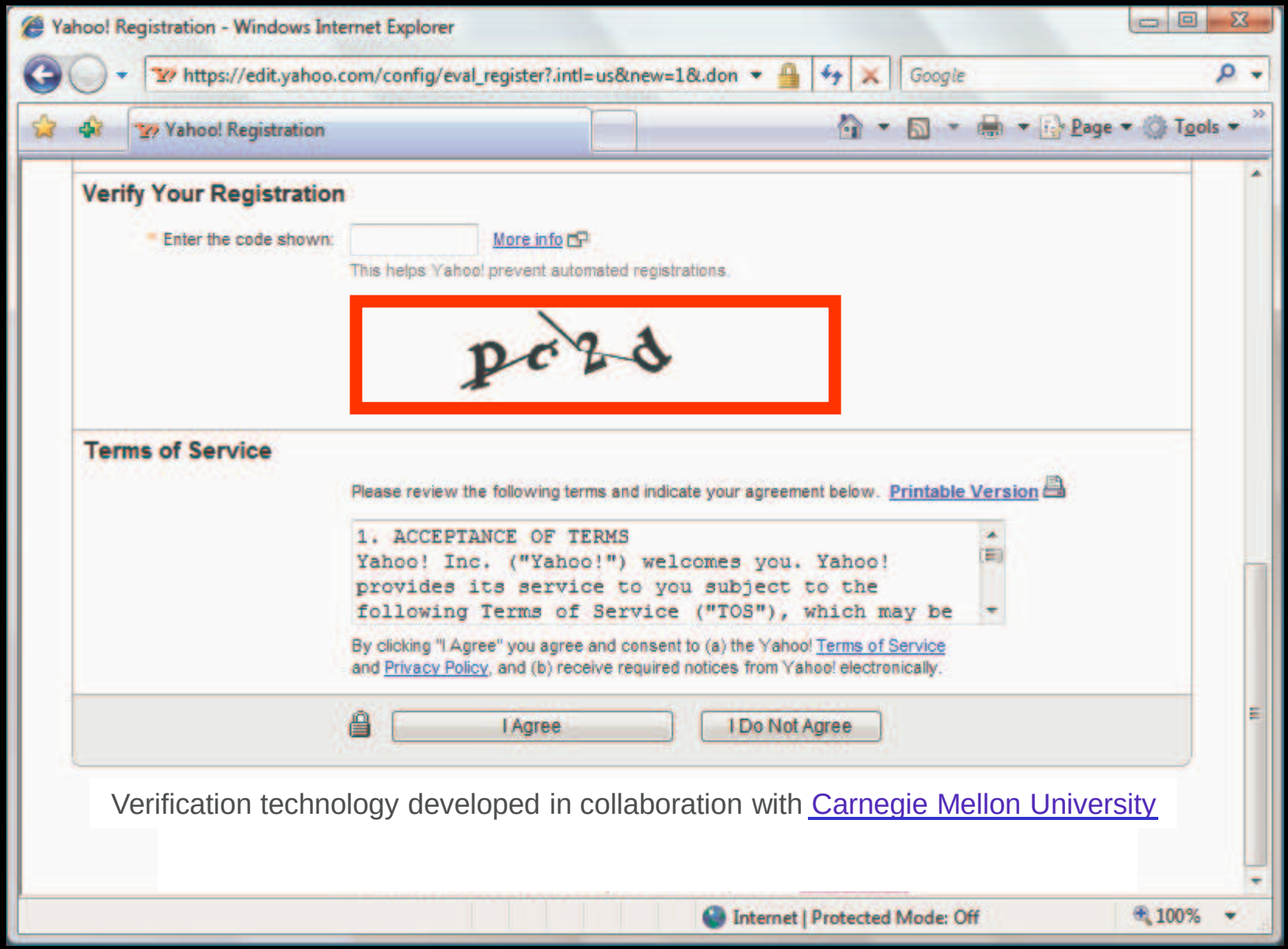
Human Computation

Luis von Ahn

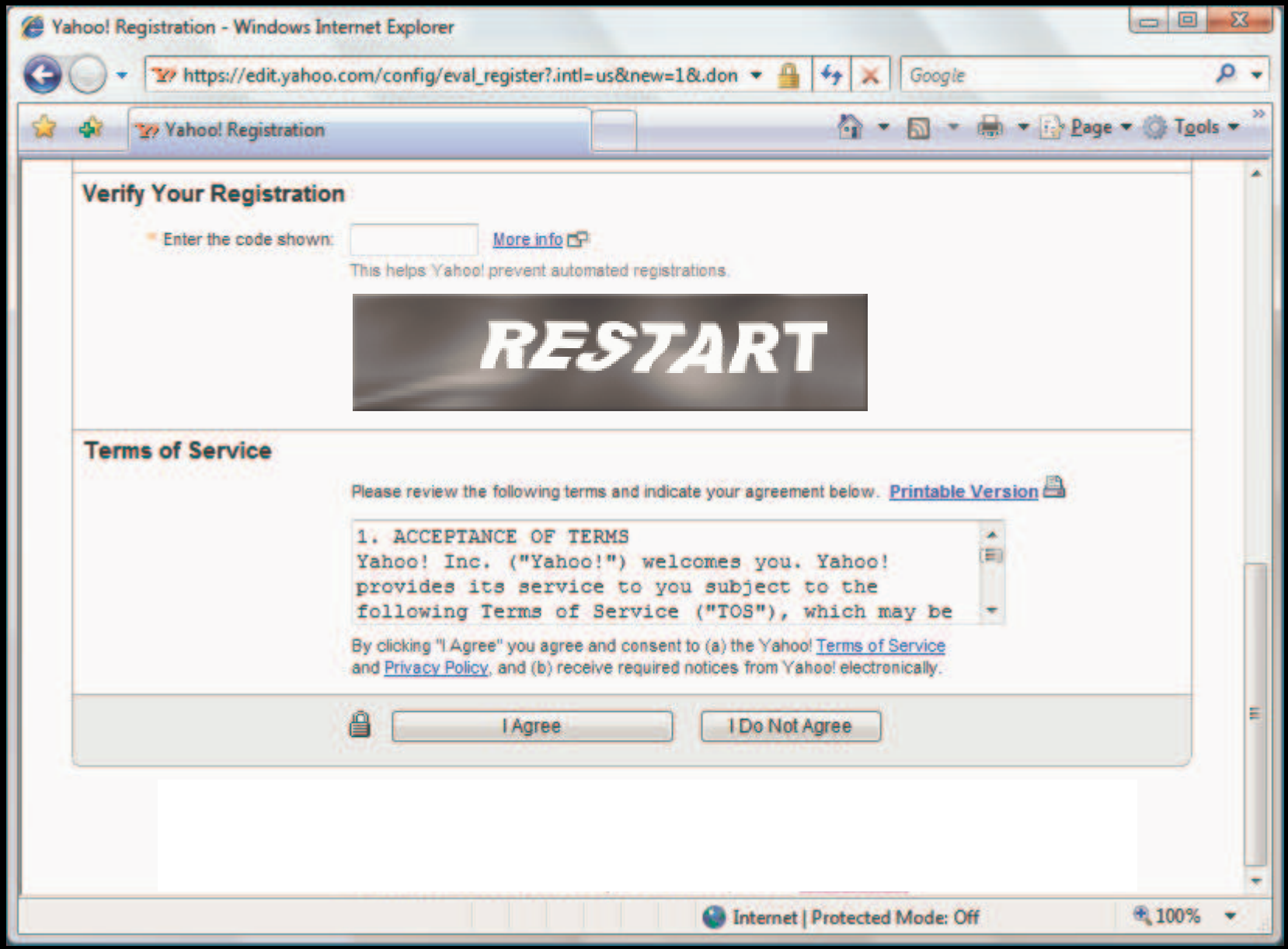
Carnegie Mellon University



Verification technology developed in collaboration with Carnegie Mellon University

Verification technology developed in collaboration with Carnegie Mellon University

"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
Page
Tools
Verify Your Registration
Enter the code shown:
More info
