Rethinking Passwords

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Intel's rules

- The password must be at least 8 characters long.
- The password **must** contain at least:
  - one alpha character [a-zA-Z];
  - one numeric character [0-9];
  - one special character from this set:
    ` ! @ $ % ^ & * ( ) - _ = + [ ] ; : ' " , < . > / ?
- The password **must not**:
  - contain spaces;
  - begin with an exclamation [!] or a question mark [?];
  - contain your login ID.
- The first 3 characters cannot be the same.
- The sequence of the first 3 characters cannot be in your login ID.
- The first 8 characters cannot be the same as in your previous password.
- Passwords are treated as case sensitive.

Golden Rule Health

PASSWORD RULES (Please note the password is case sensitive)

Must contain at least 8 characters.

Must include a number and a letter.
No more than two consecutive characters may be the same.

Passwords must be changed at least every 180 days.

No password may be re-used for a period of 1 year.

3 invalid attempts to login will result in a 30 minute lockout.

Wachovia

- User IDs must be 7-20 characters
- User IDs must contain at least one letter; numbers are allowed, but not required
- User IDs cannot contain spaces
- User IDs cannot contain your Social Security Number, Tax Identification Number, or your Customer Access Number
- No special characters are allowed, such as: ! @ # $ % ^ &
- Use of an underscore is allowed but not required: _
- Do not use your Password as your User ID

Password:

- Passwords must be 7-20 characters
- Must include at least one letter and one number, with no spaces
- Semi-colons cannot be part of a Password
- Passwords are case sensitive
- Do not use your User ID as your Password

Dartmouth

- It should be eight characters long using only numbers and upper- and lower-case letters. **Note**: Passwords longer than eight characters will not work to authenticate you with some applications used at Dartmouth, such as Kerberos and Oracle Calendar.
- There can be no more than four characters in sequence (e.g., **12345** or **abcde** are not allowed).
- It must contain at least five different characters (e.g., **2a3a2a3a** only contains three different characters so is not allowed).
- It cannot be a word found in the dictionary, including foreign languages (e.g., **password**).
- It cannot be a reversal of a word found in the dictionary (e.g., **drowssap**).
- It cannot be a word found in the dictionary, plus one additional character either before or after the word (e.g., **xalgebra** or **algebrax**).
- It cannot be a word found in the dictionary with numbers substituted for look-alike letters (e.g., **passw0rd** or **pa55word**).
- It cannot be a word found in the dictionary minus any punctuation, symbols, or numbers (e.g., **oclock** or **soninlaw**).

AT&T (Uverse)

1. Passwords are case sensitive.
2. Passwords must be 6-24 characters long.
3. Password characters must be alphanumeric.
4. Password must contain at least one alpha character and at least one numeric character.
5. Password cannot match Member ID.
6. Password cannot have any special characters except hyphen (-) and/or underscore (_).
7. Avoid using personal information, such as name, birth date or ZIP code.

AT&T Global Network Services

Passwords can contain alpha or numeric characters (No special characters).
A password must begin with an alphabetic character.
Passwords are a minimum of 5 characters and a maximum of 8 characters.
You may not reuse a password for six months.
Passwords are not case sensitive.

Note: **Your password will expire every 60 days**.

OAG password rules

* The password must be at least seven characters long and cannot exceed fifty characters.
* The password is case sensitive and must include at least one letter and one numeric digit.
* The password may include punctuation characters but cannot contain spaces or single or double apostrophes.
* The password must be in Roman characters

World of Warcraft Wizard Rules

*** Your Account Password must contain at least one numeric character and one alphabetic character.**
*** It must differ from your Account Name.**
*** It must be between eight and sixteen characters in length.**
*** It may only contain alphanumeric characters and punctuation such as A-Z, 0-9, or !"#$%.**

DHS

- Passwords shall not contain any proper noun or the name of any person, pet, child, or fictional character. Passwords shall not contain any employee serial number, Social Security number, birth date, phone number, or any information that could be readily guessed about the creator of the password.
- Passwords shall not contain any simple pattern of letters or numbers, such as "qwerty" or "xyz123".
- Passwords shall not be any word, noun, or name spelled backwards or appended with a single digit or with a two-digit "year" string, such as 98xyz123.
- Pass phrases, if used in addition to or instead of passwords, should follow the same guidelines.
- Passwords shall not be the same as the User ID.

Create a password between 8 to 15 characters.
Your password must contain at least:

- **one special character (shift-number)**
- **one uppercase character**
- **one lowercase character**
- **and NOT contain any spaces**

Fillet of a fenny snake,
In the cauldron boil and bake;
Eye of newt and toe of frog,
Wool of bat and tongue of dog,
Adder's fork and blind-worm's sting,
Lizard's leg and howlet's wing,
For a charm of powerful trouble,
Like a hell-broth boil and bubble.

-- Macbeth, Act 1, Scene 1

	length	case sens.	A-Z	a-z	0-9	sym	OK	not OK
Intel	>=8	Yes	R	R	R	ok		␣
Golden Rule	>=8							
Wachovia	7-20	Yes	ok	R		no		
Dart-mouth	8		ok	ok	ok	no		
AT&T Uvers	6-24	Yes	R		R	no	- _	
AT&T GNO	5-8	No						
OAG	7-50	Yes	R		R			␣ ‘ “
War-craft	8-16		R		R			-!”#$
DHS	8-15		R		R			␣
Calnet	9-255		3	3	3	3	␣	
UAL	6-24	No						
Lehigh	>=7		2	2	2	2		

Use A Different Password on each Target System

Change Your Password Frequently

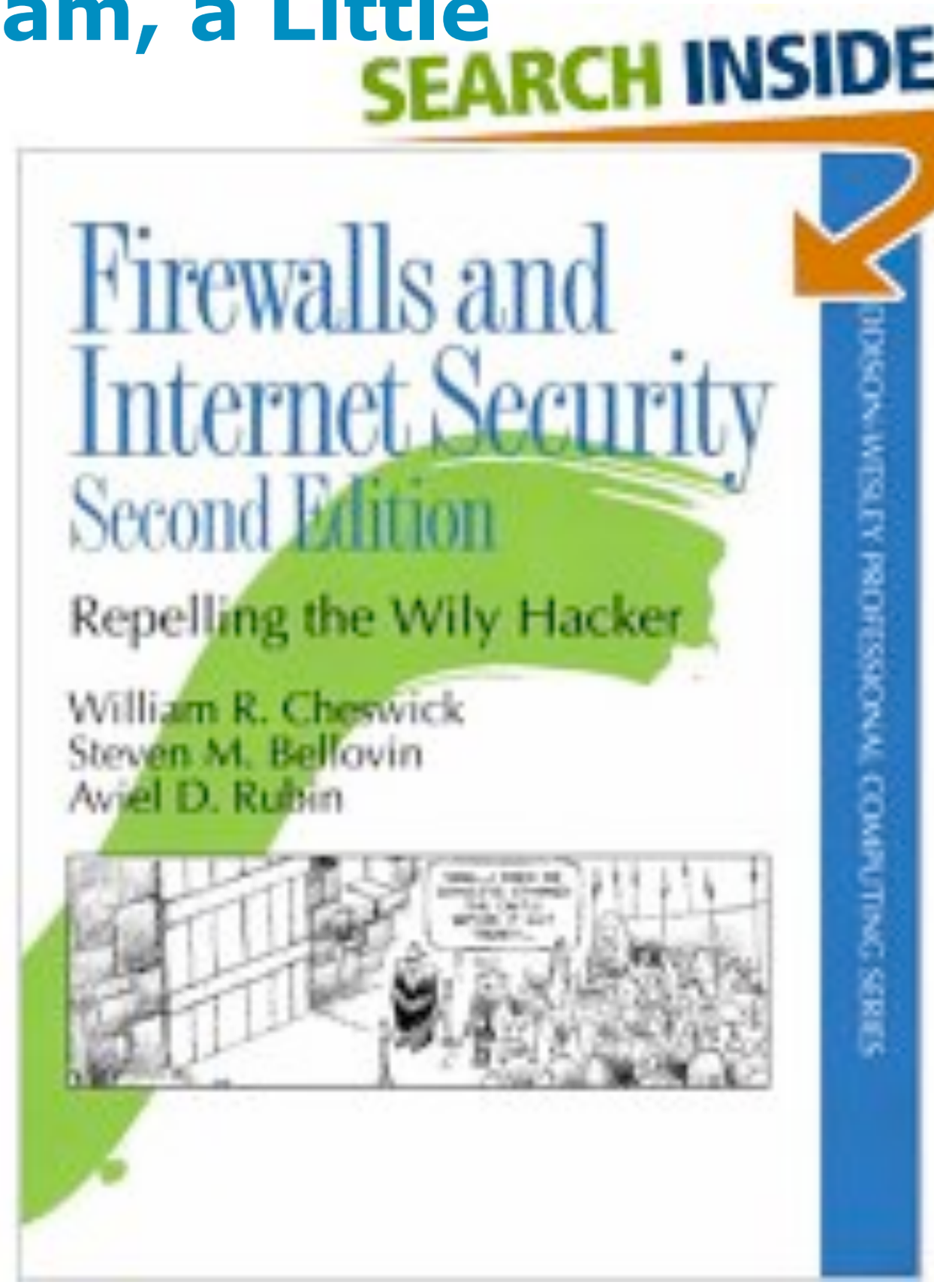
Don’t Reuse Passwords

Don’t Write Your Password Down

This is a usability nightmare!

Who is Responsible For This Eye-Of-Newt Password Fascism?

Well, I am, a Little



A Short Excerpt From a 1950s Security Training Film

Security people are paid to think bad thoughts - Bob Morris

Acme model 1C Magic Cave Door, with daemon locking feature

- **Naive, but it was a rush job**
- **{open|close} PASSWORD**
- **After-action review initiated many of the changes you are familiar with today**

The client

- A very difficult client, but influential
- We were hoping to use this job for marketing
- He insisted on the Jackals clause on all his contracts, including ours
  - HR had big problems with this
  - We did get to greatly increase our fees
  - I was to New Mexico office before this incident to address signage problems
- Note: Jackals are not indigenous to the area

Consider the program for the door

- {open|close} $PASSWORD
  - dictionary attack
- limit tries
  - fast dictionary attack (Moore's law in efrits)
- limit time
  - how long?
  - ask the client?
- lockout time
  - how long
  - ask the client?

Consider the door (cont)

- back door
  - for the client?
  - for admin?
  - guessable?
- biometrics
  - only hasan and client?
  - who can authorize other ones
  - what about Acme?

Consider the door

- **Logging**
- **Different users, different passwords?**
- **Who maintains the list?**
- **Under what circumstances can it change?**

Mister Hasan

- **Independent contractor, hired by the client, not Acme**
- **Not our ideal for choice of a guard**
- **Value in the vault: 18m^2 of gold mined for all time, ~= $4.4 trillion dollars**

Attack

- **The three B-s**
  - **burglary**
  - **bribery**
  - **blackmail**

Defense

- **Why does Hassan need to know the password in the first place?**
- **Even if he is trustworthy (a big if), is he capable, or a flawed part of our security scheme.**

Wait a minute...

- **Bugs didn’t need to know the password**
- **The “firewall” could be avoided**
- **You don’t go through security, you go around it.**

100 Most Influential People in IT
eWeek, 2008-04-04

96. Dave Winer
Software developer and entrepreneur

Winer is the developer of RSS.

