

# Human Computation

**Luis von Ahn**

Carnegie Mellon University

Yahoo! Registration - Windows Internet Explorer

https://edit.yahoo.com/config/eval\_register?.intl=us&new=1&.don

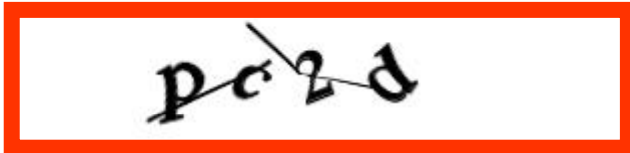
Google

Yahoo! Registration

### Verify Your Registration

\* Enter the code shown:  [More info](#)

This helps Yahoo! prevent automated registrations.



### Terms of Service

Please review the following terms and indicate your agreement below. [Printable Version](#)

1. ACCEPTANCE OF TERMS  
Yahoo! Inc. ("Yahoo!") welcomes you. Yahoo! provides its service to you subject to the following Terms of Service ("TOS"), which may be

By clicking "I Agree" you agree and consent to (a) the Yahoo! [Terms of Service](#) and [Privacy Policy](#), and (b) receive required notices from Yahoo! electronically.

Verification technology developed in collaboration with [Carnegie Mellon University](#)

Internet | Protected Mode: Off 100%

# CAPTCHA

A program that can tell whether its user is a **human or a computer**



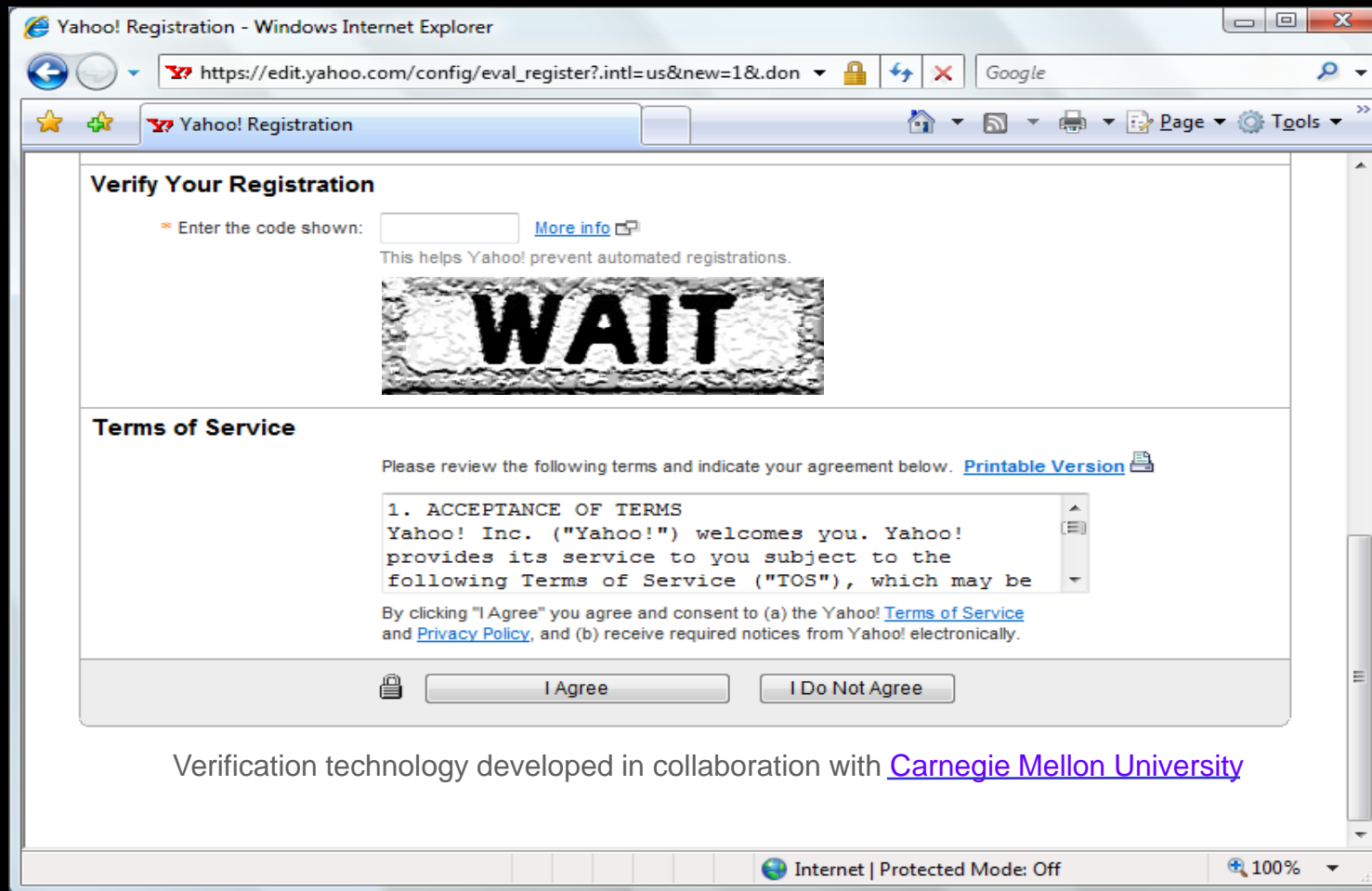
[CACM] [EUROCRYPT]

# CAPTCHA

A **program** that can generate and grade tests that:

A. Most humans can pass

B. Current computer  
programs cannot pass



“ Help! I’ve been waiting for 20 minutes, and nothing happens ”

Yahoo! Registration - Windows Internet Explorer

https://edit.yahoo.com/config/eval\_register?.intl=us&new=1&.don


Google

Yahoo! Registration

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## QUICKVOTE

Which is the best Computer Science  
Grad School in the US?