This helps Yahoo! prevent automated registrations.
RESTART
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.
I Agree
I Do Not Agree
Internet | Protected Mode: Off
100%

CAPTCHA

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

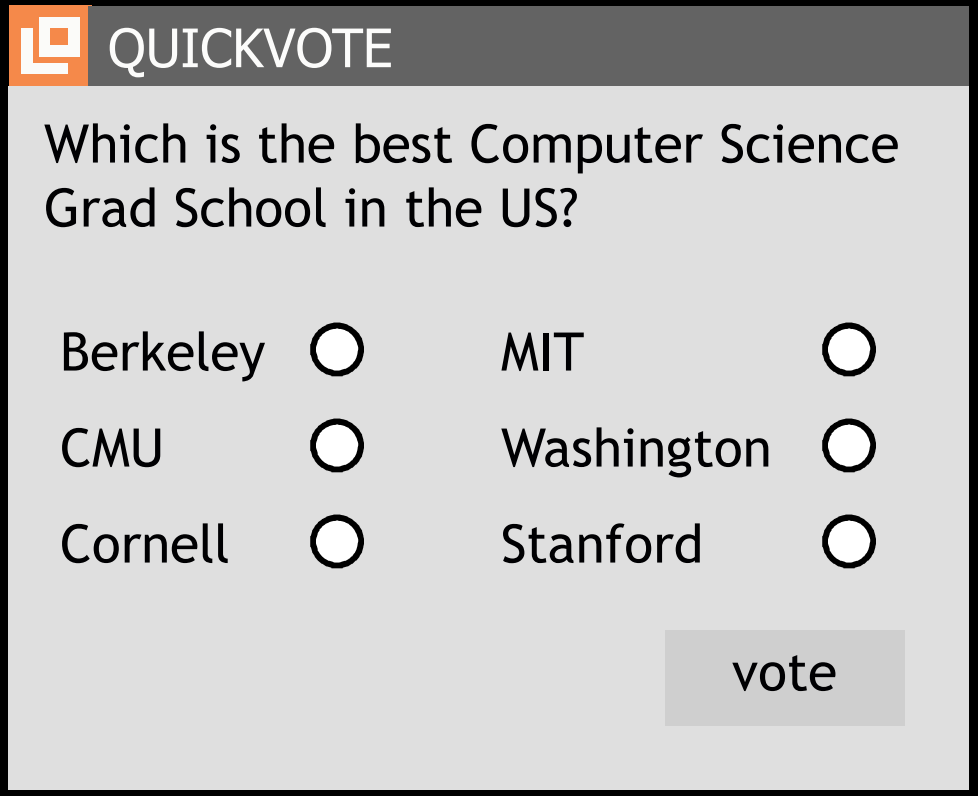
[CACM] [EUROCRYPT]

CAPTCHA

A program that can generate and grade tests that:

A. Most humans can pass

B. Current computer programs cannot pass



(From www.slashdot.org)