97. Thornton May
Florida Community College, IT Leadership Academy
May is a noted technology futurist.

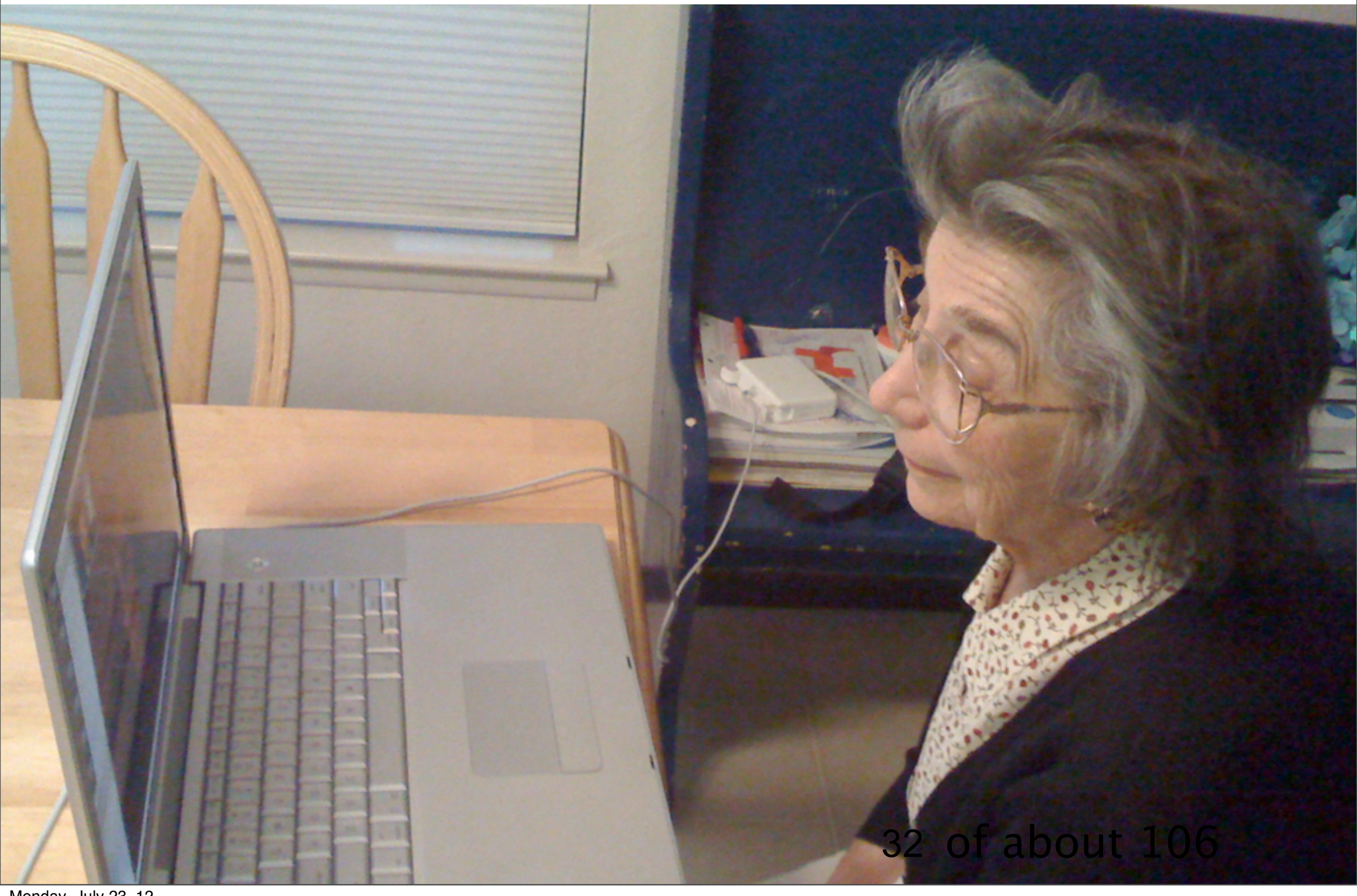
98. William Cheswick
Lead member of technical staff, AT&T Labs

Cheswick continues to innovate in the area of communications research.

99. Chris Anderson
Author
Anderson, editor in chief of Wired, proffered the notion of the niche in his book, “The Long Tail: Why the Future of Business Is Selling Less of More.”

100. Ben Bernanke
Chairman, Federal Reserve Board
No one will have a bigger impact on the fate of the nation’s banks and financial services companies, interest rates, or access to credit.

A note on Grandma



We knew that people are lousy at picking passwords by 1990 (actually much earlier)

- **Klein, D. V.; *Foiling the Cracker; A Survey of, and Improvements to Unix Password Security*, Proceedings of the United Kingdom Unix User's Group, London, July 1990.**

The Dictionary Attack Arms Race

- **Moore's Law: 12 doublings since 1990**
- **And multi-core CPUs are perfect for password cracking**
- **Can a human choose and remember a password that a computer can't guess when limited only by computer speed and time available?**

Where Do Security Policies Come From?

Dini Florêncio and Cormac Herley

SOUPS 2010

Those that accept advertising, purchase sponsored links, or user has a choice have weakest password requirements

Strongest passwords: .gov, then .edu

These rules come from the Deep Past in computing and security

- **Time sharing terminals in public places**
- **Attacks on the login interfaces on network services**
- **Network eavesdropping was often trivial**
- **The stakes were usually much lower**
- **Institutionalized passwords on, say, telephone switches**
- **Changing passwords: lost military crypto gear**

What are the most common current threats

- **Keystroke loggers**
- **Phishing attacks**
- **Password database compromise**

None of these are grandma's fault!

- ***Users are Not the Enemy*, A. Adams and M.A. Sasse, *Commun. ACM*, 42(12), 1999.**

It is simply poor engineering to expect people to select and remember passwords that are resistant to dictionary attacks

Results

- **People violate many of these rules routinely, for usability reasons**
- **Stringent rules increase use of fall-back systems, which are usually less secure, or more expensive**
- **The rules don’t make most things more secure in the face of most current threats**

Some Password Ideas

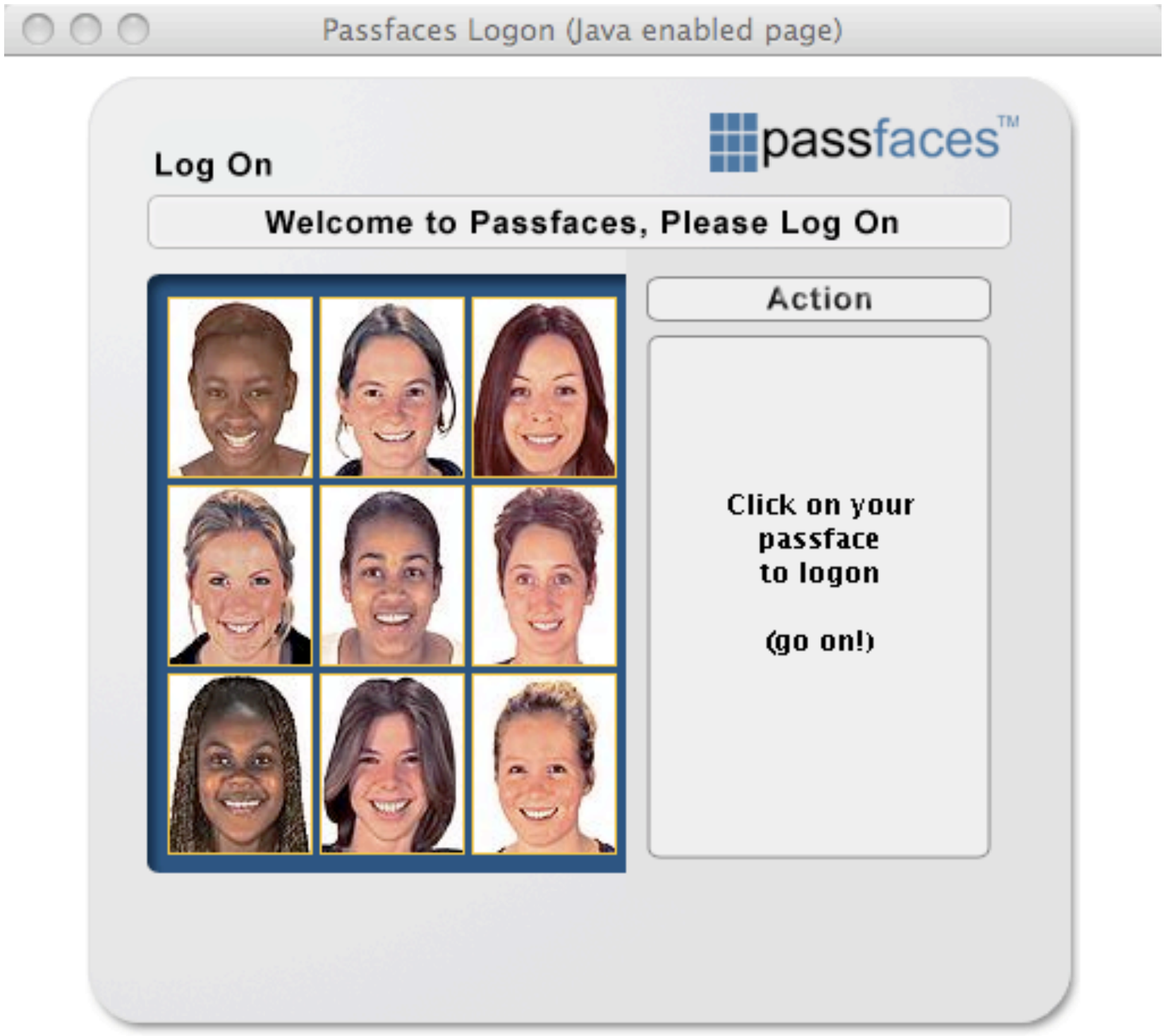
From academia, and me

For a complete survey, see

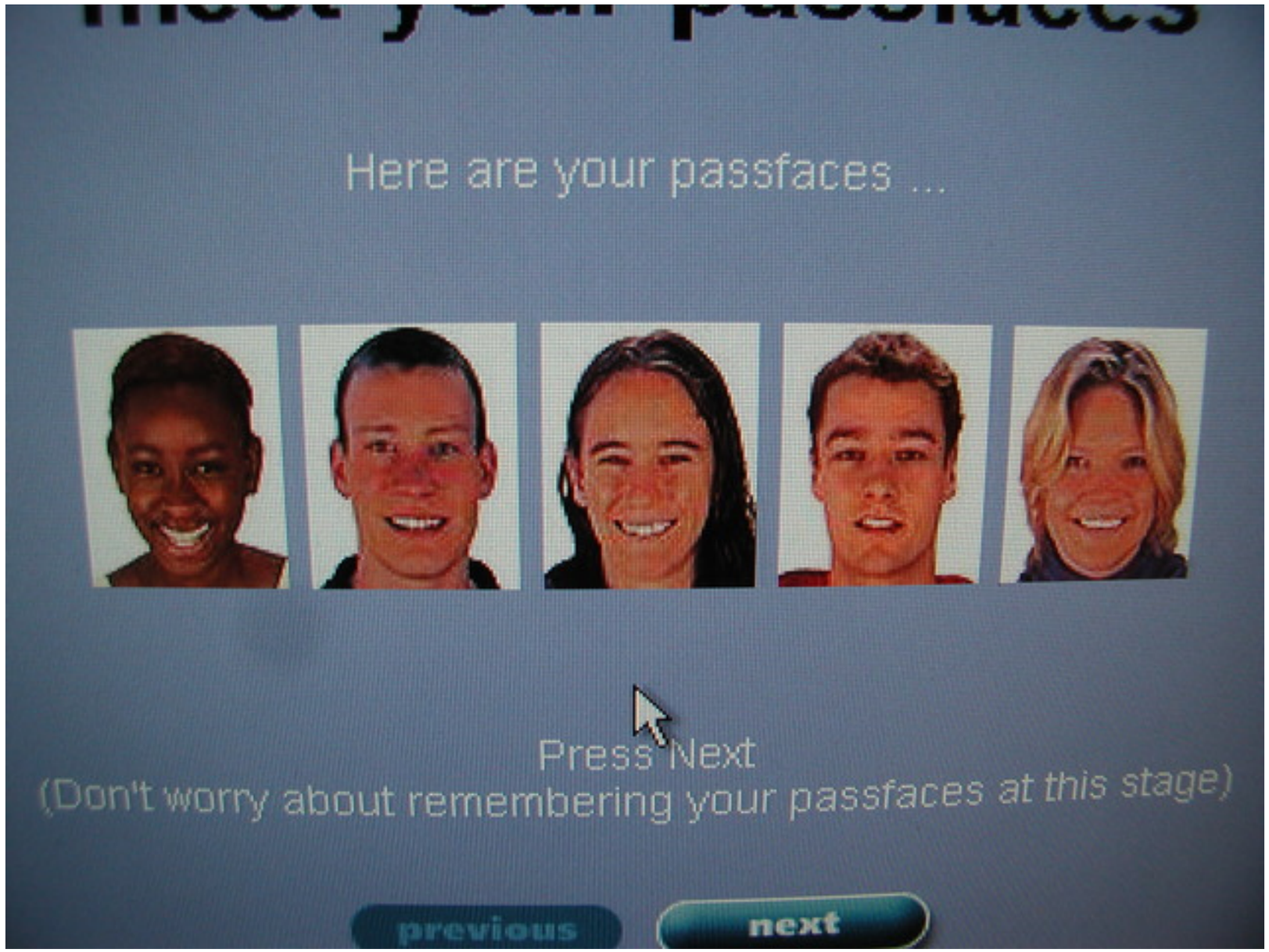
- http://people.scs.carleton.ca/~paulv/papers/gpsurvey-27sept2010.pdf

