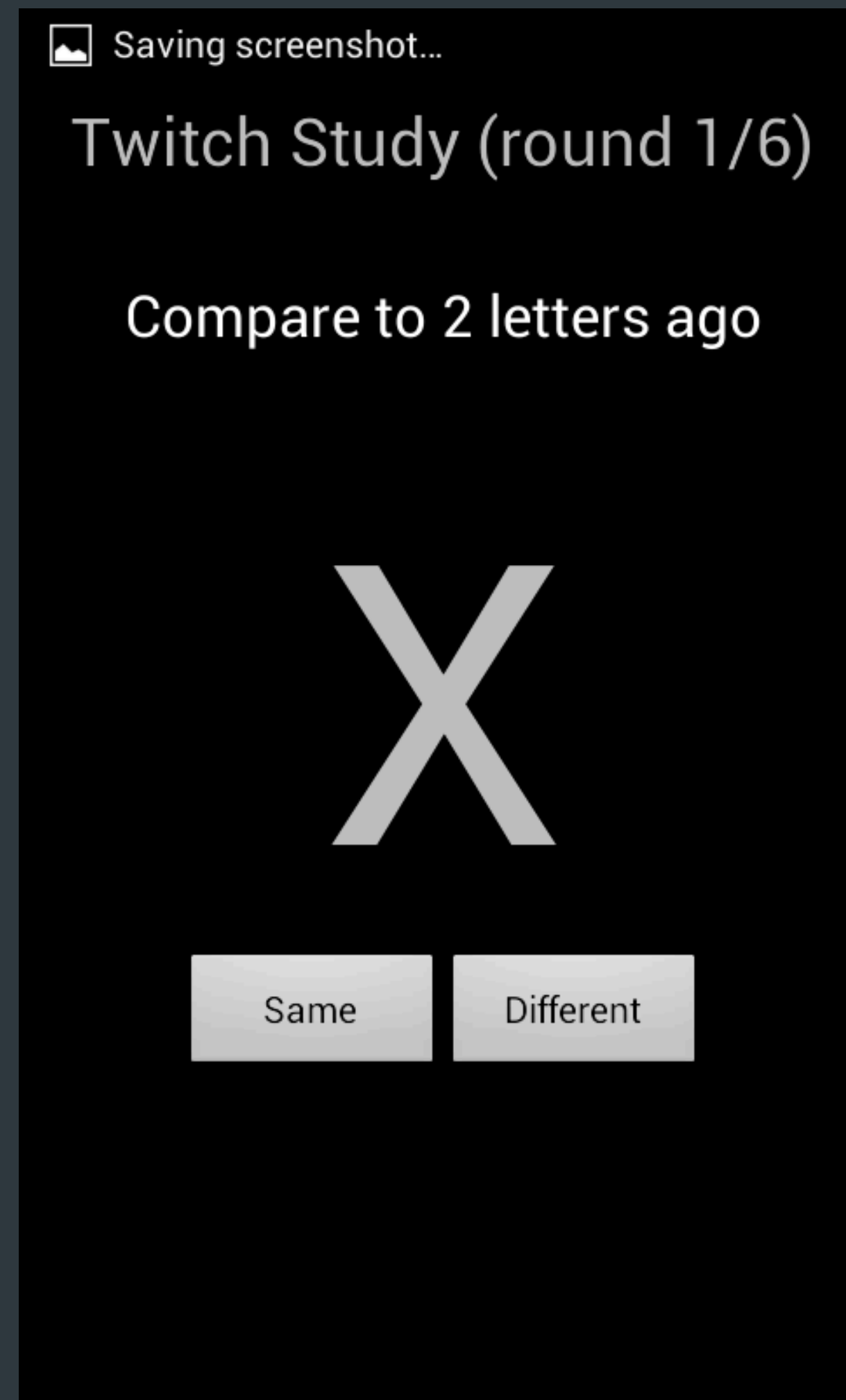


# COGNITIVE LOAD STUDY: WALKTHROUGH



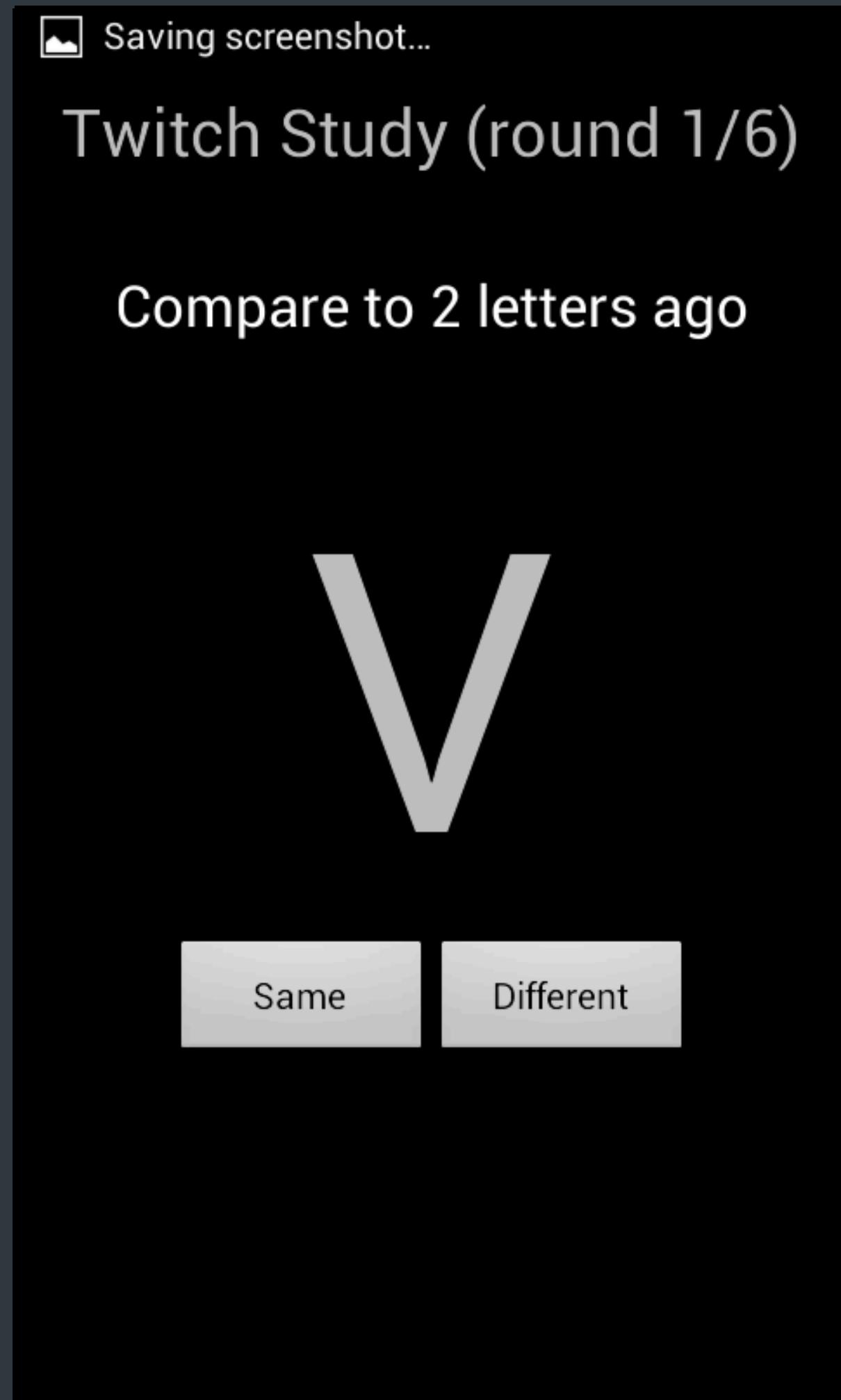


# COGNITIVE LOAD