Applications

Free e-mail services

Data collection

Worms

Comment spam in blogs

Preventing dictionary attacks

Applications

Free e-mail services

Data collection

Worms

Comment spam in blogs

Preventing dictionary attacks

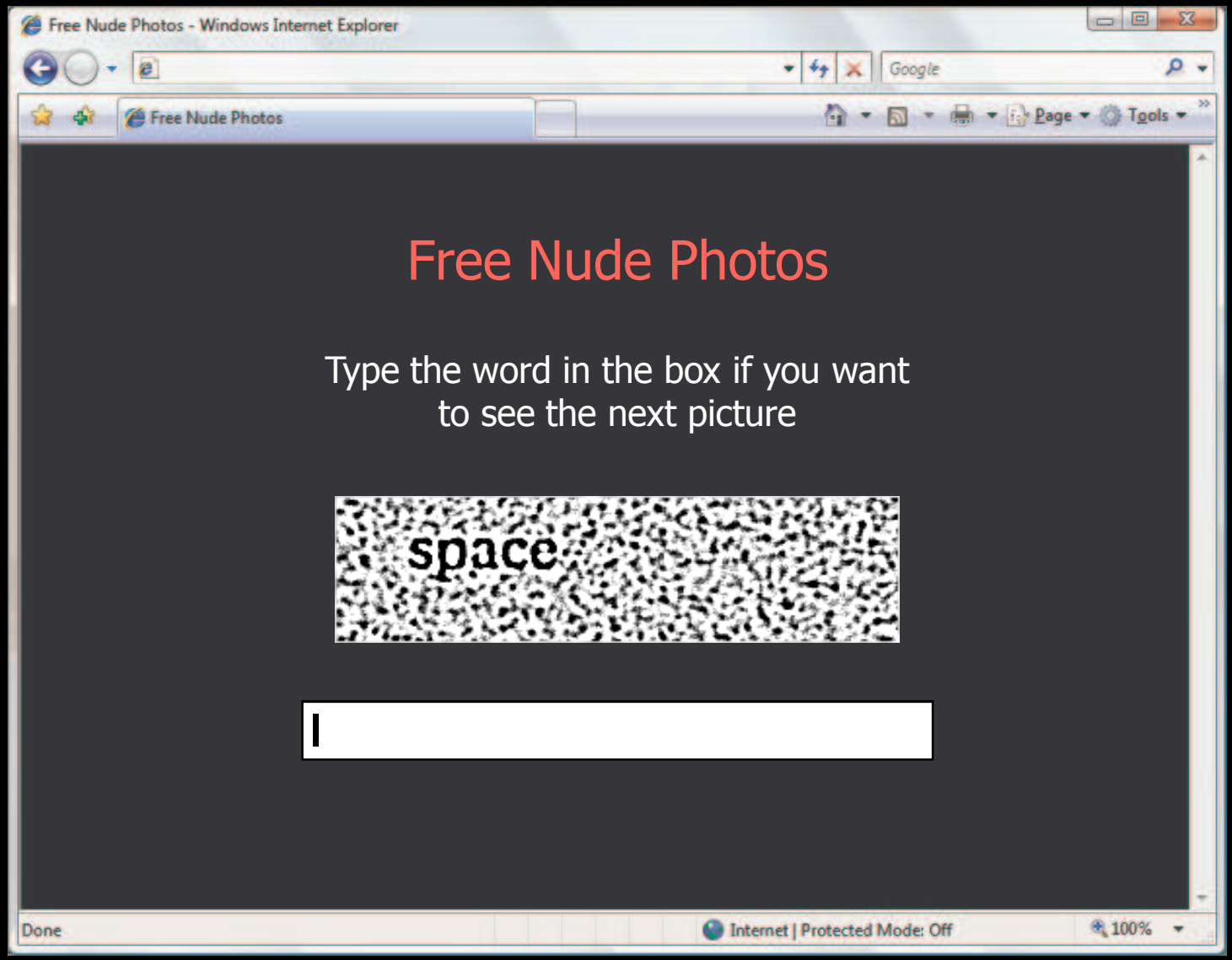
CAPTCHA Sweat Shops

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


Free Nude Photos - Windows Internet Explorer
Google
Free Nude Photos
Page
Tools
Free Nude Photos
Type the word in the box if you want
to see the next picture
space
Done
Internet | Protected Mode: Off
100%

reCAPTCHA

Roughly 60 million CAPTCHAs are solved every day

10s of human time per CAPTCHA

Can we use this human effort for good?

Digitizing Books

Scan

OCR

Bell Henry,
BeH Henry
Bell Henry
Bdl I8aac

OCR isn't perfect

Scanned book

Word that OCR can't read

Randomly distorted Image of word

We’re Doing This For Realz!

+

reCAPTCHA: Stop Spam, Read Books - Windows Internet Explorer
http://recaptcha.net/
Google
reCAPTCHA: Stop Spam, Read Books
Page
Tools
reCAPTCHA
WHAT IS reCAPTCHA
GET reCAPTCHA
PROTECT YOUR EMAIL
MY ACCOUNT
RESOURCES
STOP SPAM.
READ BOOKS.
overlooks
inquiry
Type the two words:
Protect your site from abuse and help digitize books.
Use reCAPTCHA on your site for free.
About Us | Contact
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Done
Internet | Protected Mode: Off
100%

reCAPTCHA comes with
an audio test as well

CNN.com - Technology - Windows Internet Explorer

http://www.cnn.com/TECH/

Google

CNN.com - Technology

Page Tools

CNN.com

Member Center: Sign In | Register

International Edition

SEARCH THE WEB CNN.COM Search powered by YAHOO! SEARCH

- Home Page
- World
- U.S.
- Weather
- Business at CNNMoney
- Sports at SI.com
- Analysis at Time.com
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- Law
- Technology
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- Video
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- I-Reports

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TECHNOLOGY

Updated: 5:24 p.m. EDT (21:24 GMT), May 29, 2007

Web registration tool digitizes books

Researchers at Carnegie Mellon University have discovered a way to enlist people across the globe to help digitize books every time they solve the simple distorted word puzzles commonly used to register at Web sites or buy things online.

FULL STORY

MORE NEWS

- Robots put the cool back in computer science
- Concerts merge live, Internet and virtual world
- Cyber-spies tracking terror on Web
- CNNMoney: FTC probes Google-DoubleClick deal
- Infrared burners heat up backyard grills

WATCH VIDEO

More Video

- Wastler on Google's concerns
- Explorers fall through ice
- Tracking fire

Internet | Protected Mode: Off

100%

In the first month:

- Over 5,000 websites signed up
- Over 500,000 words digitized

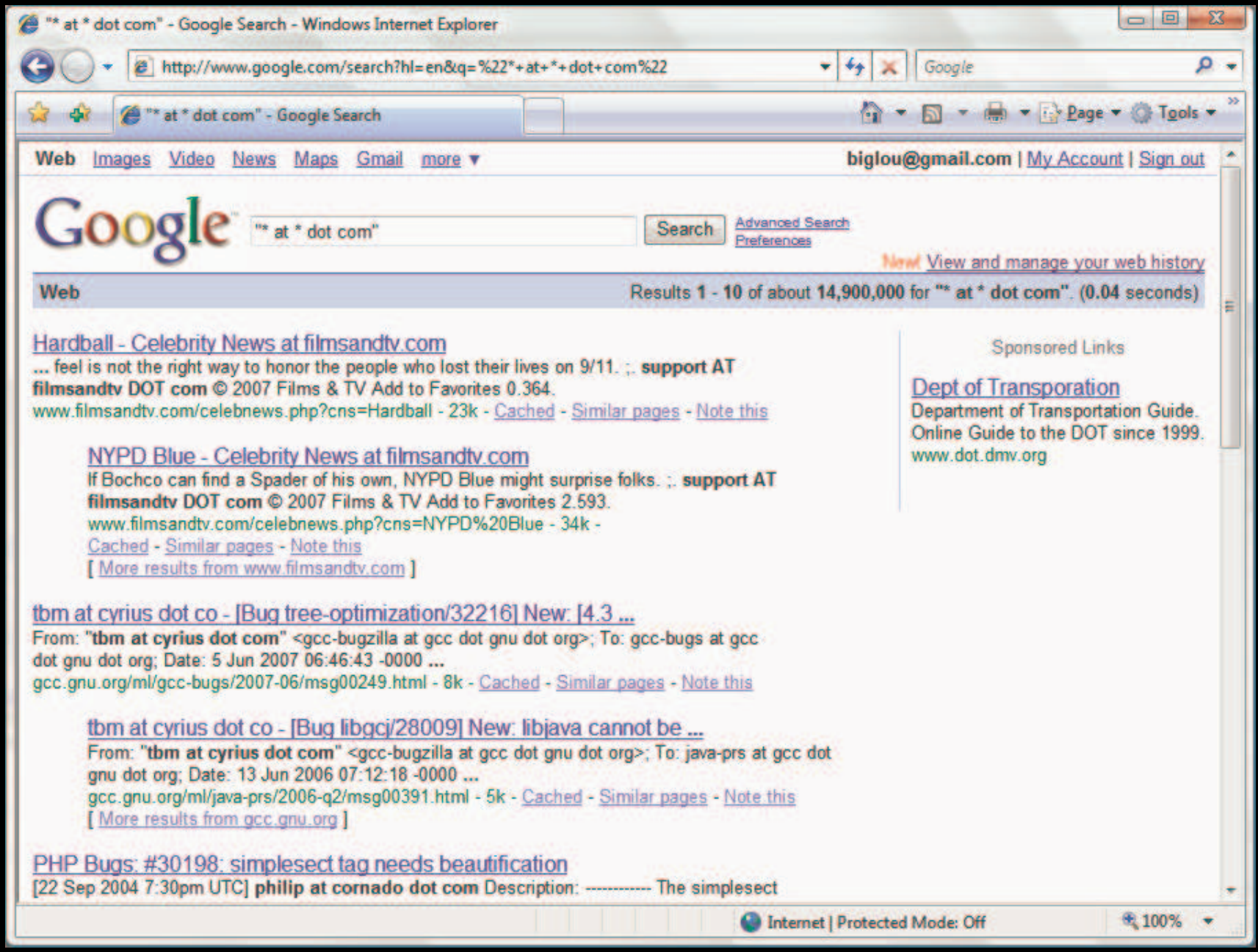
JEFP House Parties - Sign up for an account - Windows Internet Explorer
http://party.johnedwards.com/signup.php
Google
JEFP House Parties - Sign up for an account
Page
Tools
JOHNEDWARDS.COM
Party for Change
Search events: Enter your ZIP code
Go
Host A Party
Find A Party
Resources
Log in • Sign up
Sign 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
letting
majority
Type the two words:
reCAPTCHA
Create My Account
Internet | Protected Mode: Off
100%

OnlineBootyCall.com - Finding the pieces.... without the Puzzle - Windows Internet Explorer
http://www.onlinebootycall.com/sign_up2.php
Google
OnlineBootyCall.com - Finding the pieces.... with...
Page
Tools
Hair Color *
- Select -
Hair Color:
Choose natural hair color.
Eye Color *
- Select -
Eye Color:
Choose natural eye color.
Height *
- Select -
Height:
Give or take an inch or two.
Weight *
Pounds
Kilograms
Weight:
Keep it real ... lol. We like all sizes!
Expectation *
Select one...
Expectation:
Let everyone know why you're here.
Type the two words:
reCAPTCHA
By clicking *I Accept* you are certifying that you are at least 18 years of age and agree to the terms of membership.
Done
OBC
OnlineBootyCall.com
Finding the pieces without the puzzle.

Protecting Email Addresses

Posting your email address on the Web is dangerous!

“biglou at cs dot cmu dot edu”