from *Dirik, Memon, Birget*; SOUPS 2007

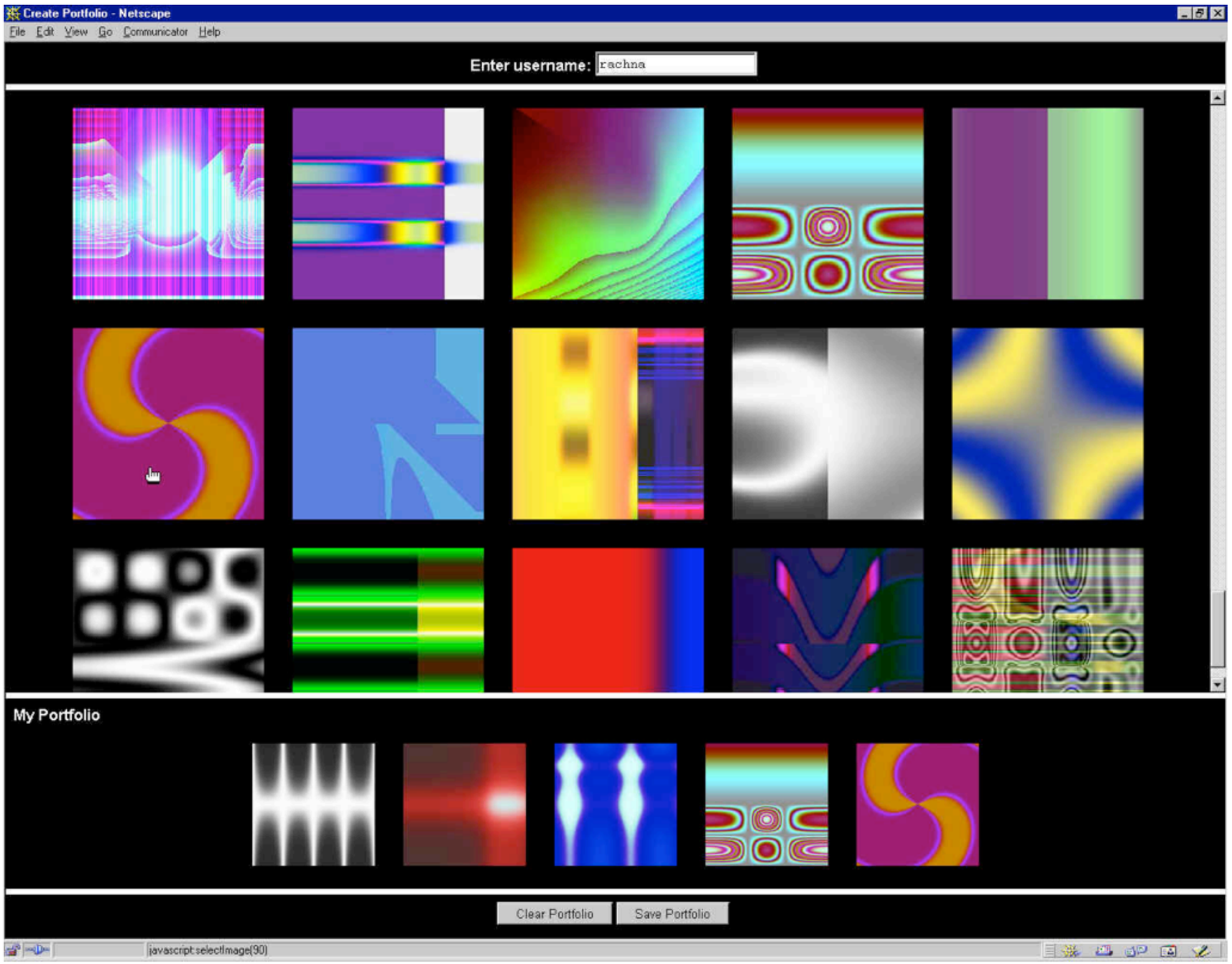
Passfaces


Passfaces Logon (Java enabled page)
Log On
passfaces™
Welcome to Passfaces, Please Log On
Action
Click on your passface to logon
(go on!)

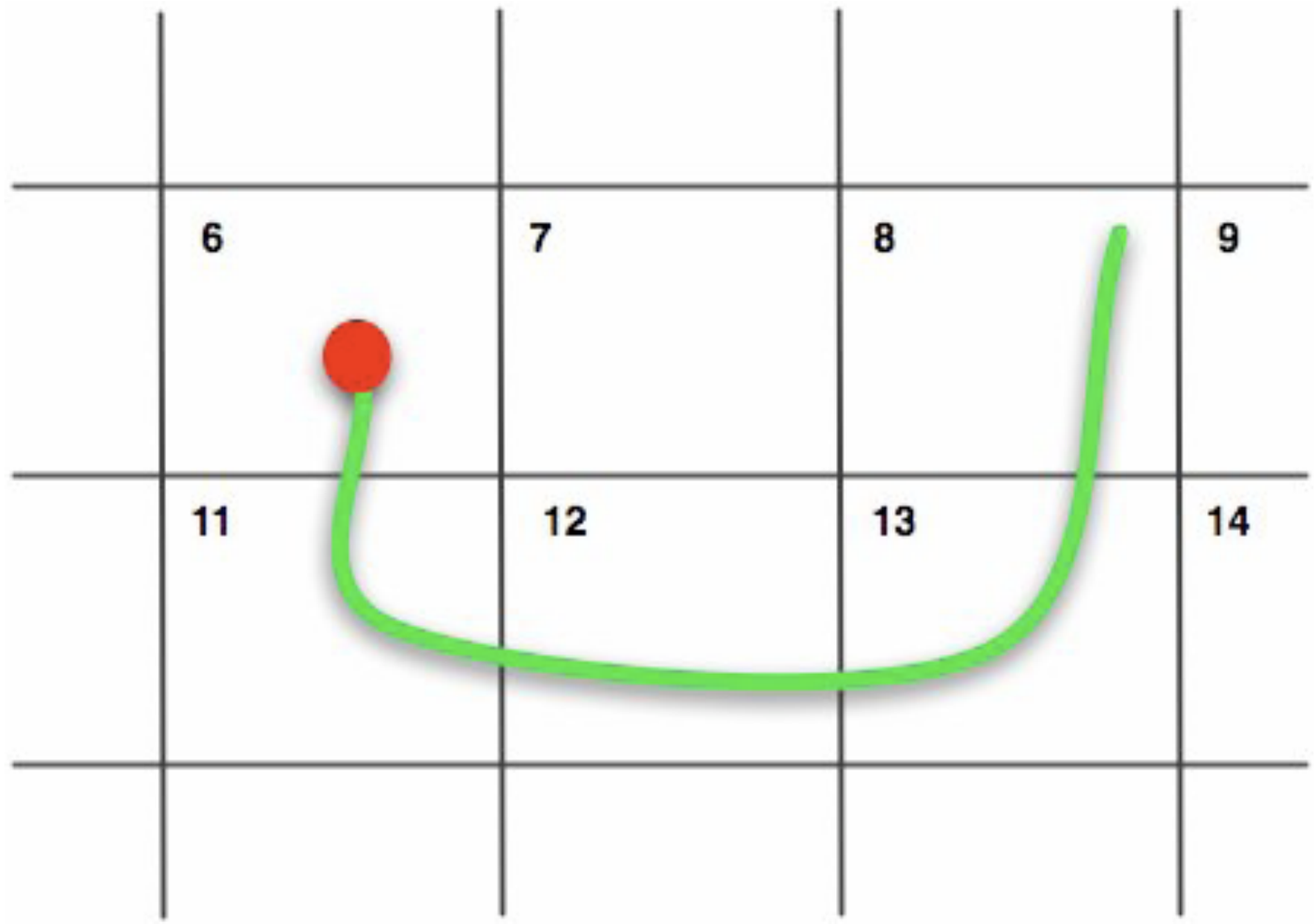
My passfaces



Deja Vu (Recognition-based)



Draw a Secret



Lin, Dunphy, *et al.* SOUPS 2007

Use Your Illusion (SOUPS 2008)

A Very Short Course on Entropy

2^{10} = 1024 of the most common British words

the of and a in to it is to was for that you he with on by at are not this but had they his from she that which or we an were as do been their has would there what will all if can said who one so up as them some when could him into its then two out time my about did your now me no other only just more these also people know any first see very new may well should like than how get way one our made got after think between many years er those go being down yeah three good back make such on there through year over must still even take too more here own come last does oh say no work where erm us government same man might day yes however put world over another in want as life most against again never under old much something why each while house part number out off different went really thought came used children always four where without give few within about system local place great during although small before look next when case end things social most find group quite mean five party every company women says important took much men information per both national often seen given school fact money told away high point night state business second need taken done right having thing looked area perhaps head water right family long hand like already possible nothing yet large left side asked set whether days mm home called development week such use country power later almost young council himself of far both use room together tell little political before able become six general service eyes members since times problem anything market towards court public others face full doing war car felt police keep held problems road probably help interest available law best form looking early making today mother saw knew education work actually policy ever so at office am research feel big body door let name person services months report question using health turned million main though words enough child less book period until several sure father for level control known society major seemed around began itself themselves minister economic wanted upon areas after therefore woman city community only including centre gave job among position effect likely real clear staff black kind read provide particular became line moment international action special difficult certain particularly either open management taking across idea whole age process act around evidence view better off mind sense rather seems believe morning third else half white death sometimes thus brought getting church ten shall try behind heard table change support back sort whose industry ago free care so order century range gone yesterday training working ask street home word groups history central all study usually remember trade hundred programme food committee air hours experience rate hands indeed sir language land result course someone everything certainly based team section leave trying coming similar once minutes authority human changes little cases common role true necessary nature class reason long saying town show subject voice companies since because simply especially department single short personal as pay value member started run patients paper private seven eight systems herself practice wife price type seem figure former rather lost right need matter decision bank countries until makes union terms financial needed south university club president friend parents quality building north stage meeting foreign soon strong situation comes late bed recent date low concerned girl hard according as twenty higher tax used production various understand led bring schools ground conditions secretary weeks clearly bad art start up include poor hospital friends decided shown music month tried game anyone wrong ways chapter followed cost play present love issue at goes described more award king royal results workers expected amount students despite knowledge moved news light approach lord cut basis hair required further paid series better before field allowed easy kept questions natural live future rest project greater feet meet simple died for happened added manager computer security near met evening means round carried hear heart forward sent above attention story structure move agreed nine letter individual force studies movement account per call board success following considered current everyone fire agreement please boy capital stood analysis whatever population modern theory books stop in legal material son received model chance environment finally performance sea rights growth authorities provided nice whom produced relationship talk turn built final east talking fine worked west parties size record red close property myself example space giving normal nor reached buy serious quickly along plan behaviour recently term previous couple included pounds anyway cup treatment energy total thank director prime levels significant issues sat income top choice away costs design pressure scheme change a list suddenly continue technology hall takes ones details happy consider won defence following parts loss industrial activities throughout spent outside teachers generally opened floor round activity hope points association nearly allow rates sun army sorry wall hotel forces contract dead stay reported as hour difference meant summer county specific numbers wide appropriate husband top played relations figures chairman set lower product colour ideas look arms obviously unless produce changed season developed unit appear investment test basic write village reasons military original successful garden effects each aware yourself exactly help suppose showed style employment passed appeared page hold suggested continued offered products popular science window expect beyond resources rules professional announced economy picture okay needs doctor maybe events a direct gives advice running circumstances sales risk interests dark event thousand involved written park returned ensure fish wish opportunity commission oil sound ready lines shop looks immediately worth in college press fell blood goods playing carry less film prices useful conference operation follows extent designed application station television access response degree majority effective established wrote region green ah western traditional easily cold shows offer though statement published forms down accept miles independent election support importance lady site jobs needs plans earth earlier title parliament standards leaving interesting houses planning considerable girls involved increase species stopped concern public means caused raised through glass physical thought eye left heavy walked daughter existing competition speak responsible up river follow