STUDY: WALKTHROUGH



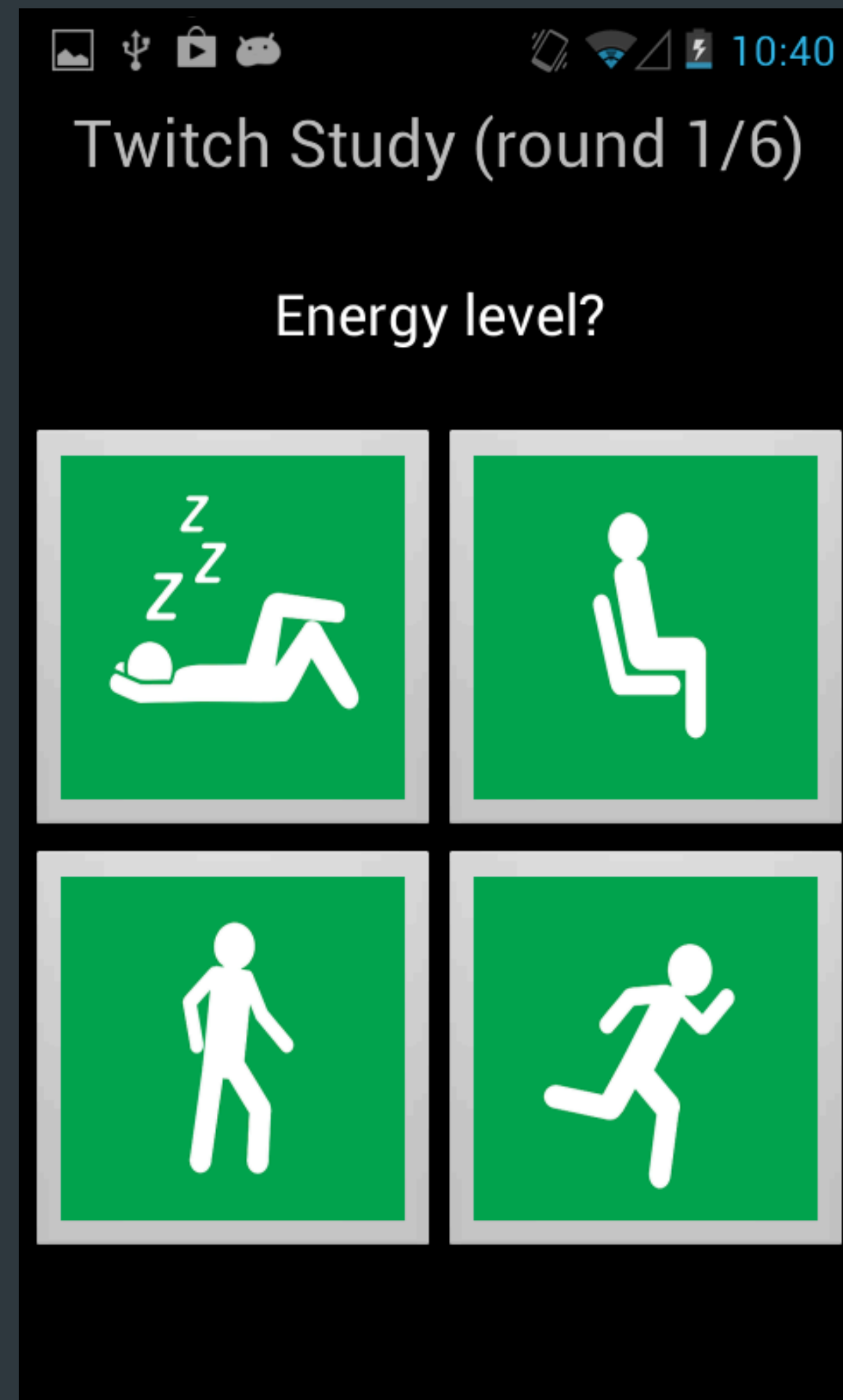
Different!