Berkeley  MIT

CMU  Washington

Cornell  Stanford

vote

(From [www.slashdot.org](http://www.slashdot.org))

Yahoo! Registration - Windows Internet Explorer

https://edit.yahoo.com/config/eval\_register?.intl=us&new=1&.don


Google

Yahoo! Registration

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Verification technology developed in collaboration with [Carnegie Mellon University](#)

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# CAPTCHA Sweat Shops

Spam companies hire humans to solve CAPTCHAs **all day long**

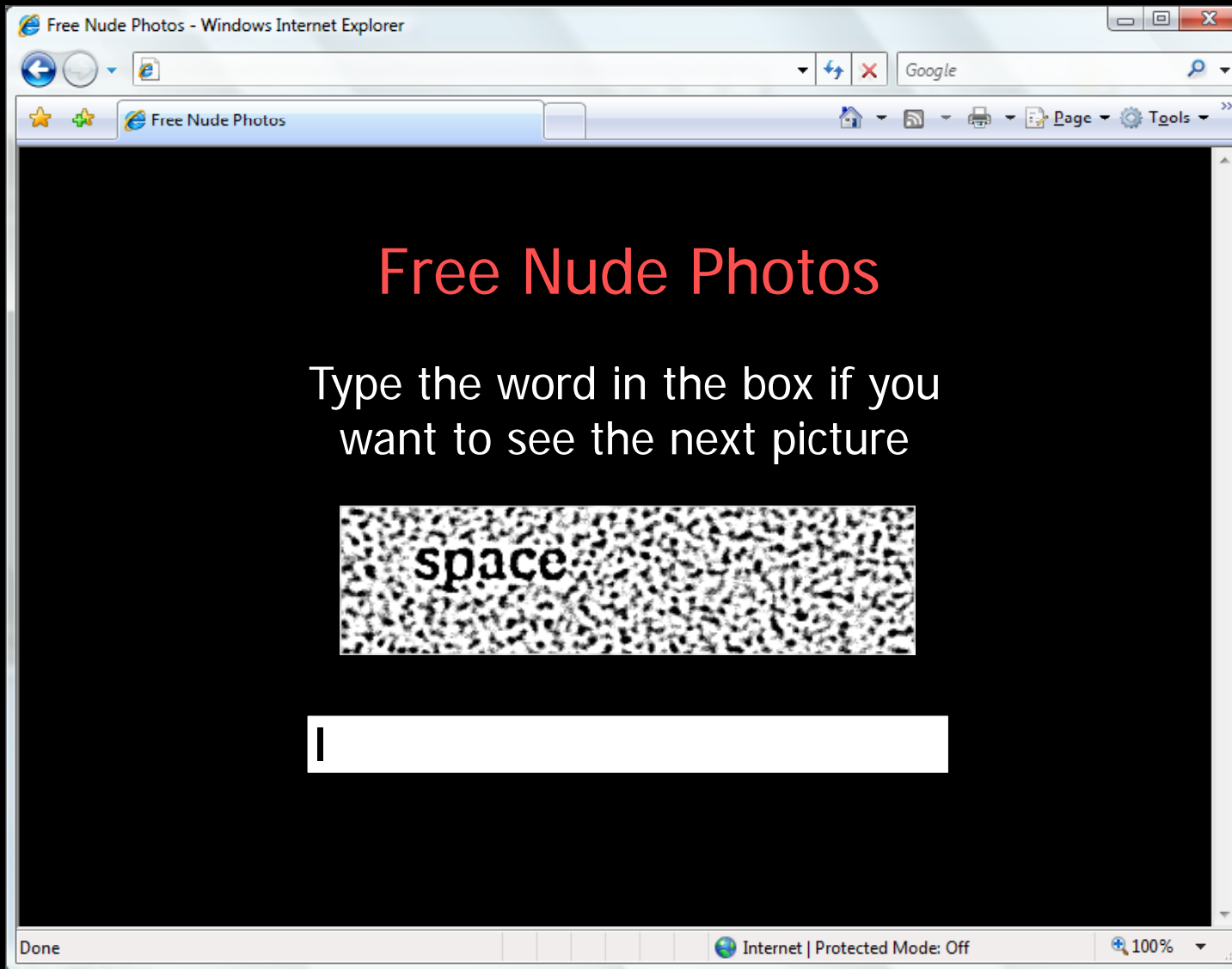
\$2.50 per hour for each human

720 captchas per hour per human

---

1/3 cent per account





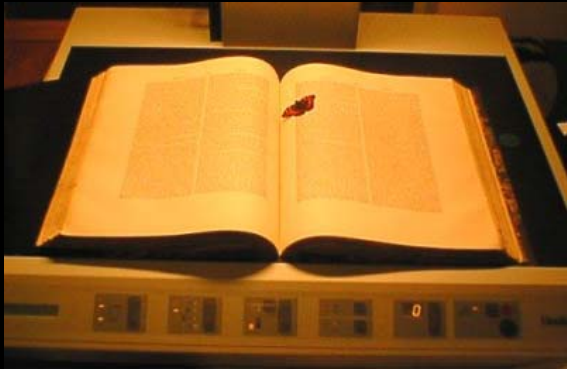


Roughly 200 million CAPTCHAs are  
typed every day

10s of human time per CAPTCHA

**Can we use this human  
effort for good?**

# Digitizing Books

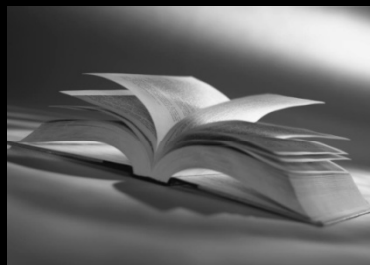


➔  
Scan

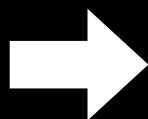
AND MANY OTHER PROBLEMS.  
THE 18-YEAR-OLD WOMAN WAS  
X-RAYED AFTER THE INCIDENT.

↓ OCR

AND **MARY** OTHER PROBLEMS.  
THE 18-YEAR-OLD WOMAN WAS  
**X-RATED** AFTER THE INCIDENT.



Scanned  
book



**between**

Word that OCR  
can't read

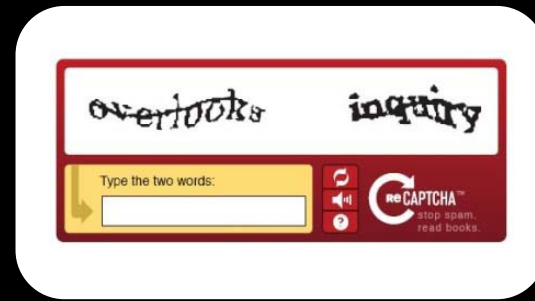


**between**

Randomly distorted  
image of word

A screenshot of a reCAPTCHA challenge. It features a white box with a red border containing two distorted words: 'UPDA' and 'between'. Below the box is a yellow input field with the text 'Type the two words:' and a white text box. To the right of the input field are three icons: a refresh button, a volume icon, and a reCAPTCHA logo with the text 'stop spam. read books.'.

# Free





Facebook | Sign Up for Facebook - Windows Internet Explorer

https://register.facebook.com/r.php?r=102

Facebook | Sign Up for Facebook

facebook login sign up tour

**Email:**  
lav@andrew.cmu.edu

**Password:**

Login

Forgot Password?

### Sign Up and Start Using Facebook

Join Facebook to **connect with your friends, share photos, and create your own profile**. Fill out the form below to get started (all fields are required to sign up).