Pick one at random, entropy = 10 bits ($2^{10} = 1024$)

the of and a in to it is to was for that you he with on by at are not this but had they his from she that which or we an were as do been their has would there what will all if can said who one so up as them some when could him into its then two out time my about did your now me no other only just more these also people know any first see very new may well should like than how get way one our made got after think between many years er those go being down yeah three good back make such on there through year over must still even take too more here own come last does oh say no work where erm us government same man might day yes however put world over another in want as life most against again never under old much something why each while house part number out off different went really thought came used children always four where without give few within about system local place great during although small before look next when case end things social most find group quite mean five party every company women says important took much men information per both national often seen given school fact money told away high point night state business second need taken done right having thing looked area perhaps head water right family long hand like already possible nothing yet large left side asked set whether days mm home called development week such use country power later almost young council himself of far both use room together tell little political before able become six general service eyes members since times problem anything market towards court public others face full doing war car felt police keep held problems road probably help interest available law best form looking early making today mother saw knew education work actually policy ever so at office am research feel big body door let name person services months report question using health turned million main though words enough child less book period until several sure father for level control known society major seemed around began itself themselves minister economic wanted upon areas after therefore woman city community only including centre gave job among position effect likely real clear staff black kind read provide particular became line moment international action special difficult certain particularly either open management taking across idea whole age process act around evidence view better off mind sense rather seems believe morning third else half white death sometimes thus brought getting church ten shall try behind heard table change support back sort whose industry ago free care so order century range gone yesterday training working ask street home word groups history central all study usually remember trade hundred programme food committee air hours experience rate hands indeed sir language land result course someone everything certainly based team section leave trying coming similar once minutes authority human changes little cases common role true necessary nature class reason long saying town show subject voice companies since because simply especially department single short personal as pay value member started run patients paper private seven eight systems herself practice wife price type seem figure former rather lost right need matter decision bank countries until makes union terms financial needed south university club president friend parents quality building north stage meeting foreign soon strong situation comes late bed recent date low concerned girl hard according as twenty higher tax used production various understand led bring schools ground conditions secretary weeks clearly bad art start up include poor hospital friends decided shown music month tried game anyone wrong ways chapter followed cost play present love issue at goes described more award king royal results workers expected amount students despite knowledge moved news light approach lord cut basis hair required further paid series better before field allowed easy kept questions natural live future rest project greater feet meet simple died for happened added manager computer security near met evening means round carried hear heart forward sent above attention story structure move agreed nine letter individual force studies movement account per call board success following considered current everyone fire agreement please boy capital stood analysis whatever population modern theory books stop in legal material son received model chance environment finally performance sea rights growth authorities provided nice whom produced relationship talk turn built final east talking fine worked west parties size record red close property myself example space giving normal nor reached buy serious quickly along plan behaviour recently term previous couple included pounds anyway cup treatment energy total thank director prime levels significant issues sat income top choice away costs design pressure scheme change a list suddenly continue technology hall takes ones details happy consider won defence following parts loss industrial activities throughout spent outside teachers generally opened floor round activity hope points association nearly allow rates sun army sorry wall hotel forces contract dead stay reported as hour difference meant summer county specific numbers wide appropriate husband top played relations figures chairman set lower product colour ideas look arms obviously unless produce changed season developed unit appear investment test basic write village reasons military original successful garden effects each aware yourself exactly help suppose showed style employment passed appeared page hold suggested continued offered products popular science window expect beyond resources rules professional announced economy picture okay needs doctor maybe events a direct gives advice running circumstances sales risk interests dark event thousand involved written park returned ensure fish wish opportunity commission oil sound ready lines shop looks 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Two random choices = 20 bits

the of and a in to it is to was for that you he with on by at are not this but had they his from she that which or we an were as do been their has would there what will all if can said who one so up as them some when could him into its then two out time my about did your now me no other only just more these also people know any first see very new may well should like than how get way one our made got after think between many years er those go being down yeah three good back make such on there through year over must still even take too more here own come last does oh say no work where erm us government same man might day yes however put world over another in want as life most against again never under old much something why each while house part number out off different went really thought came used children always four where without give few within about system local place great during although small before look next when case end things social most find group quite mean five party 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20 bits, our two words

- **“example early”**

Good stuff!

- **The list of words isn’t secret**
- **so spelling checker is okay!**
- **easy words to type**
- **on an iPhone, pick words where the “tappos” give the word you wanted**

Required entropy, according to Florêncio and Herley

- **Facebook, Twitter, etc. are a minimum of ~20 bits**
- **Banks are in the 30s**
- **Government in the mid 40s and up**

Another Solution: Don’t allow common passwords

Popularity* is *Everything

Stuart Schechter, Cormac Herley, Michael Mitzenmacher;

HOTSEC 2010.

Count and limit password choices

- **I.E. only 100 people (out of a million?) may use *password* as a password**
- **Makes the dictionary attack much harder: common targets vanish**
- **Makes passwords harder to choose, like picking a gmail account name: *dragonslayer6478***

Authentication schemes in general

- **Entropy is hard for usable systems**
- **High entropy systems are usually hard**
- **User studies are required**
  - **uses college kids, two department secretaries, and someone's grandma**
  - **results seldom surprising (to me, at least)**
- **Mechanical Turk can give much higher N, but tests are hard to create.**

Some Whacko Ideas from ches

Passmaps

(Zoomauth demo)

Carrier 10:46 AM

Keyring | Key options | Continue

Key name: Sample

Use hex for responses OFF

Zero if bad unlock ON

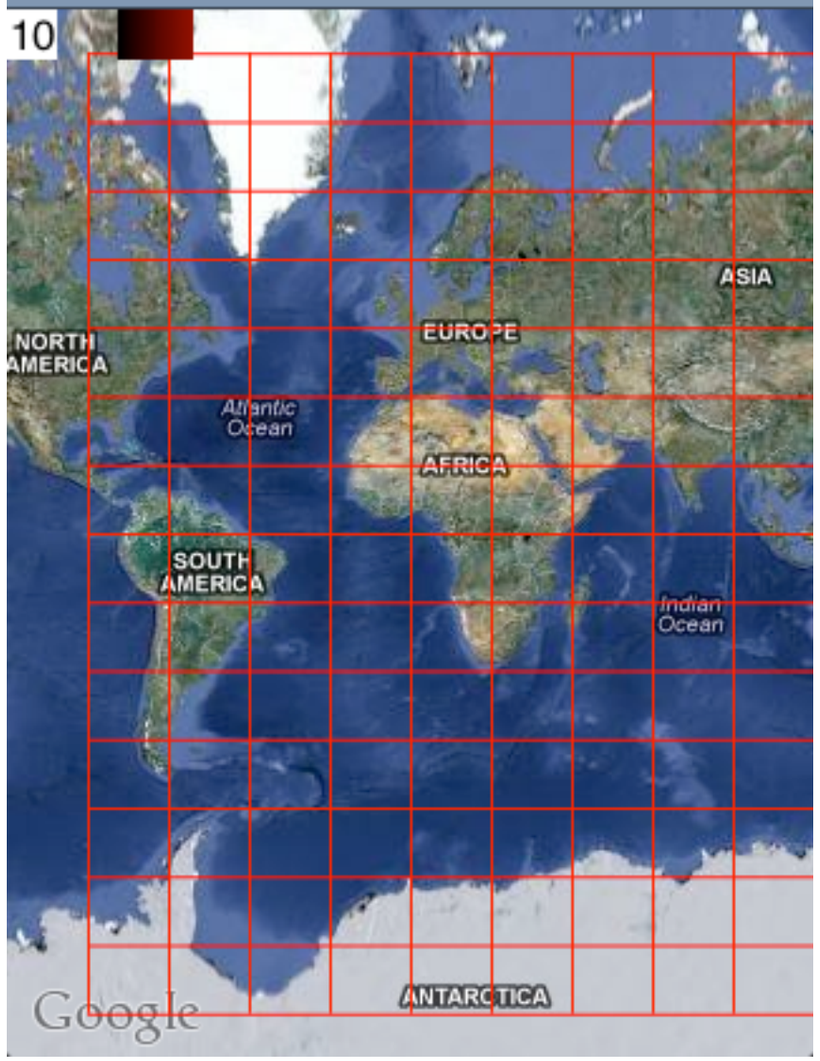
Use helper bits OFF

Select zoom type:

Map | Graph | Document

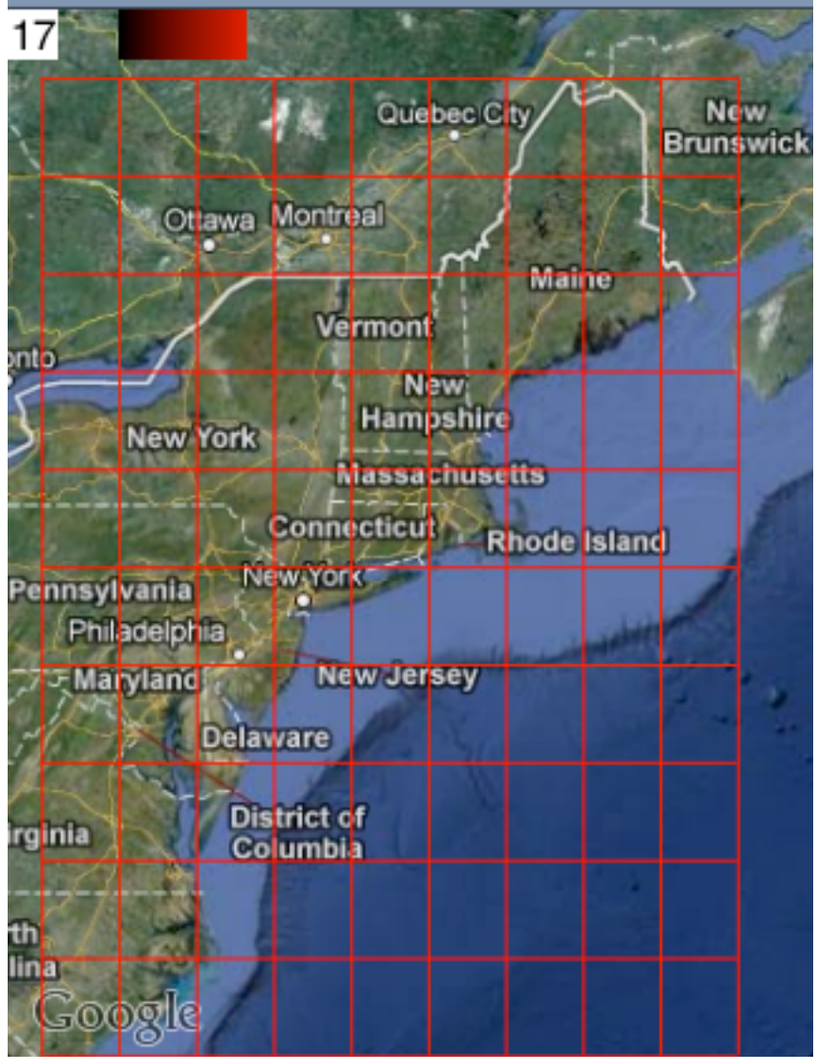
Carrier 10:46 AM

Key options | Zoom and tap

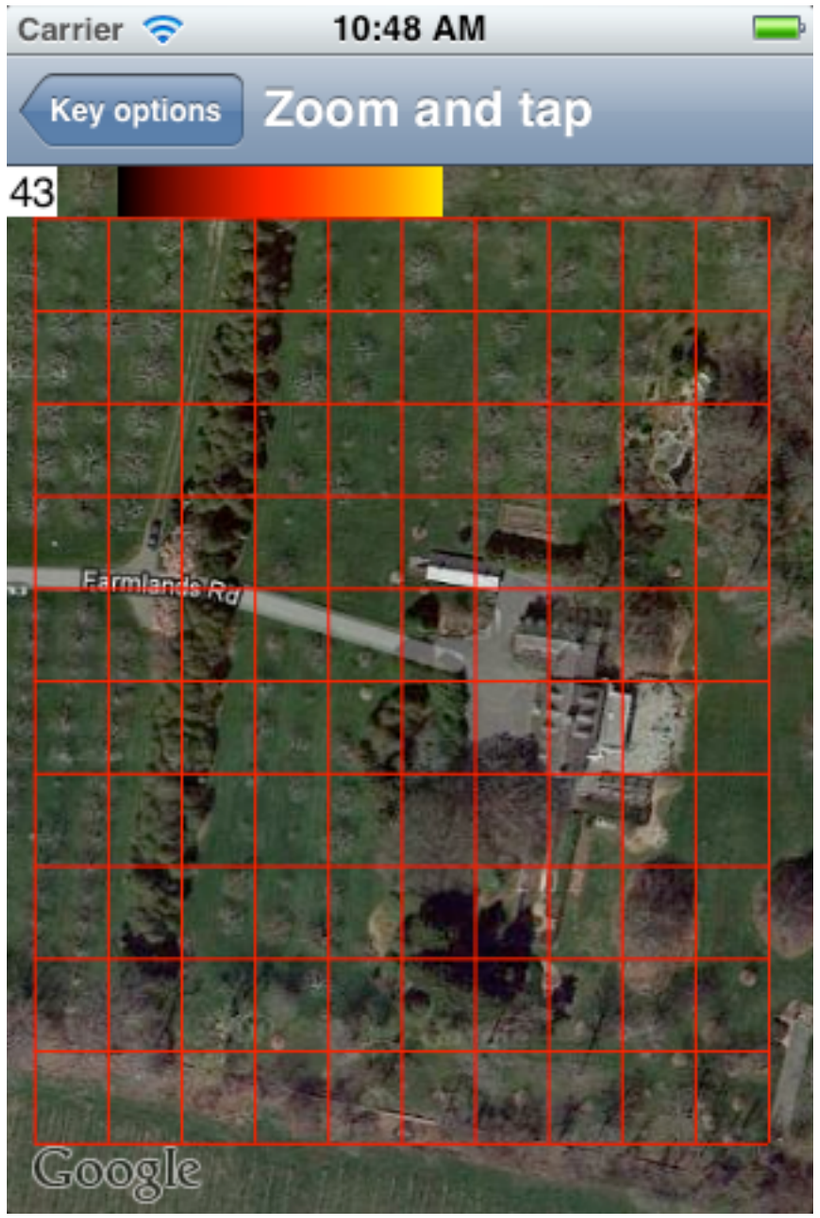


Carrier 10:47 AM

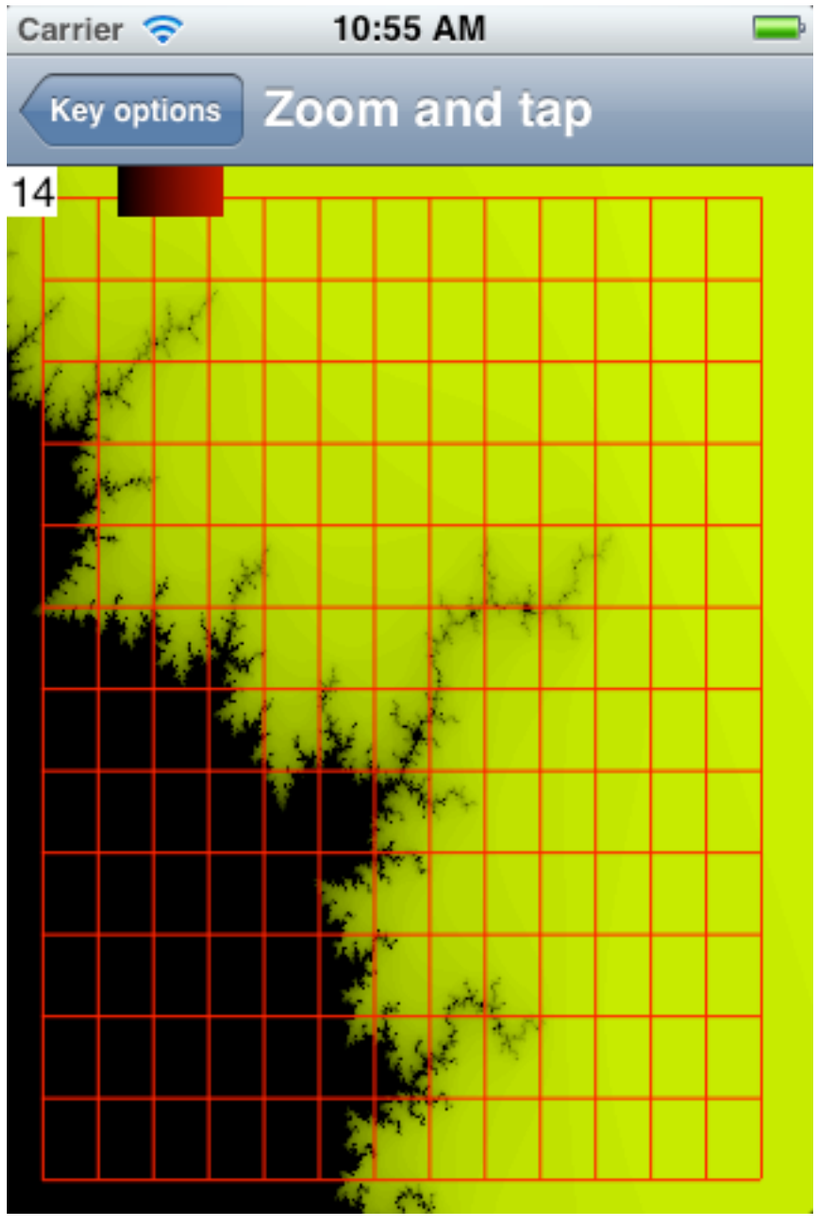
Key options | Zoom and tap




Carrier
10:47 AM
Key options
Zoom and tap
35
Sandy Point
Wapping Rd
Google


Carrier
10:48 AM
Key options
Zoom and tap
43
Farmlands Rd
Google


Carrier
10:48 AM
Key options
Zoom and tap
47
mlands Rd
Google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Key options | Select document

- calculus.pdf
- tcith-asl.pdf
- walden.pdf

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Page 172

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$$22^{-2} \qquad \int \quad -2$$

$$u = 1 - x^2,\ x^2 = 1 - u \text{ and the in}$$

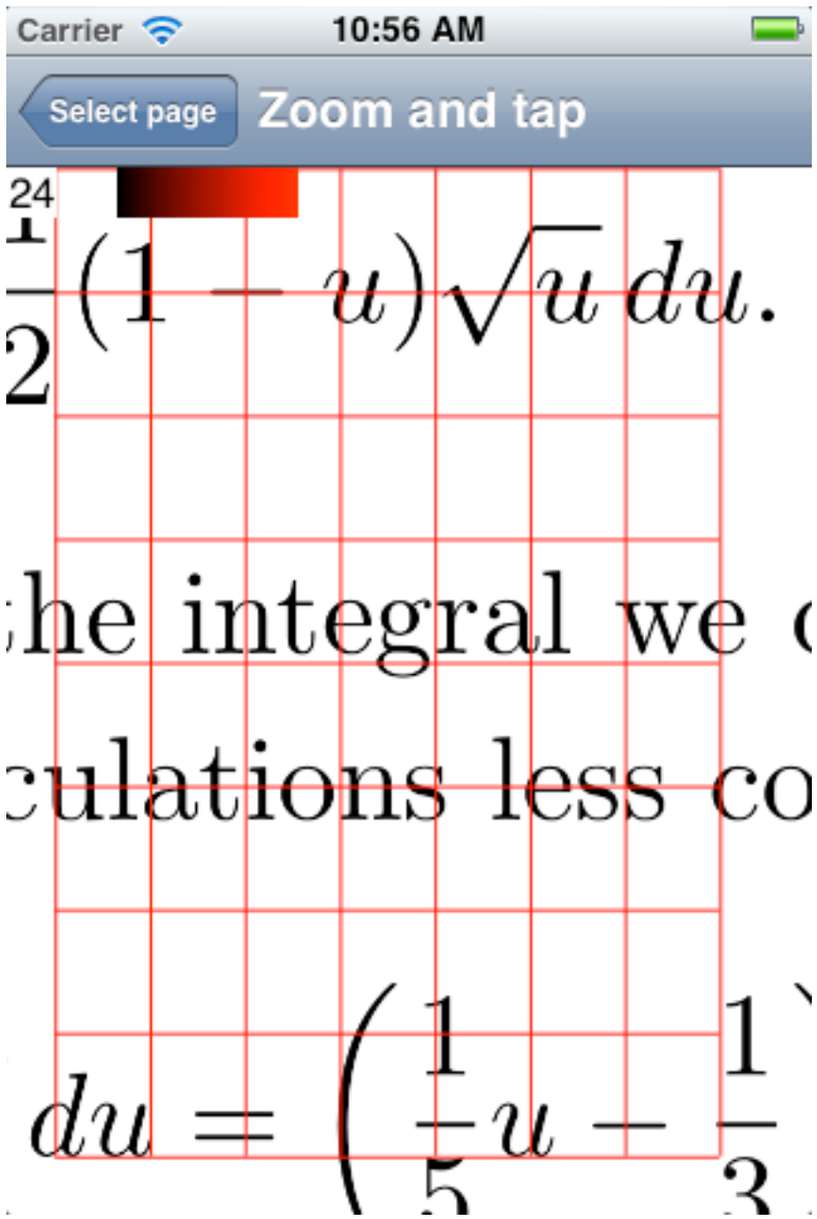
$$\int -\frac{1}{2}(1-u)\sqrt{u}\,du.$$

exactly the integral we computed

e the calculations less confusing.