# COGNITIVE LOAD STUDY: WALKTHROUGH

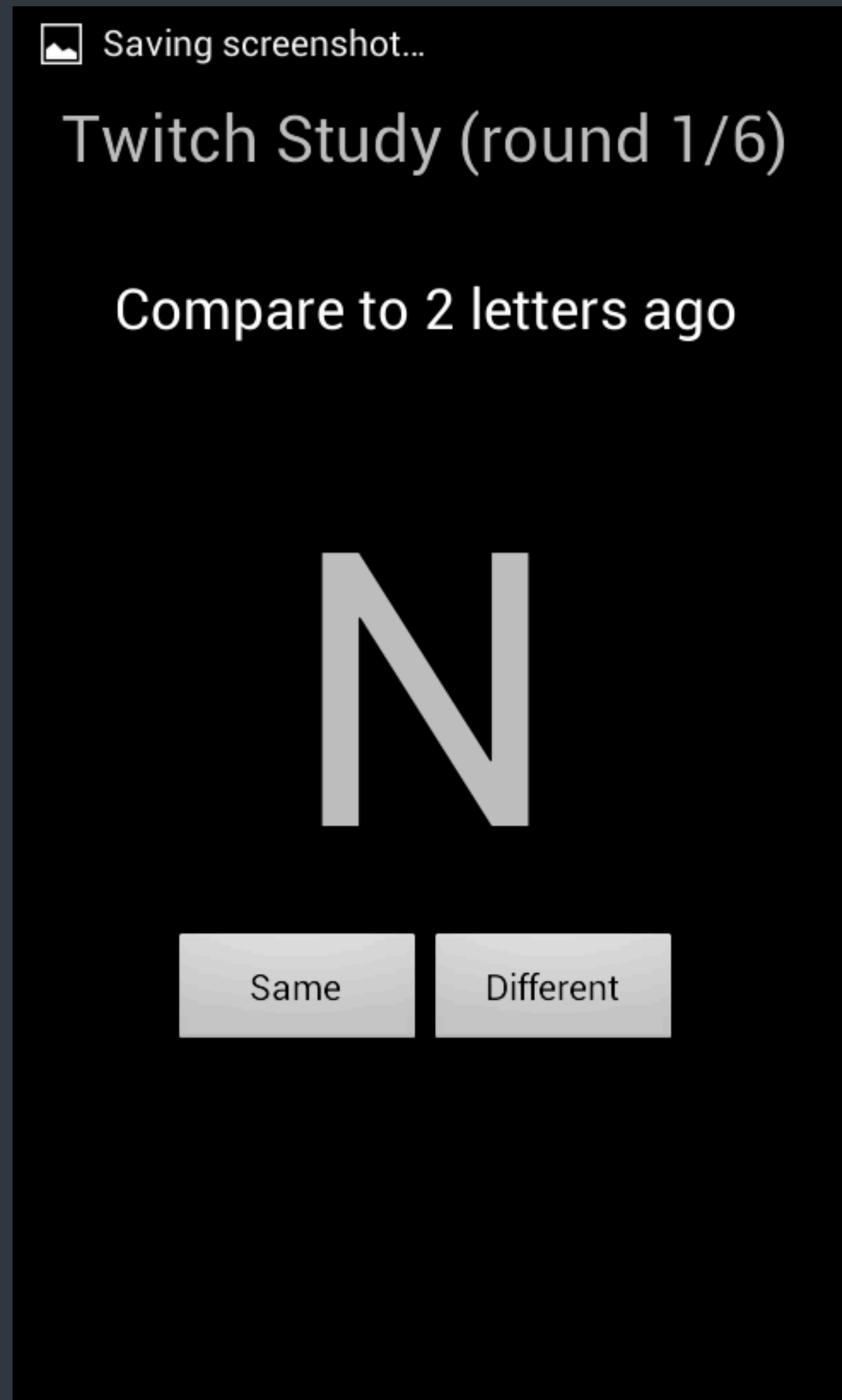




# COGNITIVE LOAD