Full Name:

I am:

Email:

Password:

Date of Birth: Month:  Day:  Year:

Security Check:

Enter **both** words below, separated by a **space**. What's This?  
Can't read this? Try another.

*1790 incapacity*

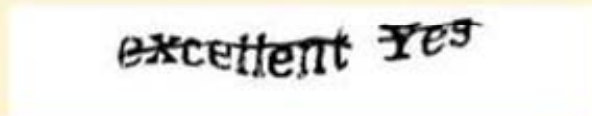
Text in the box:

I have read and agree to the [Terms of Use](#) and [Privacy Policy](#).

Done Internet | Protected Mode: Off 100%

## Security Check

Type both words separated by a space below



Type both words:



[Get a new word](#)



[Vision Impaired](#)



[Help](#)

### The Security Check allows us to:

#### Ensure Fair Access to Tickets

Automated programs known as "Bots" cannot read distorted text as well as humans. The Security Check helps prevent automated programs from blocking other customers from getting tickets.

#### Digitize Books One Word at a Time

By entering the words in the box, you are also helping to digitize books from the Internet Archive and preserve literature that was written before the computer age.

#### Provide an Audio Option for Visually Impaired Customers

An audio option allows visually impaired customers to hear a set of 8 digits that can be entered instead of the word challenge.

You do not have permission to access this website if you are using an automated program.

[Continue](#)

Security Check provided by [reCAPTCHA](#). © Carnegie Mellon University, all rights reserved.



Find folks to follow!

search

or [Login / Join Twitter!](#)

## Create a Free Twitter Account

Username:  Your URL: <http://twitter.com/USERNAME>

No spaces, please.

Password:  6 characters or more (be tricky!)

Confirm Password:

Email Address:  In case you forget something

Humanness:

Type the two words:

I want the inside scoop—please send me email updates!

By clicking on 'I accept' below, you confirm that you are over 13 years of age and accept the [Terms of Service](#).



Already a member?  
Please [Sign In!](#)

Already use Twitter on your phone? [Head over here](#) and we'll get you signed up on the web.