$$-u)\sqrt{u}\,du = \left(\frac{1}{5}u - \frac{1}{3}\right)u^{3/2} +$$

$$^2\,dx = \left(\frac{1}{5}(1-x^2) - \frac{1}{3}\right)(1-x^2)^3$$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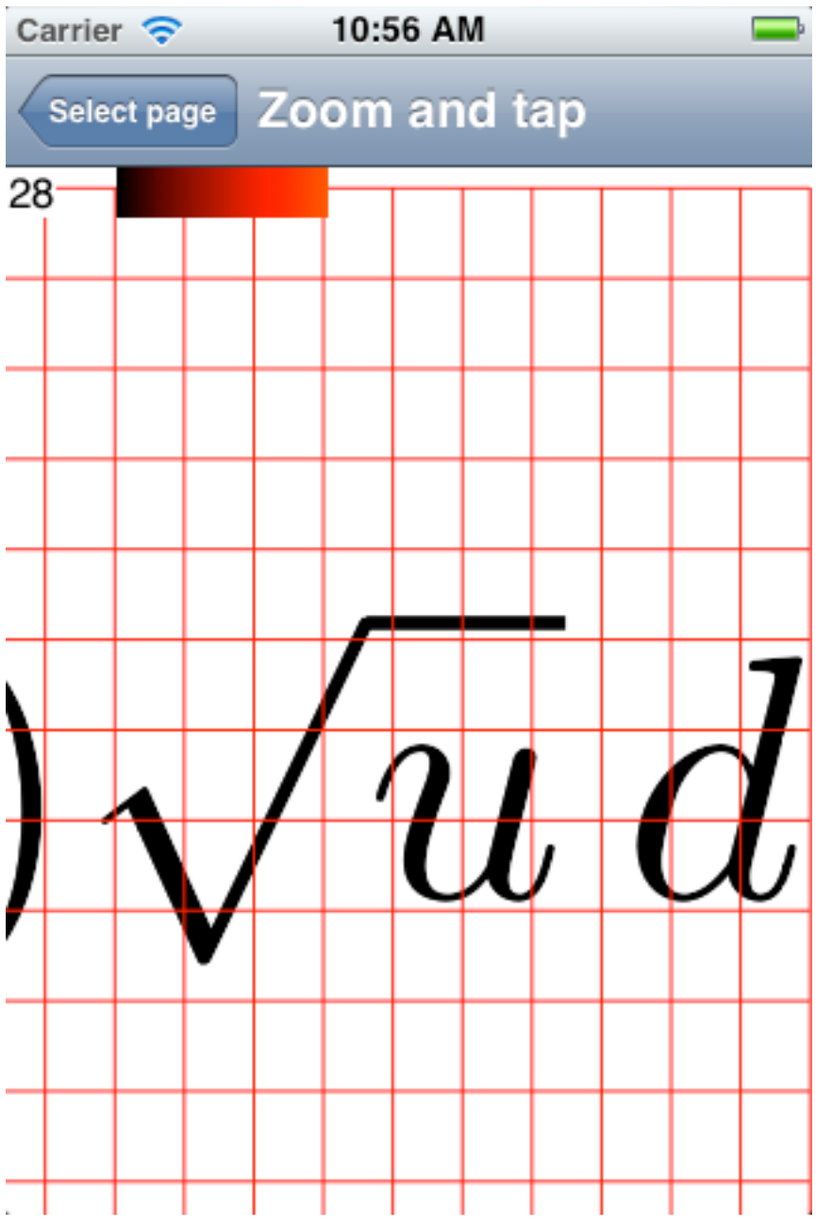
culations less co
$du = \left(\frac{1}{5}u - \frac{1}{3}\right.$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$)\sqrt{u}\,d$

Some Whacko ches Ideas

Obfuscated human-computed challenge response

Problem

- **One-time passwords solve a lot of password problems**
- **One-time passwords (usually challenge/ response) require something you have**
- **Equipment can be expensive, and it may be necessary to authenticate when equipment is not available**

Baseball players

- **Under a lot of stress**
- **Information is often vital to the game**
- **Not always the sharpest knife in the drawer**
  - **Babe Ruth forgot the signs five steps out on the field**

Key insight?

- **Humans can’t compute well, but perhaps they can obfuscate well enough**

Proposed approach

- **Use human-computed responses to computer challenges for authentication**
- **Though the computation is easy, much of the challenge and response is ignored**
- **Obfuscation and lack of samples complicate the attacker's job beyond utility**

Challenge:	Response:	
ches 00319 Thu Dec 20 15:32:22 2001	23456bcd;f.k	
root 00294 Fri Dec 21 16:47:39 2001	nj3kdi2jh3yd6fh:/	
ches 00311 Fri Dec 21 16:48:50 2001	/ldh3g7fgl	
ches 00360 Thu Jan 3 12:52:29 2002	jdi38kfj934hdy;dkf7	
ches 00416 Fri Jan 4 09:02:02 2002	jf/l3kf.l2cxn. y	
ches 00301 Fri Jan 4 13:29:12 2002	j2mdjudurut2jdnch2hdtg3kdjf;s'/s	
ches 00301 Fri Jan 4 13:29:30 2002	j2mdgfj./m3hd'k4hfz	
ches 00308 Tue Jan 8 09:35:26 2002	/l6k3jdq,	
ches 84588 Thu Jan 10 09:24:18 2002	jf010fk;.j	
ches 84588 Thu Jan 10 09:24:35 2002	heu212jdg431j/	
ches 00306 Thu Jan 17 10:46:00 2002	jfg.bv,vj/,1	
ches 00309 Fri Jan 18 09:37:09 2002	no way 1 way is best!/1	
ches 00309 Fri Jan 18 09:37:36 2002	jzw	* no *
ches 00368 Tue Jan 22 09:51:41 2002	84137405jgf/	
ches 77074 Tue Feb 19 09:02:52 2002	d	* no *
ches 77074 Tue Feb 19 09:02:57 2002	hbcg3]'d/	
ches 00163 Mon Feb 25 09:24:30 2002	d	* no *
ches 00163 Mon Feb 25 09:24:35 2002	ozhdkf0ey2k/.,vk0l	
ches 00156 Tue Mar 12 12:41:12 2002	3+4=7 but not 10 or 4/2	
ches 00161 Fri Mar 15 09:41:20 2002	/.,kl9djfir	
ches 00161 Fri Mar 15 09:41:36 2002	3	* no *
ches 00160 Mon Mar 25 08:52:59 2002	222	
ches 00160 Mon Mar 25 08:53:09 2002	2272645	
ches 29709 Mon Apr 1 11:36:34 2002	4	
ches 41424 Mon Apr 8 09:49:09 2002	ab3kdhf	
ches 85039 Tue Apr 9 09:46:06 2002	04	
ches 00161 Thu Apr 18 10:49:14 2002	898for/dklf7d	

Can Something You Know Be Saved?

Baris Coskun and Cormac Herley, in *Proc. 11th Information Security Conference (ISC 2008)*, pp. 421-440, Springer-Verlag [September 2008]

Can "something you know be saved?"

- I think so
- and, we don't have a choice in most cases
- security and convenience: tradeoff?
- It is going to be one of the authentication factors
  - something you know
  - something you have
  - something you are
  - where you are
  - .....

Better Solutions

#1: Getting out of the game

SecureNet Key SNK-004

A login from my distant past

RISC/os (inet)

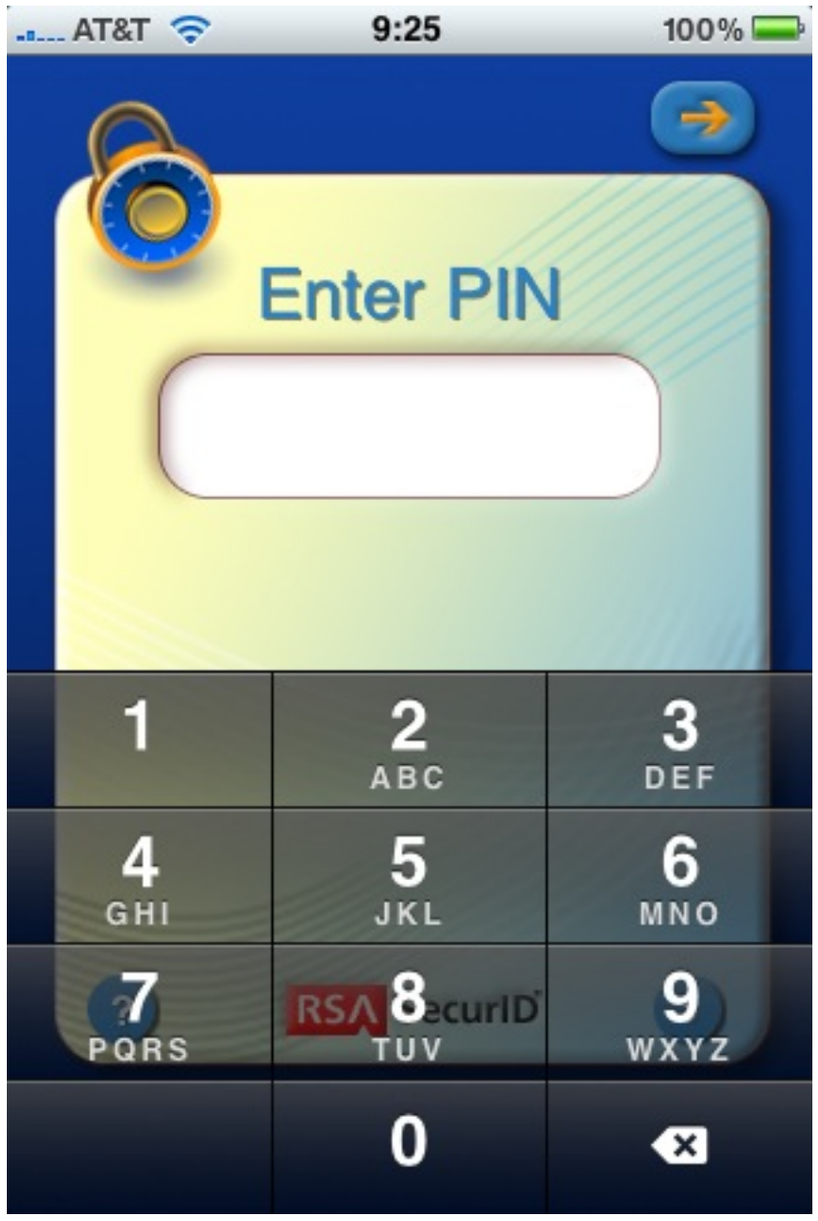
Authentication Server.

Id? ches
Enter response code for 70202: 04432234

Destination? cetus
$

SecureID

RSA Softkey


AT&T
9:25
100%
Enter PIN
1
2 ABC
3 DEF
4 GHI
5 JKL
6 MNO
7 PQRS
8 TUV
9 WXYZ
0
RSA SecurID


AT&T
9:25
100%
Passcode
8621 1490
27 sec remaining
RSA SecurID

Great Things about the Softkey

- **You always have your iPhone with you**
- **A bad PIN simply gives the wrong answer**
- **That means that the program doesn’t know the right answer**
- **That means that forensics can’t run a dictionary attack on it with having an observed login**
- **That means that a lost iPhone isn’t an authentication disaster**

Challenge/Response passwords

- **Gets us out of the game**
- **Sniffing is not useful**
- **Man-in-the-middle can still be used**
- **Pretty much nothing to forget**
- **A PIN is helpful to make two-factor authentication**
- **Surprisingly cheap**

Why aren't these ubiquitous?

- **Cheap devices available before 1990**
- **People hate:**
  - **Having to carry the device**
  - **Entering the challenge (why SNK lost)**
  - **Entering the response**
  - **Carrying multiple devices**

Better Solutions

#2: Limiting guesses

Limiting guesses

- **This has worked for ATM PINs since the early 1970s!**
- **It requires and authentication server, or some means to shut off the card/account**
- **It replaces the *eye of newt* rules with...**

The Non-moronic password rule!