"* at * dot com" - Google Search - Windows Internet Explorer
http://www.google.com/search?hl=en&q=%22*+at+*+dot+com%22
Google
"* at * dot com" - Google Search
Page
Tools
Web Images Video News Maps Gmail more ▼
biglou@gmail.com | My Account | Sign out
Google
"* at * dot com"
Search
Advanced Search
Preferences
New! View and manage your web history
Web
Results 1 - 10 of about 14,900,000 for "* at * dot com". (0.04 seconds)
Hardball - Celebrity News at filmsandtv.com
... feel is not the right way to honor the people who lost their lives on 9/11. ;. support AT filmsandtv DOT com © 2007 Films & TV Add to Favorites 0.364.
www.filmsandtv.com/celebnews.php?cns=Hardball - 23k - Cached - Similar pages - Note this
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If Bochco can find a Spader of his own, NYPD Blue might surprise folks. ;. support AT filmsandtv DOT com © 2007 Films & TV Add to Favorites 2.593.
www.filmsandtv.com/celebnews.php?cns=NYPD%20Blue - 34k -
Cached - Similar pages - Note this
[More results from www.filmsandtv.com]
tbm at cyrius dot co - [Bug tree-optimization/32216] New: [4.3 ...
From: "tbm at cyrius dot com" <gcc-bugzilla at gcc dot gnu dot org>; To: gcc-bugs at gcc dot gnu dot org; Date: 5 Jun 2007 06:46:43 -0000 ...
gcc.gnu.org/ml/gcc-bugs/2007-06/msg00249.html - 8k - Cached - Similar pages - Note this
tbm at cyrius dot co - [Bug libgcj/28009] New: libjava cannot be ...
From: "tbm at cyrius dot com" <gcc-bugzilla at gcc dot gnu dot org>; To: java-prs at gcc dot gnu dot org; Date: 13 Jun 2006 07:12:18 -0000 ...
gcc.gnu.org/ml/java-prs/2006-q2/msg00391.html - 5k - Cached - Similar pages - Note this
[More results from gcc.gnu.org]
PHP Bugs: #30198: simplesect tag needs beautification
[22 Sep 2004 7:30pm UTC] philip at cornado dot com Description: ---------- The simplesect
Sponsored Links
Dept of Transporation
Department of Transportation Guide. Online Guide to the DOT since 1999.
www.dot.dmv.org
Internet | Protected Mode: Off
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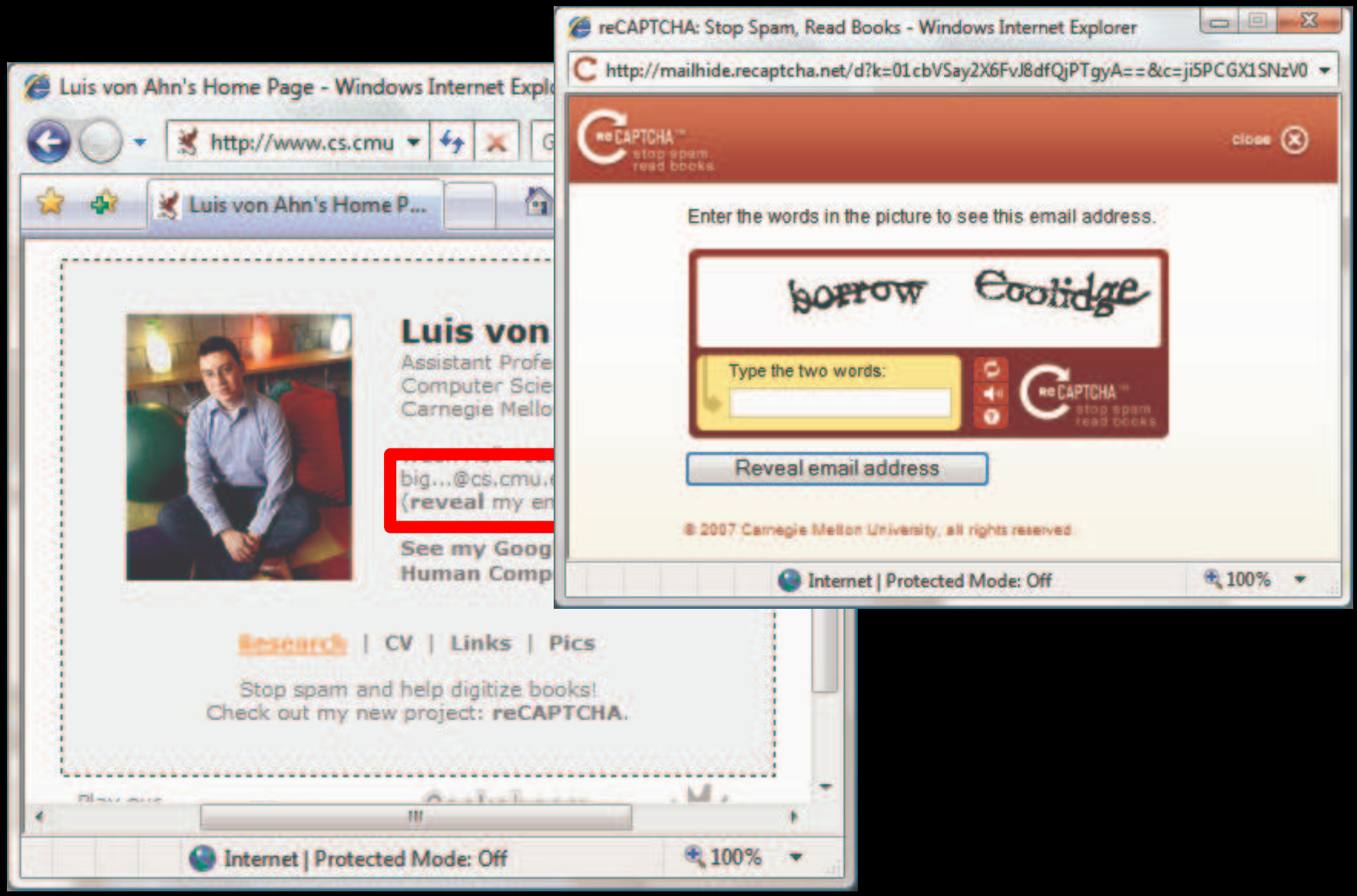
reCAPTCHA MailHide