STUDY: WALKTHROUGH

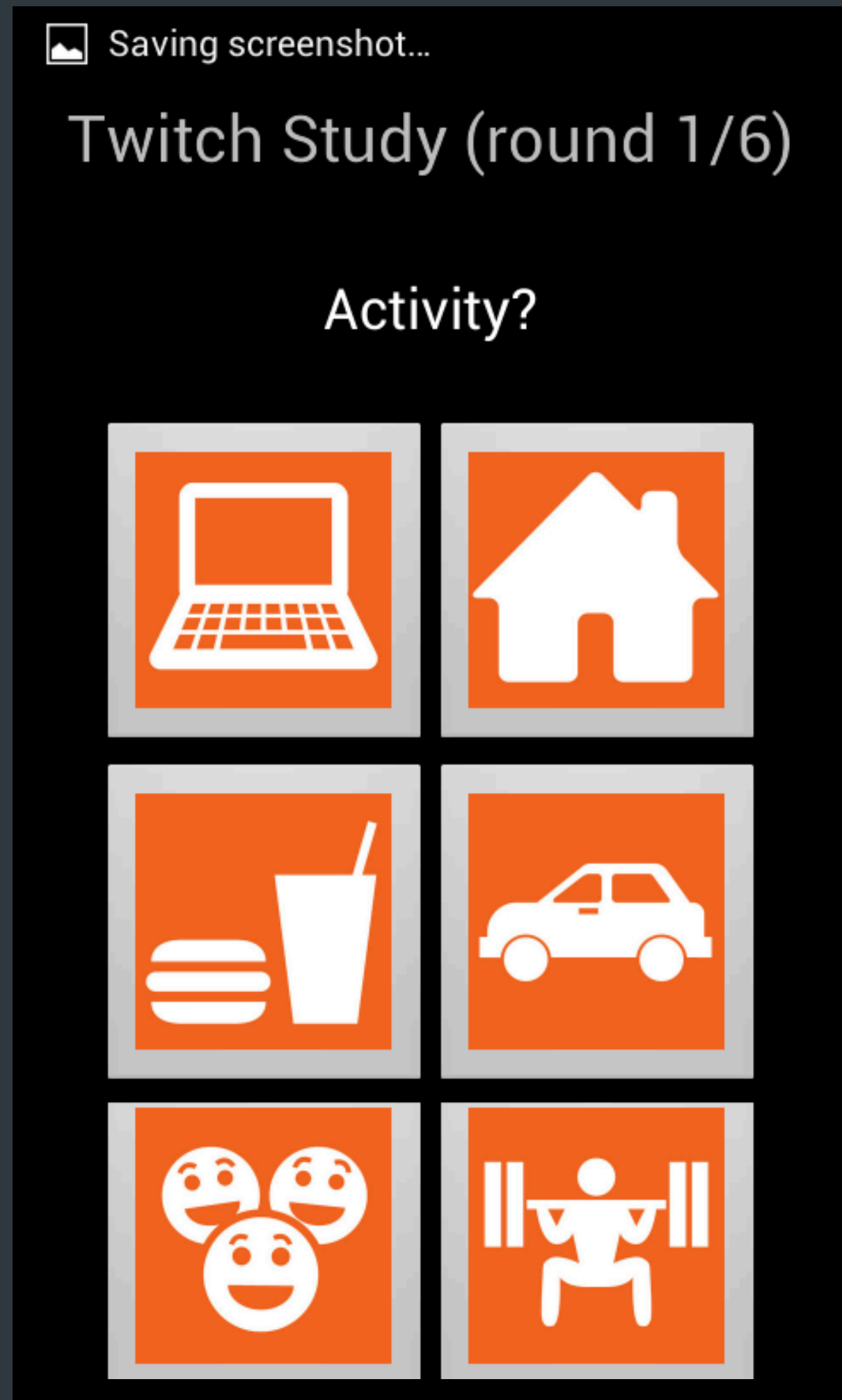


# COGNITIVE LOAD STUDY: WALKTHROUGH