Sign Up - Last.fm - Windows Internet Explorer

https://www.last.fm/join/

Sign Up - Last.fm

last.fm the social music revolution Music Users Listen Events Widgets Download

Upload music and videos You are not logged in Log in Help English

## Sign up for Last.fm

Desired username:   
(max 15 characters, no spaces)


Email:   
 The occasional newsletter to keep me up-to-date.

Password:

Confirm password:

Type Both Words:

Spam blocker by [Recaptcha](#), digitizing books two words at a time.



Can't read them? Click the image for some new words.

Type the words shown the image above:

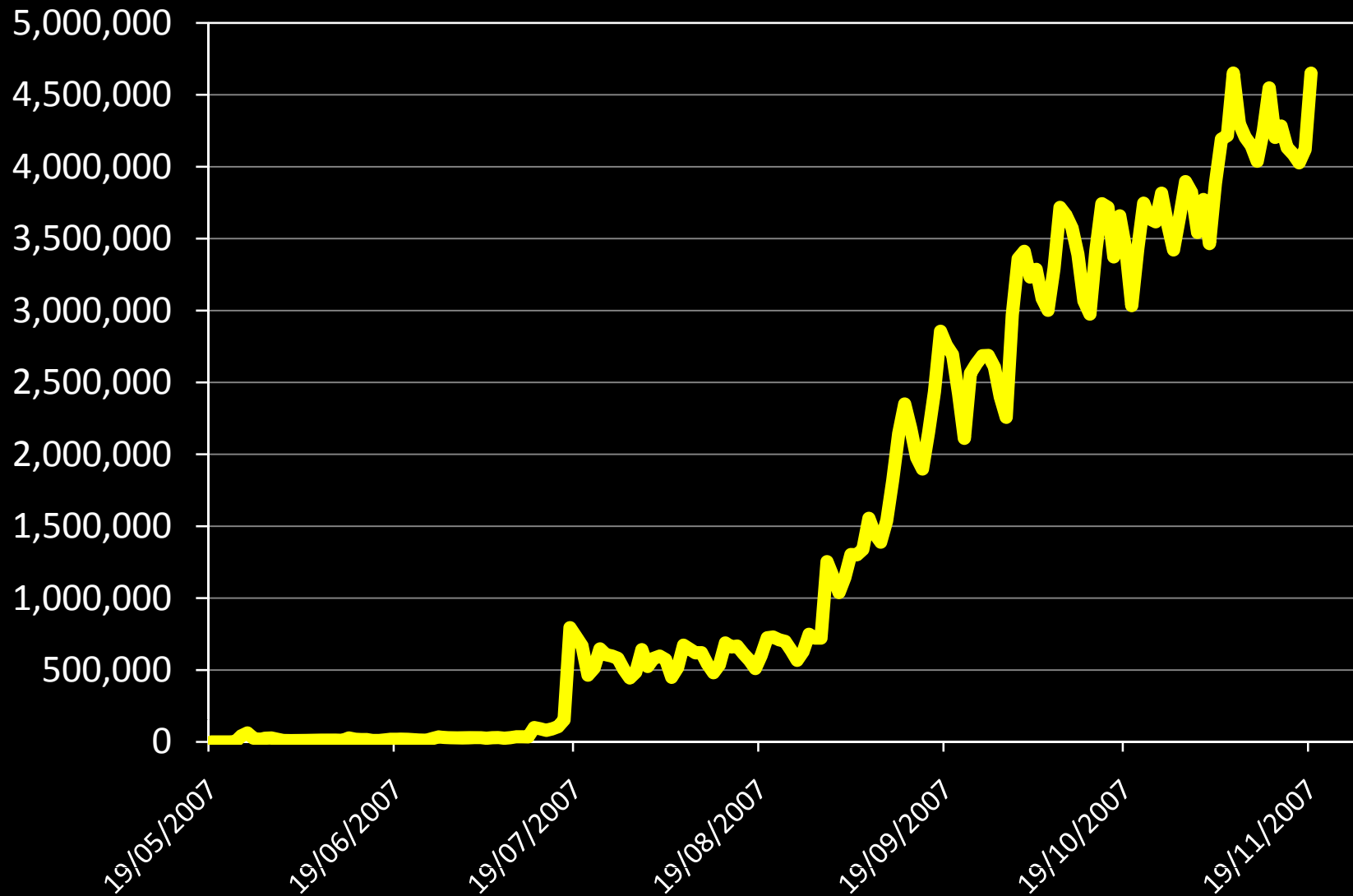
 

Done

Internet | Protected Mode: Off

100%

# Words Digitized Per Day



Home | The Embassy of the Kingdom of God - Windows Internet Explorer

http://www.theembassyofgod.com/

Home | The Embassy of the Kingdom of God

905-433-2964 | Map & D

# The Embassy

Of The Kingdom Of God

HOME THE EMBASSY CONNECTIN

bae Christians

Type the two words:

reCAPTCHA™ stop spam. read books.

JEFP House Parties - Sign up for an account - Windows Internet Explorer

http://party.johnedwards.com/signup.php

JEFP House Parties - Sign up for an account

**JOHNEDWARDS.COM**  
**Party for Change**

Search events: Enter your ZIP code  
 Go

[Host A Party](#) [Find A Party](#) [Resources](#) [Log in](#) - [Sign up](#)

### Sign Up to Party for Change

Sign up to host your own Party for Change or sign up to attend one in your area.