Pick something a friend, colleague won't guess in a few tries,

and they can't figure out while watching you type it

Summary solution

- **Limited guesses and lock the account**
- **Non-moronic passwords**
- **Make locked accounts less painful**

Grandma can understand and comply with this rule

- **It makes sense**
- **Now, dictionary words are okay**
- **Simpler passwords are easier to remember**
- **You probably don’t have to write them down**

Less painful account locking

- **Don’t count duplicate password attempts**
  - **they probably thought they mistyped it**
- **Make the password hint about the primary password, and don’t have a (weak) secondary**
- **Allow a trusted party to vouch for the user, so he can change his password**
- **Lock the account in increasing time increments**
- **Remind the user of password rules**

We need research on account locking

- **Not studied much in the open literature**
- **Practitioners could contribute:**
  - **what does a lost password cost?**
  - **how long will a user wait for an unlock?**

Better Solutions?

#3: Grasping the “passphrase” nettle

Still Want Your Strong Passwords?

Okay, fine. But let's make them fun, or at least easier to type (and tap)

iPhone-Friendly? (40 bits)

- **grade likes jokes guess**
- **goes joke gold gods rode fire rows**
- **votes mines bored alike yard**
- **what knit bomb unit star grow**
- **actor agent above angel abuse**
- **honey learn least lemon links**

www.cheswick.com/insult
(42 bits)

You grim-faced pipe of pleuritic snipe sweat
You dire chiffonier of foul miniature poodle squirt
You teratic theca of pathogenic moth dingleberry
You worrying pan broiler of bilious puff adder slobber
You vile wok of tumorigenic aphid leftovers
You baneful reliquary of pneumonic miller stumps
You atrocious terrine of harmful Virginia deer vomition
You excruciating pony of septic redstart eccrisis
You blotted kibble of unhygenic wild sheep spittle
You hard-featured fistula of podagric macaque flux

If you must, each line has 60 bits of entropy

- **value part peter sense some computer**
- **anxiety materials preparation sample experimental**
- **bliss rubbery uncial Irish**
- **2e3059156c9e378**
- **Gz4jgzkdxh**

Dictionary attacks still a concern

- **For standard Unix logins**
- **For ssh password logins**
- **Against captured oracle streams, like PGP and ssh key files, cleartext challenge/ response fields in protocols**
- **These are not mainstream attacks these days. Stolen laptops/iPhones a concern**

If you really need “high entropy” passwords

- **Not user-chosen, but user can veto, waiting for a “good one”**
  - **User-chosen phrases have much lower entropy**
- **They are going to write it down, for a while**
- **For daily use: who’s going to remember this over a year?**

Words Are Better Than Eye-of-Newt

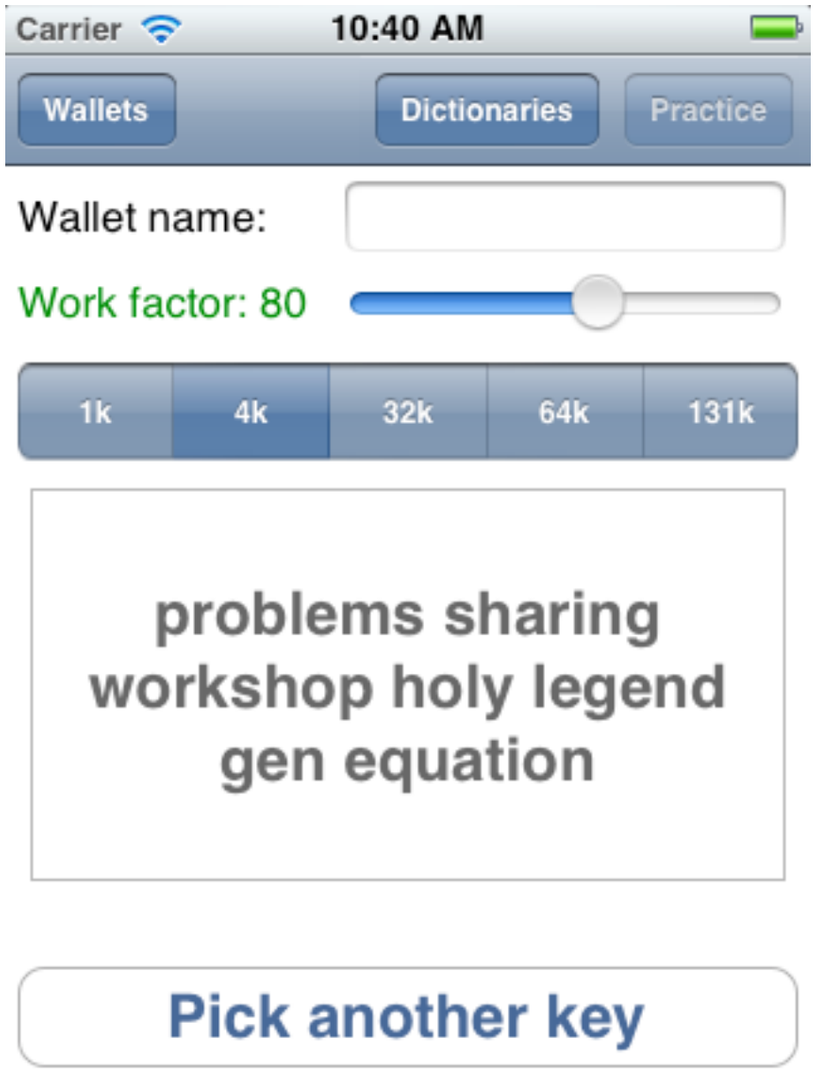
- **Much easier to type**
- **Spelling checking (iPhone) is your friend, not enemy**
- **Markus Jakobsson's *Fastwords***

Uncial

uncial |ˈən sh əl; -sēəl| adjective
1. of or written in a majuscule script with rounded unjoined letters that is found in European manuscripts of the 4th–8th centuries and from which modern capital letters are derived.

2. rare of or relating to an inch or an ounce.
noun an uncial letter or script.

(105 demo)


Carrier
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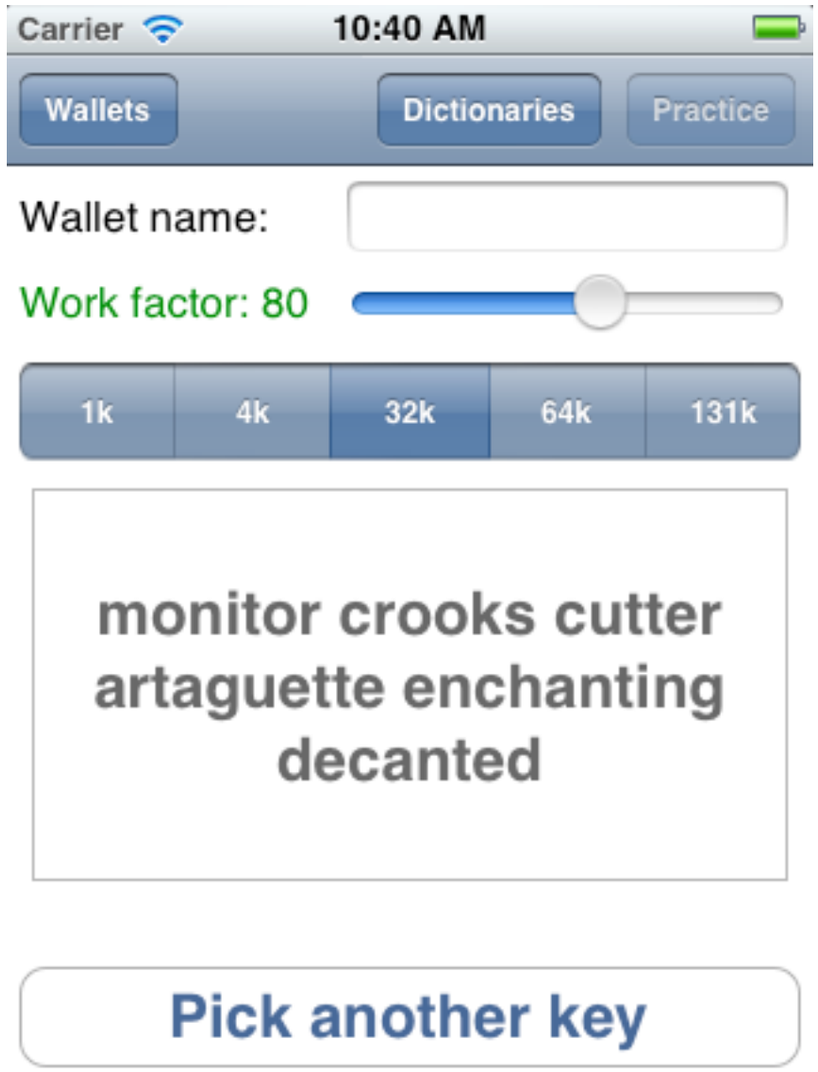
Wallets
Dictionaries
Practice
Wallet name:
Work factor: 80
1k
4k
32k
64k
131k
problems sharing workshop holy legend gen equation
Pick another key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Wallet name:
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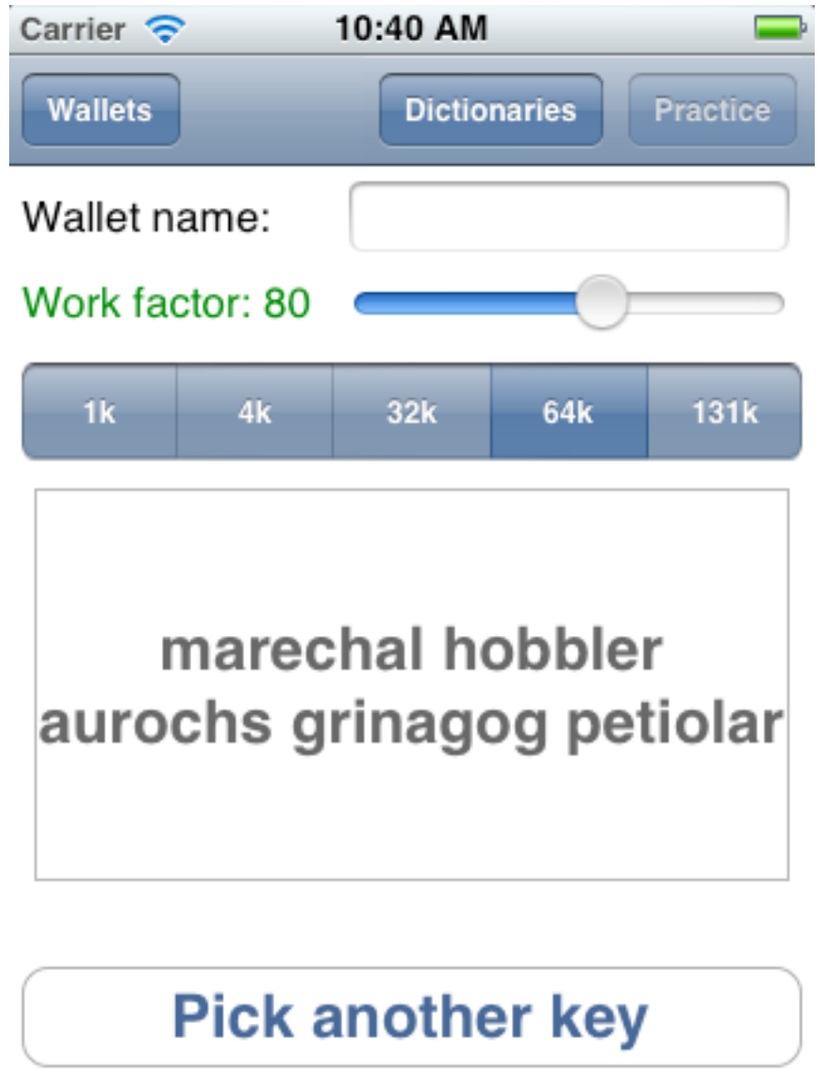
Pick another key