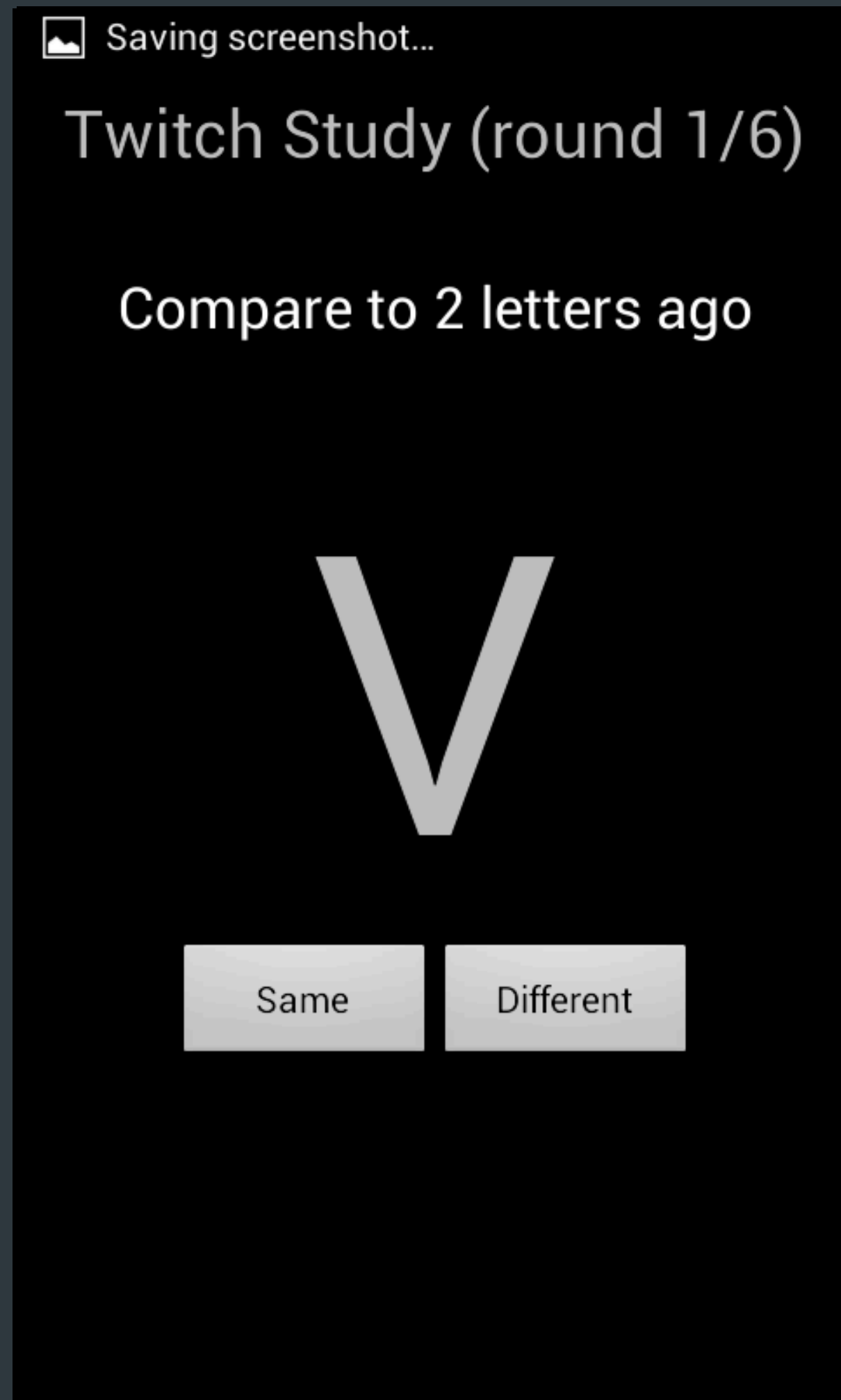




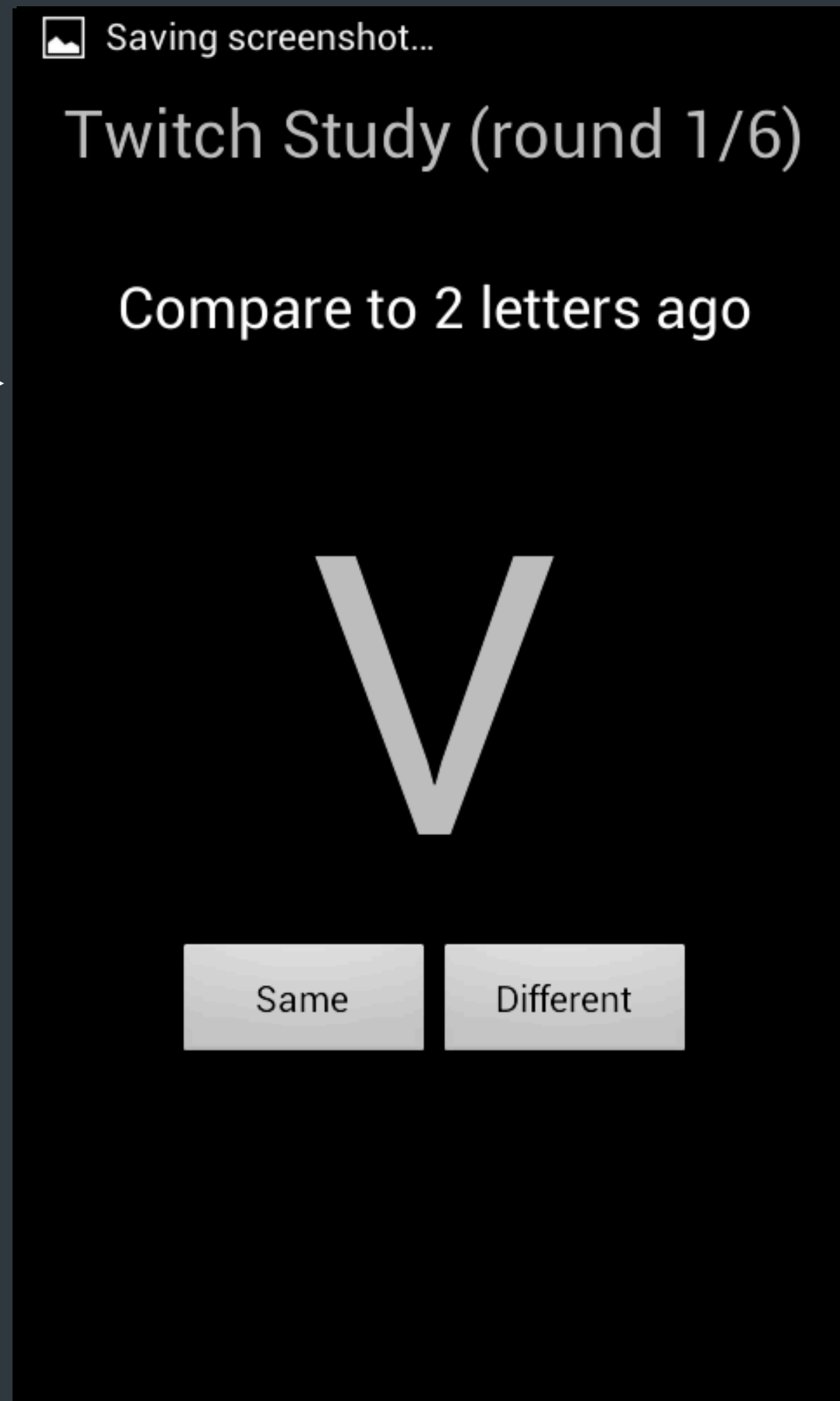