Username

Password

Password (again)

Zip Code

Email Address

Dann liberat

Type the two words:

RECAPTCHA™  
stop spam.  
read books.

Internet | Protected Mode: Off 100%

# Two Words Instead of One?

Typing two English words takes as long as  
typing 6-8 random characters

We have a guess for both words



# CAPTCHA Sweat Shops

**Mahiddin:** Would you help us find some Captcha Project?

**reCAPTCHA Support:** What kind of CAPTCHA project are you looking for?

**Mahiddin:** We are break different type of CAPTCHA right now. We have the ability type every day many Captcha.

**reCAPTCHA Support:** How fast can you type?

**Mahiddin:** Personally I can type more than 60 WPM. But I have a big team. We can give you lot of product.

**reCAPTCHA Support:** Is it ok with you that the accounts are for spamming purposes?

**Mahiddin:** No problem, you can tell me details first.

**reCAPTCHA Support:** One last question: how do you deal with IP address blocking?

Please type the following paragraph:

**DENMARK.**

**COPENHAGEN, Dec. 17—Noon.**

The royal palace at Friedericheberg took fire last night. The King himself directed the operations for extinguishing the fire. The whole structure was, however, destroyed.

# Audio CAPTCHAs

Blind people cannot see images of distorted words

Audio CAPTCHAs can be used to transcribe recorded speech

# Reusing Wasted Cycles

Solving CAPTCHAs  
(1.9s/day)

Bathroom (17m)

Electronic Games (1.1h)

Eating and Drinking (1.1h)

Household Chores (1h)

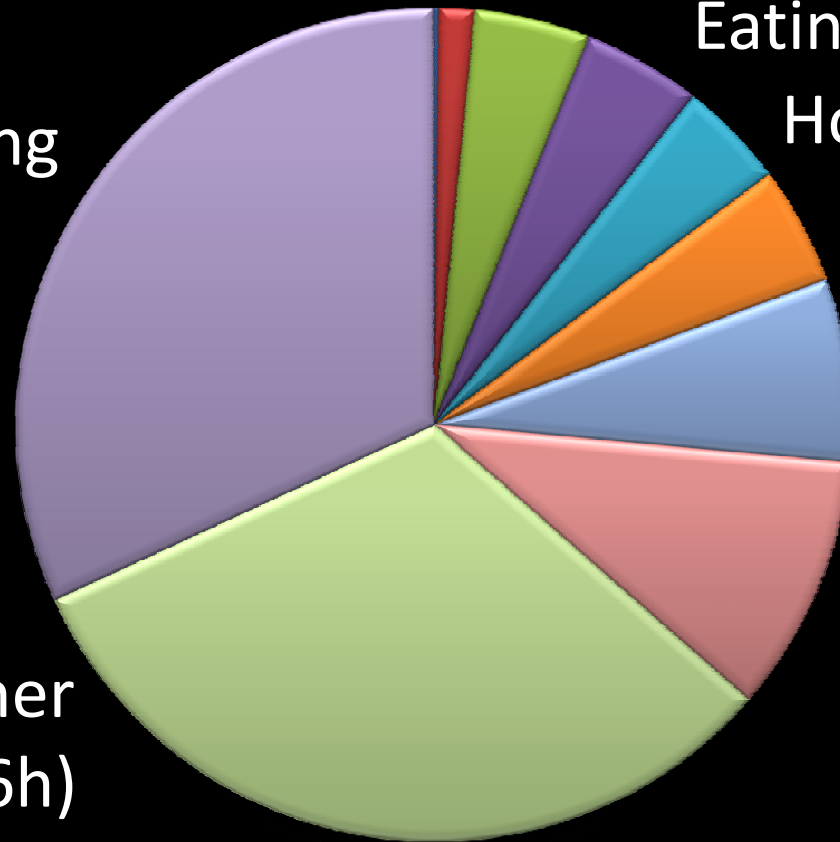
Caring for Others (1.1h)

Email and IM (1.7h)

TV (2.4h)

Sleeping  
(7.6h)

Other  
(7.6h)



9 Billion Human-Hours of Solitaire  
were Played in 2003

Empire State Building  
7 million human-hours  
(6.8 hours of solitaire)

Panama Canal  
20 million human-hours  
(less than a day of solitaire)

# Human Computation



ALL AROUND US IT IS THERE WHEN YOU WATCH TELEVISION  
美と字印が抜す国出のシ品 致集ま コロシは証 メ書万

TRIXIT IS ALL AROUND US IT IS THERE WHEN YOU WATCH  
THE MATRIX HE IS THE ONE DREAM WORLD N  
www.DeskPaper.com

の情 及術文写て 感サ絵しオ会観美イカ版もレ保の 文精なフト社明 をに美と字印が抜す国出のシ品 致集ま  
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IT IS THERE WHEN YOU WATCH TELEVISION

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をに美と字印が抜す国出のシ品 致集ま コロシは証 メ書万