Carrier
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Dictionaries
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Wallet name:
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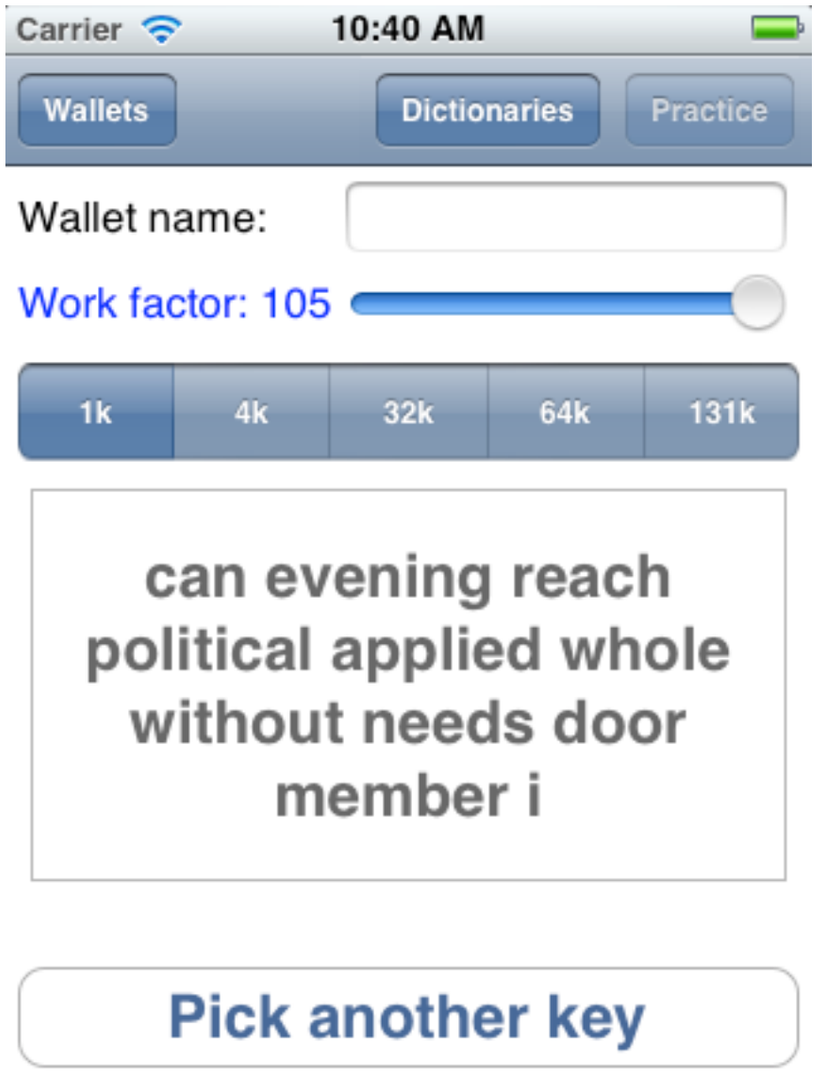
64k
131k
marechal hobbler aurochs grinagog petiolar
Pick another key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Practice
Wallet name:
Work factor: 105
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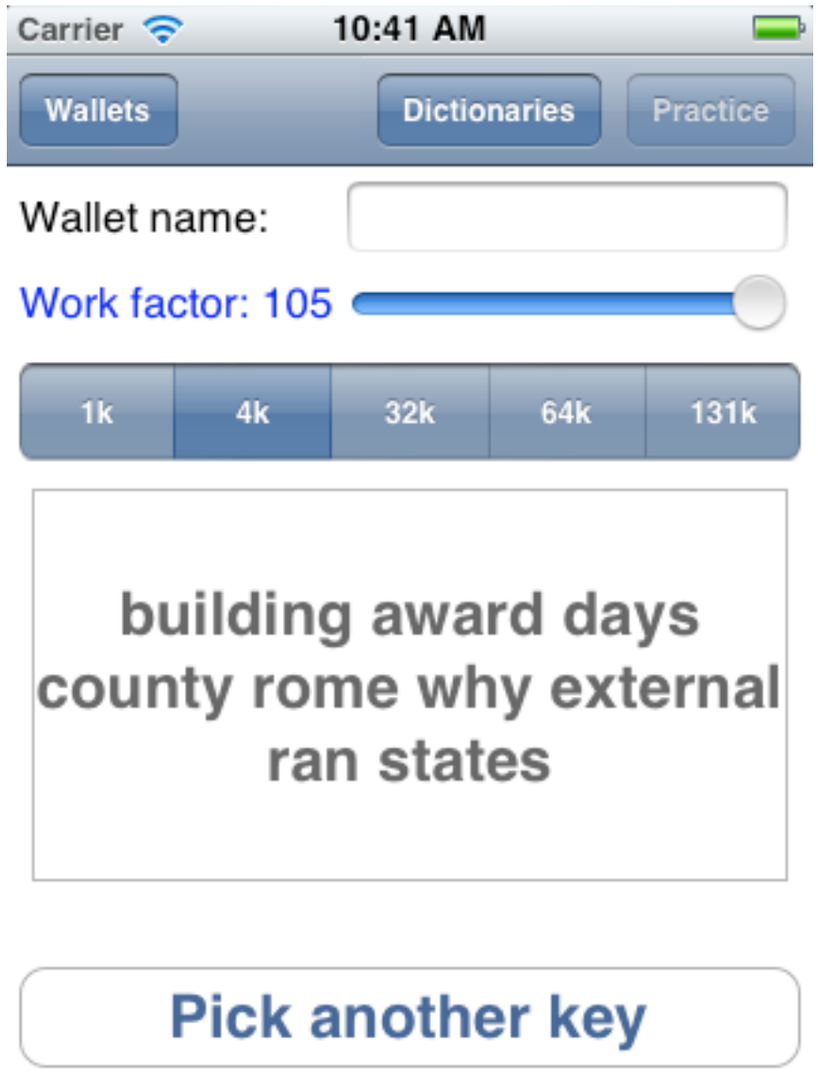
Pick another key


Carrier
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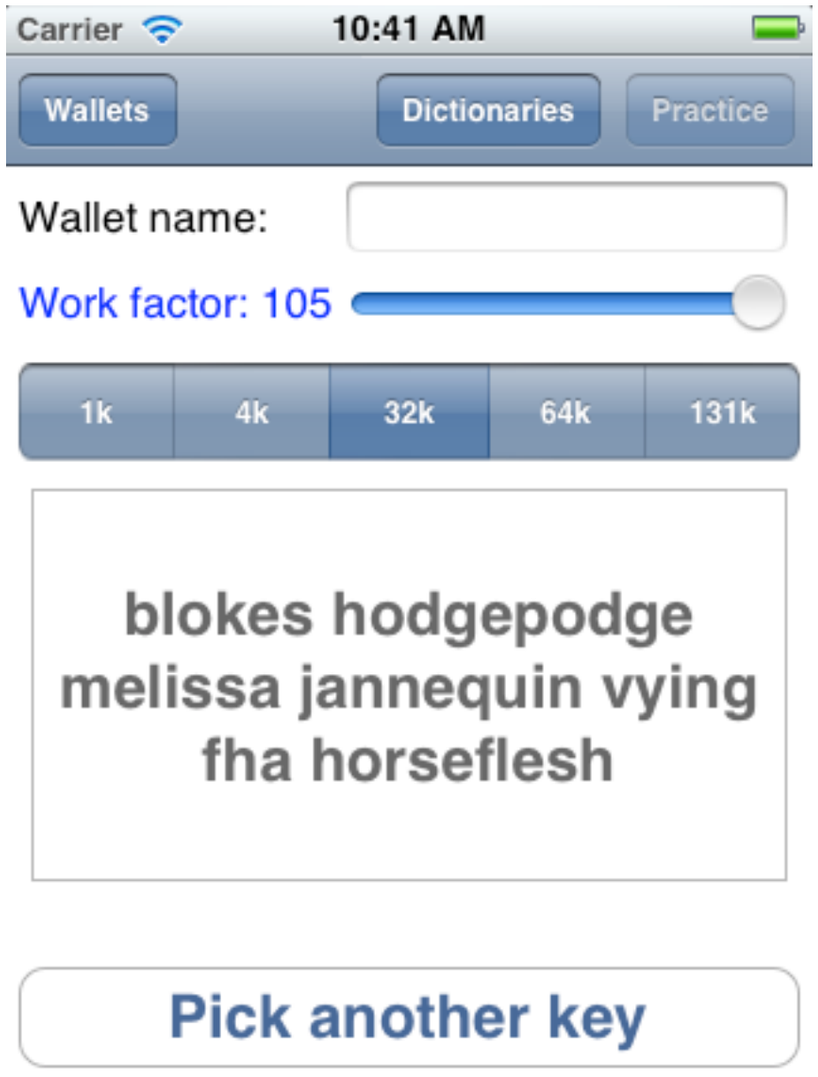
Wallets
Dictionaries
Practice
Wallet name:
Work factor: 105
1k
4k
32k
64k
131k
building award days county rome why external ran states
Pick another key


Carrier
10:41 AM
Wallets
Dictionaries
Practice
Wallet name:
Work factor: 105
1k
4k
32k
64k
131k
blokes hodgepodge melissa jannequin vying fha horseflesh
Pick another key

Use one Really Strong password to lock your password wallet

- **You are not going to remember it immediately**
- **You will learn it after a while**
- **You don’t have to change it**
- **2^105 bits means average work factor of 20,282,409,603,651,670,423,947,251,286,016 =**
- **20 * 10^30 = 33 million times Avogadro’s number**

Benefits

- **The dictionary is not secret**
- **You can use spelling checkers**
- **No fancy-pants attacks by Dave Wagner or anyone else**
- **The wallet can be stored in a public place, or even on your smart phone and backups**
- **You can lose your smartphone without leaking secrets from the wallet**
- **One can build authentication into this, giving challenge/response**

Of course, there are a lot of assumptions here

- **Secure client software**
- **No shoulder surfing**
- **Your written backup could fall in the wrong hands**
- **Rubber hose cryptography**
- **Wallet software could leave useful traces behind in the smart phone**
- **....**

Frankly, I am sick of this!

Several solutions that work

I love living in the future!

- **Velcro**
- **12 hour nasal spray**
- **“laser” surgery**
- **The web and free indexing and search**
- **Commercial space travel**
- **Commercial air travel(!)**
- **MythTV**
- **…**

People, we have to do better than this

- **The Bad Guys are getting much better**
- **Our computer systems are getting much more important to us**
- **Security has to be thought about, and reviewed**

Dangerous browsing

- ***All Your IFRAMES Point to Us*, Provos and Mavrommatis (Google), Rajab and Monrose (JHU); Usenix Security 2008**

Dangerous patches

- ***Automatic Patch-Based Exploit Generation is Possible: Techniques and Implications.*** **Brumley and Poosankam (CMU), Song (Berkeley), Zheng (Pitt); Proceedings of the IEEE Security and Privacy Symposium, May 2008.**

Provably-hidden malware

- ***Analysis-Resistant Malware.*** **Bethencourt and Song (BSD/CMU), Waters (SRI). ISOC NDSS, Feb 2008.**

COTS CPUs dangerous?

- ***Designing and Implementing Malicious Hardware.*** **King, Tucek, Cozzie, Grier, Jiang, and Zhou (U Illinois at Urbana Champaign). Usenix LEET 2008, April, San Francisco.**

Stuxnet

- **The pros are *very* good at this sort of thing**

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ches@cheswick.com