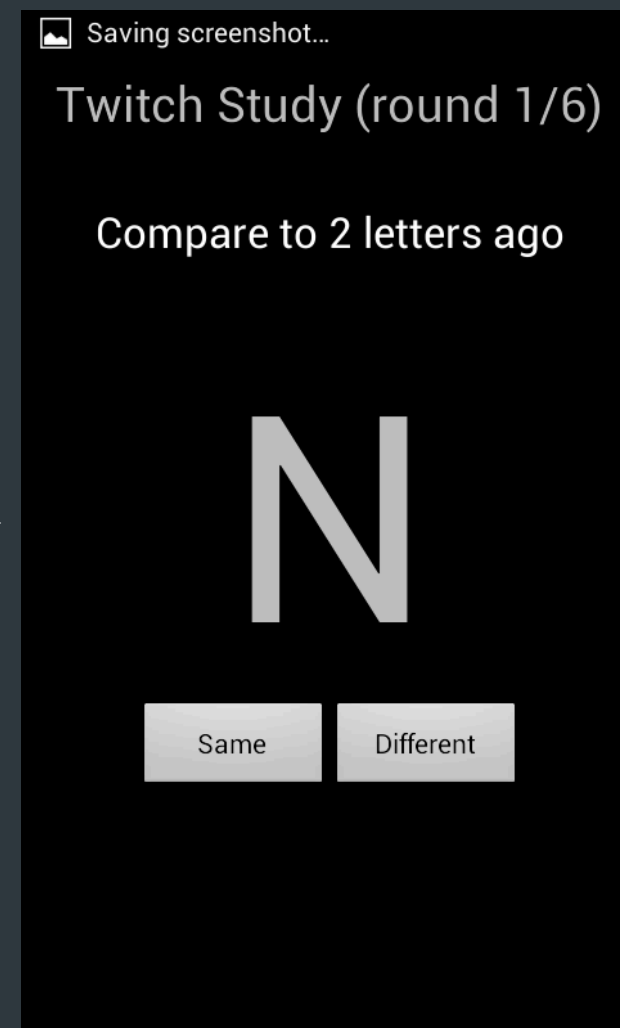
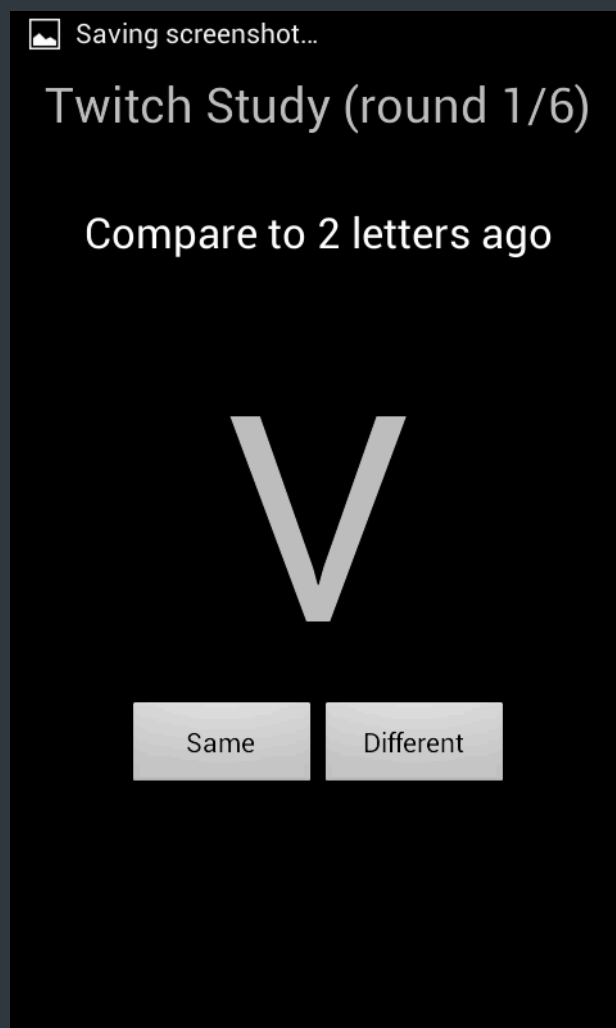
# COGNITIVE LOAD STUDY: WALKTHROUGH