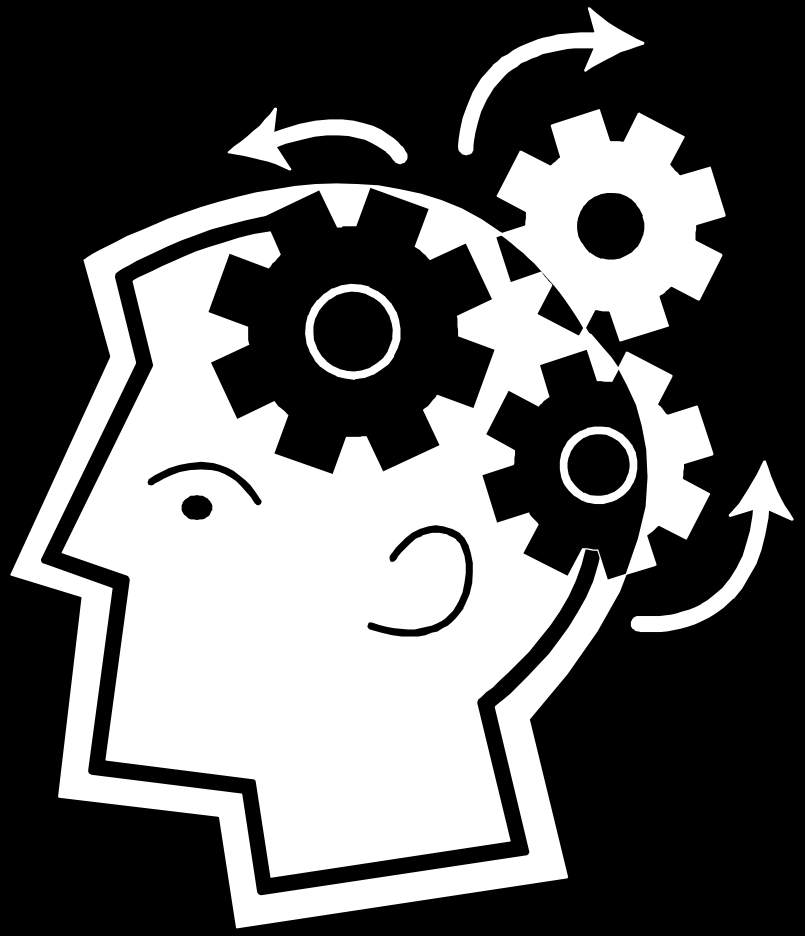
HUMAN COMPUTATION

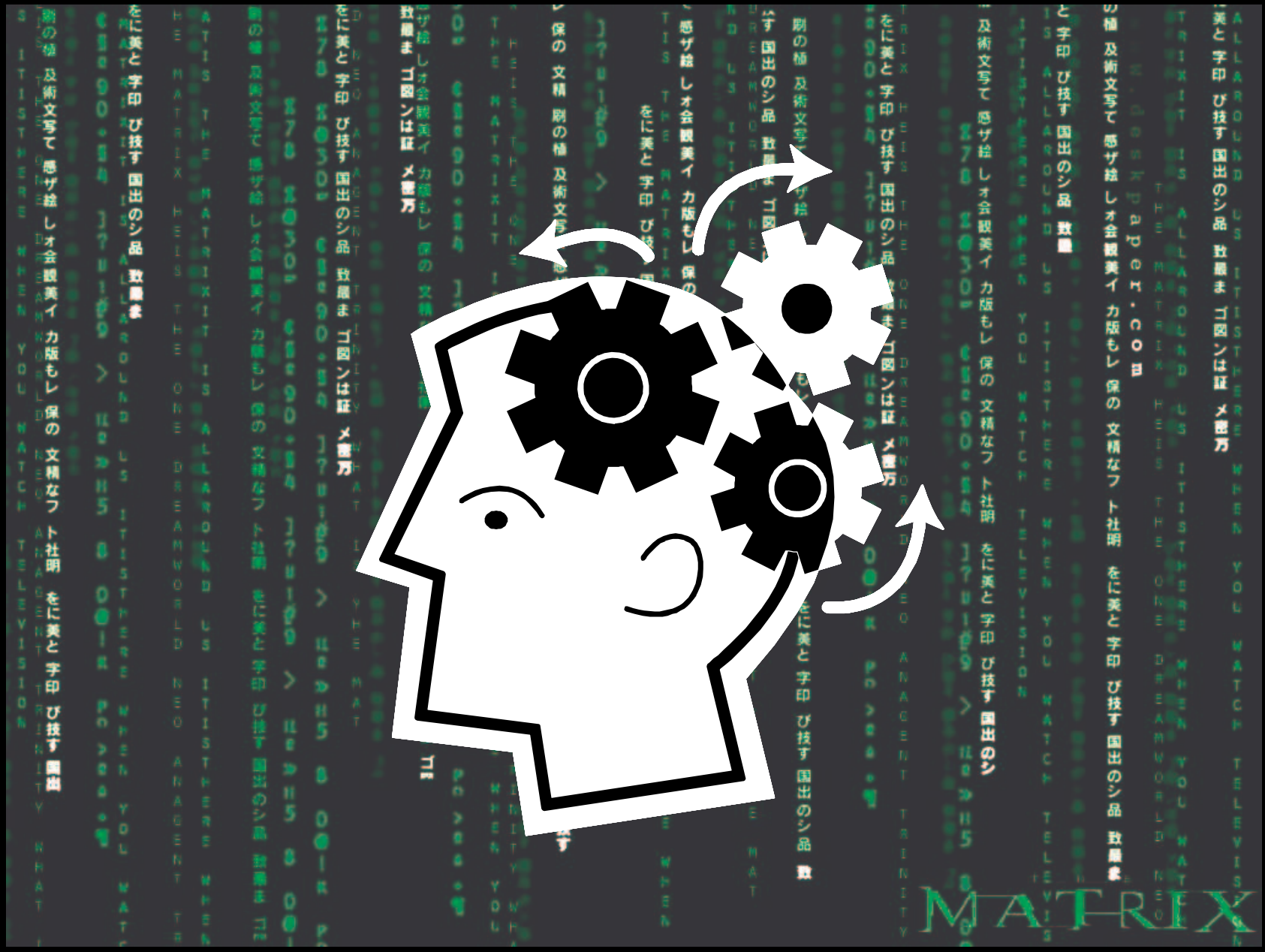
10,000

Number of hours spent playing computer and video games of a typical 21-year-old male in the United States

(equivalent to 5 years of full time work!)

Human Computation




MATRIX

Labeling Images With Words

Dick
Cheney
Vice president
Evil

Still an open problem

Image Search On The Web

Uses filenames and html text

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]

The ESP Game - Windows Internet Explorer
http://www.espgame.org/cgi-bin/play_game?id=609648808732358165769236389
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
© 2006 Carnegie Mellon University, all rights reserved. Patent Pending.
Done
Internet | Protected Mode: Off
100%

The ESP Game is Fun

25 million agreements
with 120,000 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