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をに美と字印が抜す国出のシ品 致集ま コロシは証 メ書万

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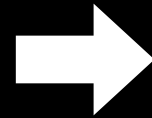
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をに美と字印が抜す国出のシ品 致集ま  
THE MATRIX  
をに美と字印が抜す国出のシ品 致集ま コロシは証 メ書万



MATRIX

# Labeling Images With Words



Martha  
Stewart  
Flowers  
Super Evil

Still an **open problem**



# Image Search On The Web

## Uses filenames and html text

Google Search: dog - Microsoft Internet Explorer

Address: <http://images.google.com/images?q=dog&hl=en&lr=&safe=active&sa=N&tab=wi>

Google Images

dog

Search

Advanced Image Search Preferences

Strict SafeSearch is on

Images Results 1 - 20 of about 1,120,000 for dog [definition] with Safesearch on. (0.10 seconds)

Show: All sizes - Large - Medium - Small

free\_top0403.gif  
700 x 1129 pixels - 210k  
[www.nifty.com/vivadog/](http://www.nifty.com/vivadog/)

dogs.jpg  
495 x 391 pixels - 45k  
[sunsite.berkeley.edu/T-Shirts/dhland/dogs.jpg](http://sunsite.berkeley.edu/T-Shirts/dhland/dogs.jpg)

dogs.gif  
190 x 150 pixels - 7k  
[sunsite.berkeley.edu/T-Shirts/index.cgi?type=...](http://sunsite.berkeley.edu/T-Shirts/index.cgi?type=...)  
[ More results from [sunsite.berkeley.edu](http://sunsite.berkeley.edu) ]

25304[1].jpg  
275 x 234 pixels - 6k  
[www.dog-gone-pet-products.com/25304%5B1%5D.jpg](http://www.dog-gone-pet-products.com/25304%5B1%5D.jpg)

rabbit.jpg  
217 x 231 pixels - 7k  
[www.pet-clothing.net/images/rabbit.jpg](http://www.pet-clothing.net/images/rabbit.jpg)

scottypphoto.jpg  
227 x 200 pixels - 6k  
[www.pet-clothing.net/images/scottypphoto.jpg](http://www.pet-clothing.net/images/scottypphoto.jpg)  
[ More results from [www.pet-clothing.net](http://www.pet-clothing.net) ]

fundtag.gif  
325 x 230 pixels - 27k  
[www.id-ideas.com/gifs/tags/fundtag.gif](http://www.id-ideas.com/gifs/tags/fundtag.gif)

gotag5.gif  
325 x 214 pixels - 31k  
[www.id-ideas.com/gifs/tags/gotag5.gif](http://www.id-ideas.com/gifs/tags/gotag5.gif)  
[ More results from [www.id-ideas.com](http://www.id-ideas.com) ]

Google Search: dog - Microsoft Internet Explorer

Address: <http://images.google.com/images?q=dog&hl=en&lr=&safe=active&sa=N&tab=wi>

Google Images

dog

Search

Advanced Image Search Preferences

Strict SafeSearch is on

Images Results 1 - 20 of about 1,120,000 for dog [definition] with Safesearch on. (0.10 seconds)

Show: All sizes - Large - Medium - Small

telescoping\_pet\_ramp-2.jpg  
483 x 475 pixels - 30k  
[www.discounttramps.com/telescoping\\_pet\\_ramp-2.jpg](http://www.discounttramps.com/telescoping_pet_ramp-2.jpg)

blackt2.jpg  
527 x 641 pixels - 50k  
[www.nhptv.org/natureworks/graphics/blackt2.jpg](http://www.nhptv.org/natureworks/graphics/blackt2.jpg)

blackt4.jpg  
542 x 839 pixels - 79k  
[www.nhptv.org/natureworks/graphics/blackt4.jpg](http://www.nhptv.org/natureworks/graphics/blackt4.jpg)

waddling-d  
1024 x 768 pixels - 10k  
[www.atpr.waddling-do](http://www.atpr.waddling-do)

shed.jpg  
640 x 480 pixels - 45k  
[www.windmeupfarm.com/shed.jpg](http://www.windmeupfarm.com/shed.jpg)

curled.jpg  
570 x 214 pixels - 54k  
[www.steelypips.org/images/dog/curled.jpg](http://www.steelypips.org/images/dog/curled.jpg)

box for web.jpg  
1200 x 866 pixels - 514k  
[www.doggonecrazy.ca/](http://www.doggonecrazy.ca/)

Dog.jpg  
1800 x 1179 pixels - 4k  
[coastal.er.usgs.gov/photos/hh/hike/Dog.j](http://coastal.er.usgs.gov/photos/hh/hike/Dog.j)

basset1web.jpg  
364 x 495 pixels - 37k  
[www.livestock.com/](http://www.livestock.com/)

dog-training-equipment-do...

dog-training-equipment-do...