# COGNITIVE LOAD STUDY: WALKTHROUGH



# COGNITIVE LOAD STUDY: WALKTHROUGH



Same!



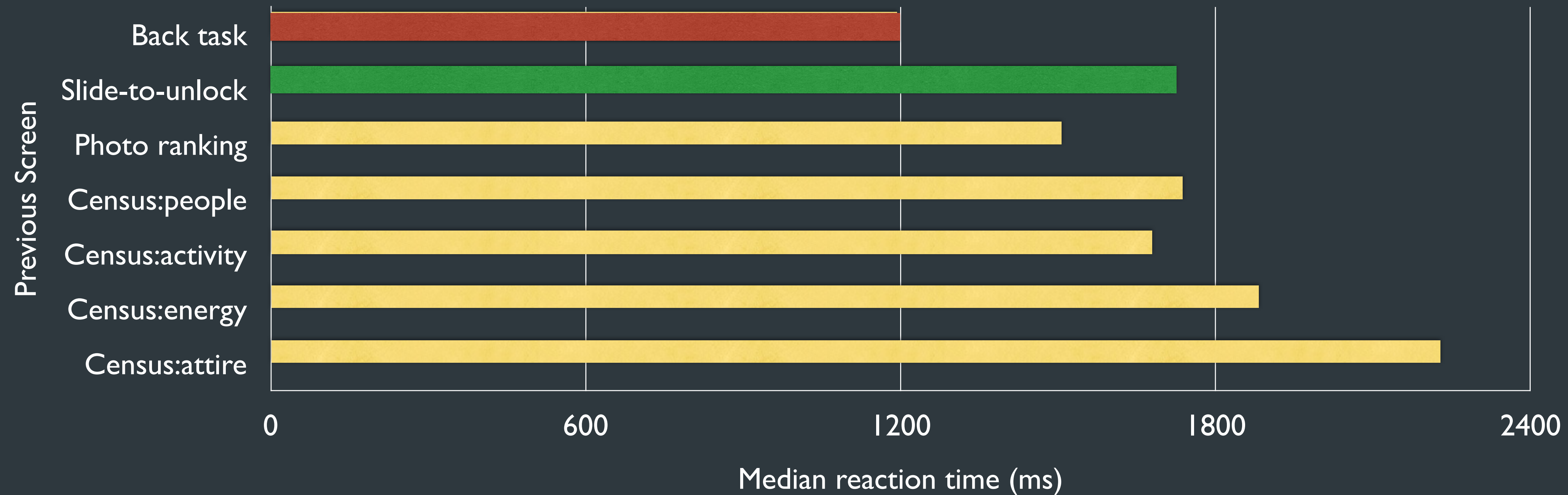
# COGNITIVE LOAD STUDY: MEASURES

Measured the effect of Twitch tasks on reaction time and accuracy

Ophir, E., et.al. Cognitive control in media multitaskers. PNAS 106, 37 (2009), 15583-7.

# TWITCH TASKS INCREASE REACTION TIME NO MORE THAN SLIDE-TO-UNLOCK

3-back task performance (N=5405 tasks; Users: 14)

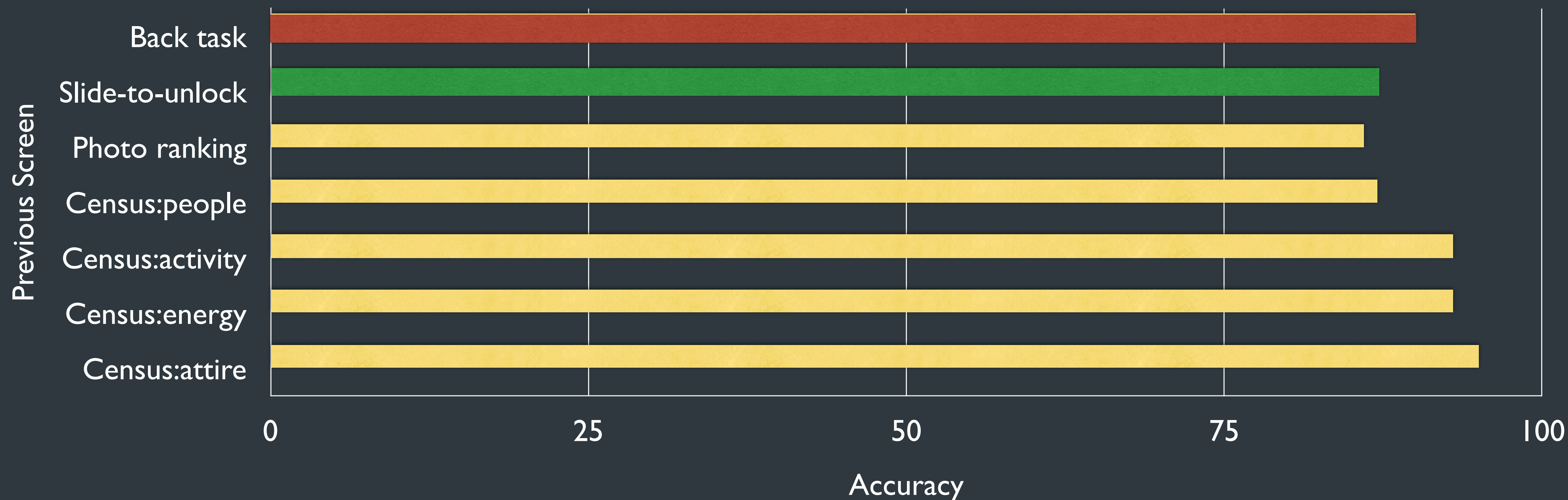


Two-way ANOVA on Twitch activity and task type revealed a significant effect of Twitch activity on reaction time:  $F(6, 5378)=25.8, p<.001$ .

Post-hoc Tukey test: **no significant difference** between Twitch tasks and slide-to-unlock.

# TWITCH TASKS DO NOT IMPACT ACCURACY

3-back task performance (N=5405 tasks; Users: 14)



Logistic regression predicting accurate response: **no significant effect of Twitch activity.**



# DISCUSSION

Will people continue completing twitch crowdsourcing tasks over a long period of time?

# DISCUSSION

Tasks become repetitive if the user is in the same location for a long period of time.

# FUTURE WORK

- End-user authored microtasks
- Intelligent task assignment
- Twitch as an experience sampling science platform



# CONCLUSION

Twitch crowdsourcing tasks:

- Are fast,
- Incur low cognitive load, and
- Contribute to worthwhile goals.



twitch.stanford.edu  
hci.stanford.edu