HalfPint1.JPG  
269 x 417 pixels - 1k  
[www.culver.com/](http://www.culver.com/)

# Accessibility

Majority of the web is not fully accessible to the **visually impaired**

Reason: Most images don't have a caption

# Desiderata

A method that can label  
all images on the web

**Fast and cheap**

# Using Humans Cleverly

**The ESP game** could label all images on  
google in a few weeks

# The ESP Game

Two-player online game

Partners don't know each other  
and can't communicate

Object of the game:

**Type the same word**

Only thing in common is

**An image**



[CHI 2004]

**1:50**  
Time Left

# The ESP Game

**0070**  
score



## Taboo Words

DOG  
PILLOW

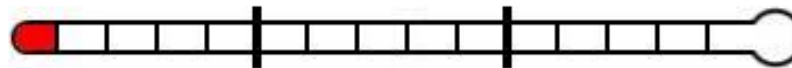
## Your Guesses

PUPPY

Type your next guess:

Pass

Your partner has entered a guess



Flag

© 2005 Carnegie Mellon University, all rights reserved. Patent Pending.

# The ESP Game is Fun

50 million agreements  
with 200,000 players

There are many people that  
play over 20 hours a week

# Labeling The Entire Web

**5000 people** playing simultaneously can label all images on Google in **2 months!**

Individual games in Yahoo! and MSN average over 5,000 players at a time



Welcome to **Google Image Labeler**, a new feature of Google Image Search that allows you to label random images to help improve the quality of Google's image search results.

[Begin as Playah](#)

[Change your nickname](#)



### How does it work?

You'll be randomly paired with a partner who's online and using the feature. Over a 90-second period, you and your partner will be shown the same set of images and asked to provide as many labels as possible to describe each image you see. When your label matches your partner's label, you'll earn some points and move on to the next image until time runs out. After time expires, you can explore the images you've seen and the websites where those images were found. And we'll

show you the points you've earned throughout the session.

For example, this image can be described by the labels: **bird**, **sky**, **soaring**, or **frigate bird**.

### What is required to participate?

Just an interest in helping Google improve the relevance of image search results for users like yourself. Although you do not have to log in to your Google account to help, logging in will allow you to keep track of your points. You can also choose to provide a nickname, or you can remain anonymous.

### Today's Top Pairs

|                           |      |
|---------------------------|------|
| 1. Knaz - guest           | 2200 |
| 2. guest - guest          | 1900 |
| 3. asgerix - Yucker       | 1800 |
| 4. guest - fiftysix       | 1700 |
| 5. Karate Monkey - eGrunt | 1700 |

### All-time Top Contributors

|            |         |
|------------|---------|
| 1. ChemaZ  | 2204200 |
| 2. khi     | 1676100 |
| 3. JoeBob  | 1444600 |
| 4. eGrunt  | 1340400 |
| 5. mdda123 | 1339600 |

# What About Cheating?

We give players **test images** for which we know all the common labels:

We only store a player's guesses if they successfully label the test images

# Search Results

ESP Search Results - Windows Internet Explorer

http://www.peakaboom.org/cgi-bin/phetch/search-esp?q=dog&page=2

ESP Search Results

Done

Internet | Protected Mode: Off

100%

# Search Results

ESP Search Results - Windows Internet Explorer

http://www.peakaboom.org/cgi-bin/phetch/search-esp?q=dog&page=2

ESP Search Results

The perfect Christmas gift... HELL

Internet | Protected Mode: Off 100%

# Search Results

ESP Search Results - Windows Internet Explorer

http://www.peakaboom.org/cgi-bin/phetch/search-esp?q=dog&page=2

ESP Search Results

Shiliga Dancing Queen

Pedigree

Done

Internet | Protected Mode: Off

100%



# Search Results

ESP Search Results - Windows Internet Explorer

http://www.peakaboom.org/cgi-bin/phetch/search-esp?q=dog&page=3

ESP Search Results

The search results are arranged in a grid on a yellow background:

- Top-left: A dog being handled at a show, with a sign that says "CLUB INC".
- Top-middle: A scruffy, grey dog standing on a wooden floor.
- Top-right: A small dog wearing a red cape with a yellow emblem.
- Middle-left: A dog in a harness, with a sign that says "Cavapoo".
- Middle-middle: A dog wearing a brown beanie.
- Middle-right: A dog wearing a grass skirt, with the text "ANIMAL MAKERS HOLLYWOOD".
- Bottom-left: The logo for "shwater.com" with a small dog icon.
- Bottom-middle: A dog sitting on a table, with the text "Photo by Some Photography".
- Bottom-right: A Snoopy icon with the name "snoopy" below it.

Done Internet | Protected Mode: Off 100%

ESP Search Results - Windows Internet Explorer

http://www.peakaboom.org/cgi-bin/phetch/search-esp

ESP Search Results

Google

Page Tools

Done

Internet | Protected Mode: Off

100%

# Guesses Over Time



britney



younger

than 40

hot



a male

crazy

rehab

shaved head



# Sample Labels



ddam  
r. wilson  
an

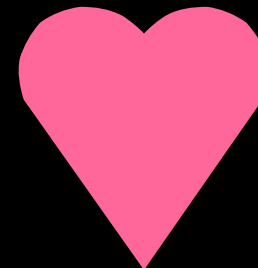


Coming soon:

Meet your **soul mate**  
through the game!



re t  
nan  
dumb  
**yuck**



Why do people like the  
ESP Game?

“ The ESP game gives its players a weird and beautiful sense of **anonymous intimacy**. On the one hand, you have no idea who your partner is. On the other hand, the two of you are bringing your minds together in a way that lovers would envy.”

“ Strangely addictive ”

“ It’s so much fun trying to guess what others think. You have to step outside of yourself to match ”

“ It’s fast-paced ”

“ It’s like crack! ”

“ Helps me learn English ”

# Blogs

“ In other crowning achievements, I haven't played in at least a week, and I am still on the **top ten list** of players on the ESP game. Number eight if I remember correctly. God, my life is sad.”

“ Many **fascinating** things about the ESP Game:  
How it uses a game structure to build  
an **index of images** on the web  
What **words become taboo** from  
frequent use  
How interesting some of the **images**  
**pulled randomly** from the web are  
But by far the most intriguing aspect of the  
game is how often your random, unknown  
partner is a complete idiot. ”

“ Dear Luis von Ahn,

Your game is a fraud

I do research on ESP (extra sensory perception), and have an online ESP telepathy test on my website

Please refrain from using the term ESP, as it makes us legitimate ESP researchers look like a fraud ”

Audio ESP  
SUCKS



# Two-Player Game

Both players can see  
each other's guesses



Edith Law

Players may or may not be  
listening to the same song

Object of the game:

**Tell if you're both  
hearing the same thing**

score  
**8790**

# Tag a Tune

Hum a few bars

time  
**3:07**

## Describe the tune...

⏸ 0:05   
 

## Listening to the same tune?

same  different 3 in a row!

your descriptions

rock  
electric guitar  
male singer

+ submit

→ pass

your partner's descriptions

loud electric guitar  
rock

gwap

ESP Game

Phetch

Tag a Tune

Verbosity

Squigl

Matchin



You play the games,



Computers get smarter,



Everyone benefits!

[Learn More](#)

username

password

[Sign In](#)

[Register](#)



remember me

[forgot password?](#)



## Tag a Tune

Hear Here

[Description](#) [Top 5 Players](#)

Quickly! Are you hearing the same tune as your partner?



PLAY NOW

# Reusing Wasted Cycles

Solving CAPTCHAs  
(1.9s/day)

Bathroom (17m)

Electronic Games (1.1h)

Eating and Drinking (1.1h)

Household Chores (1h)

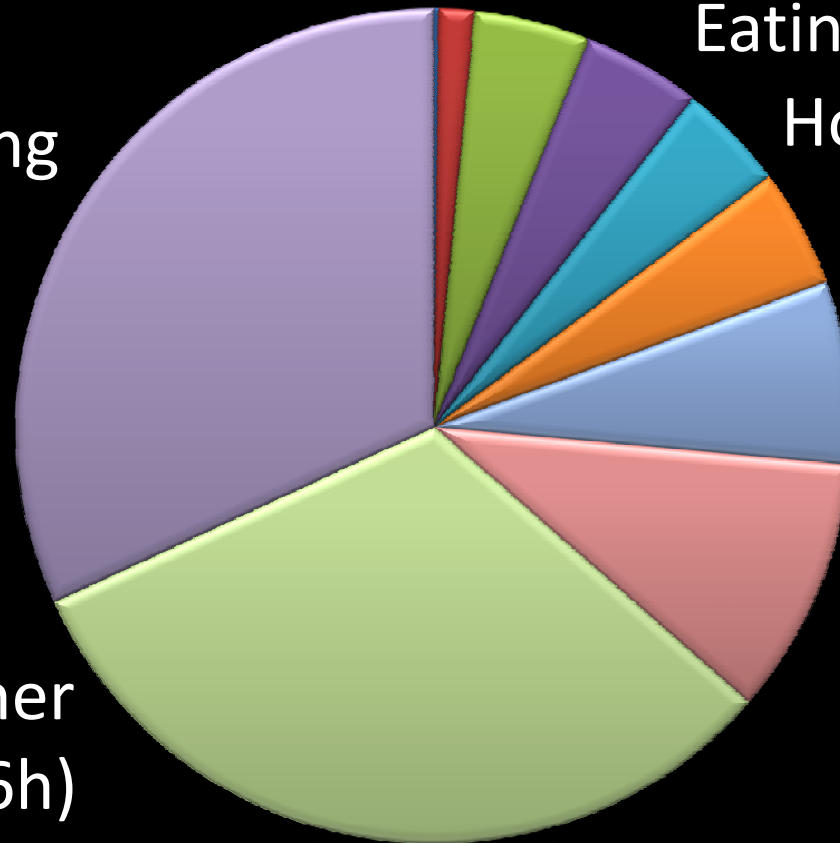
Caring for Others (1.1h)

Email and IM (1.7h)

TV (2.4h)

Sleeping  
(7.6h)

Other  
(7.6h)



# The Next Frontier



[www.recaptcha.net](http://www.recaptcha.net)

[www.gwap.com](http://www.gwap.com)

## Slide Design

Luis von Ahn

## CAPTCHA Crew

Luis von Ahn

Manuel Blum

Nicholas Hopper

John Langford

## The ESP Game Crew

Luis von Ahn

Laura Dabbish

Th Lenore Ramm :er

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The David Stork tion