Google Image Labeler BETA

Google Image Labeler

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

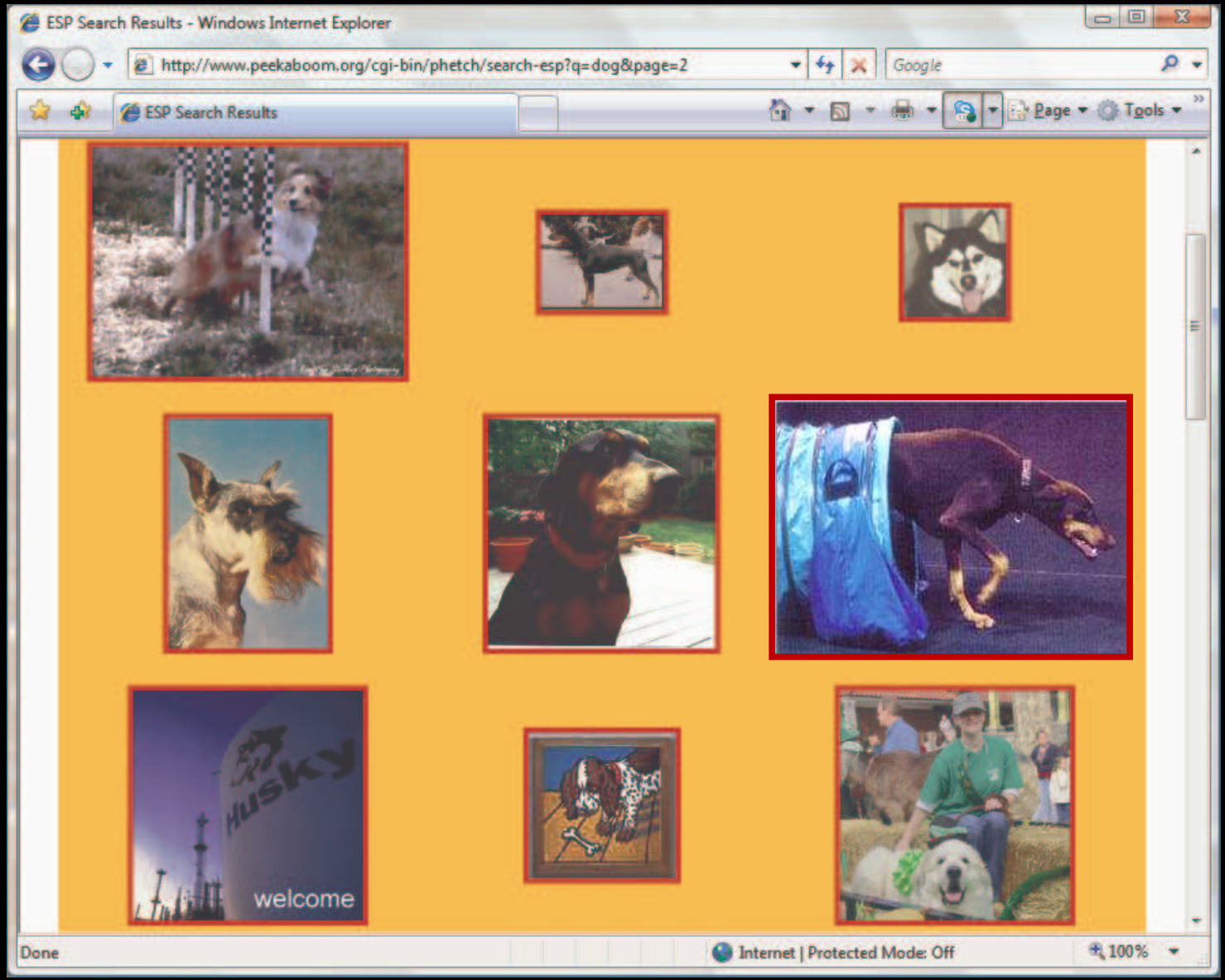
© 2006 Google

What About Cheating?

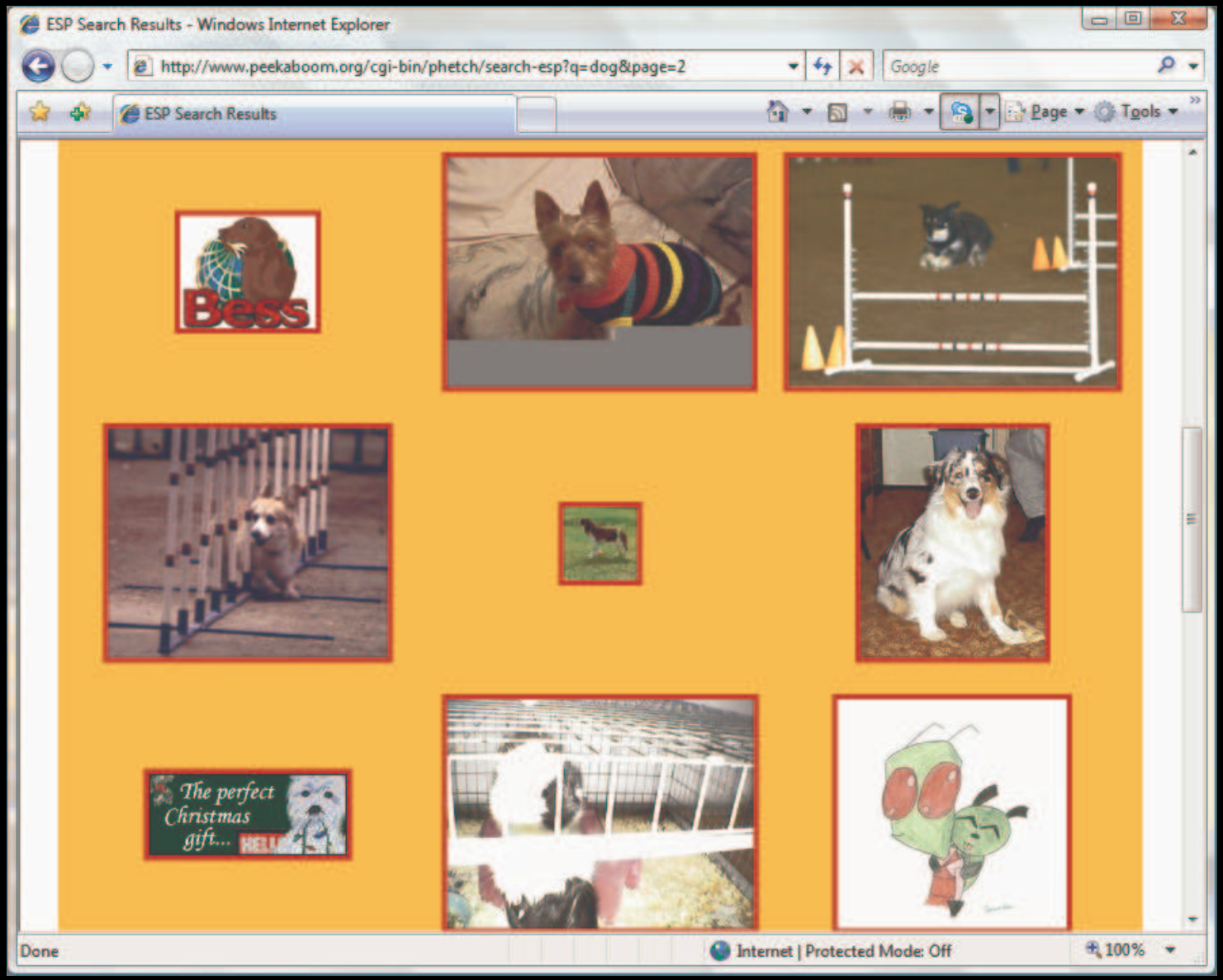
We give players test images for which we know all the common labels:

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

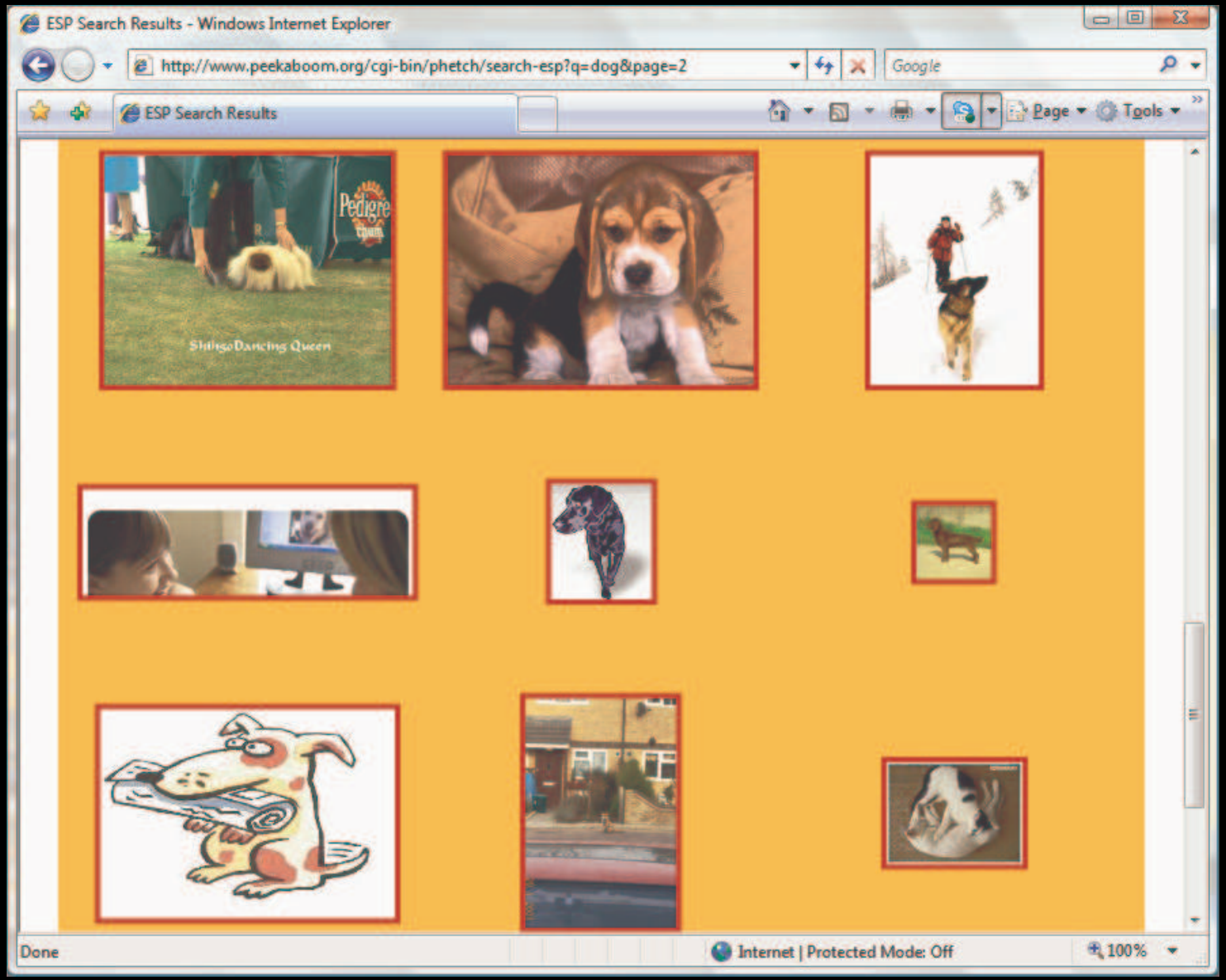
Search Results



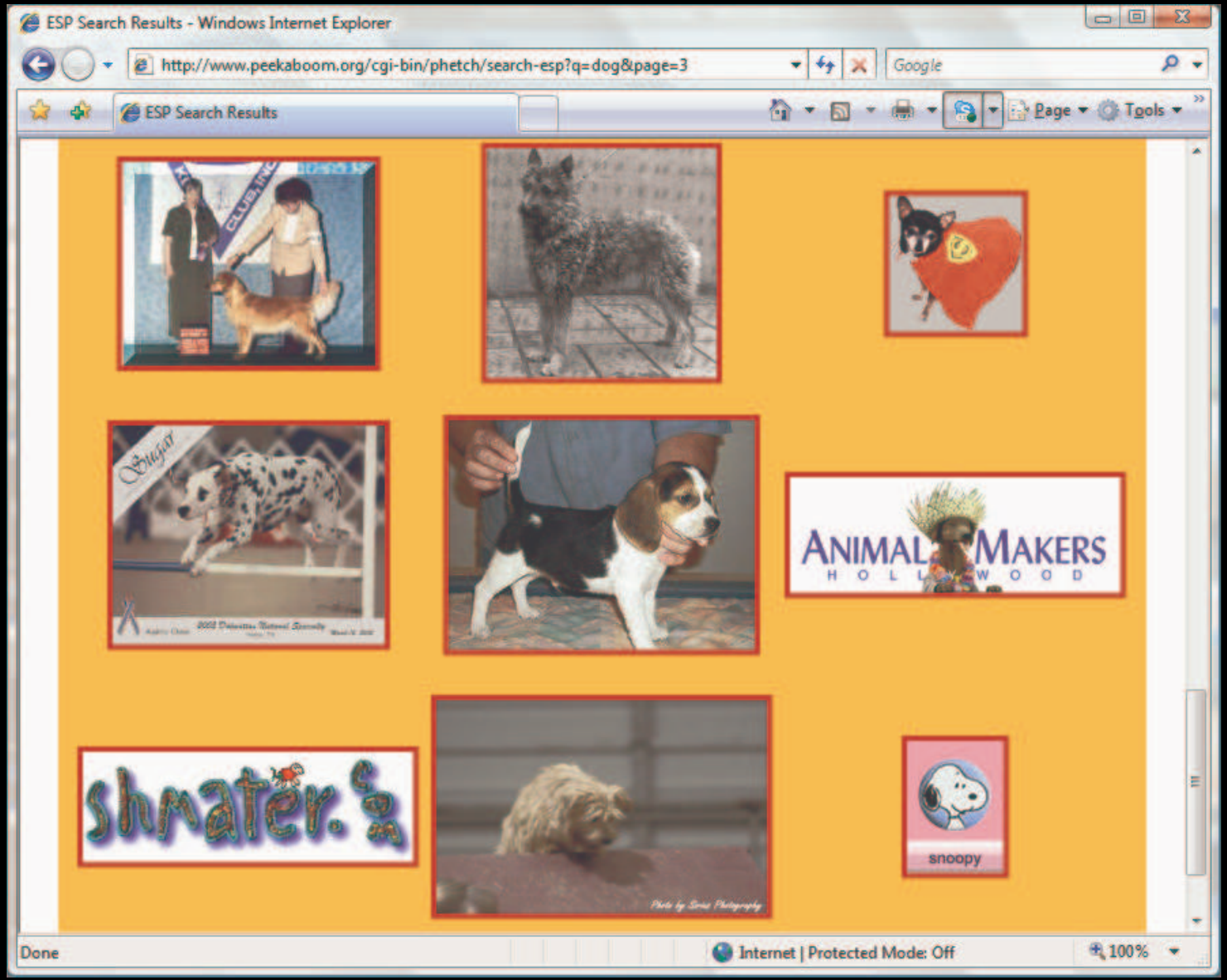
Search Results

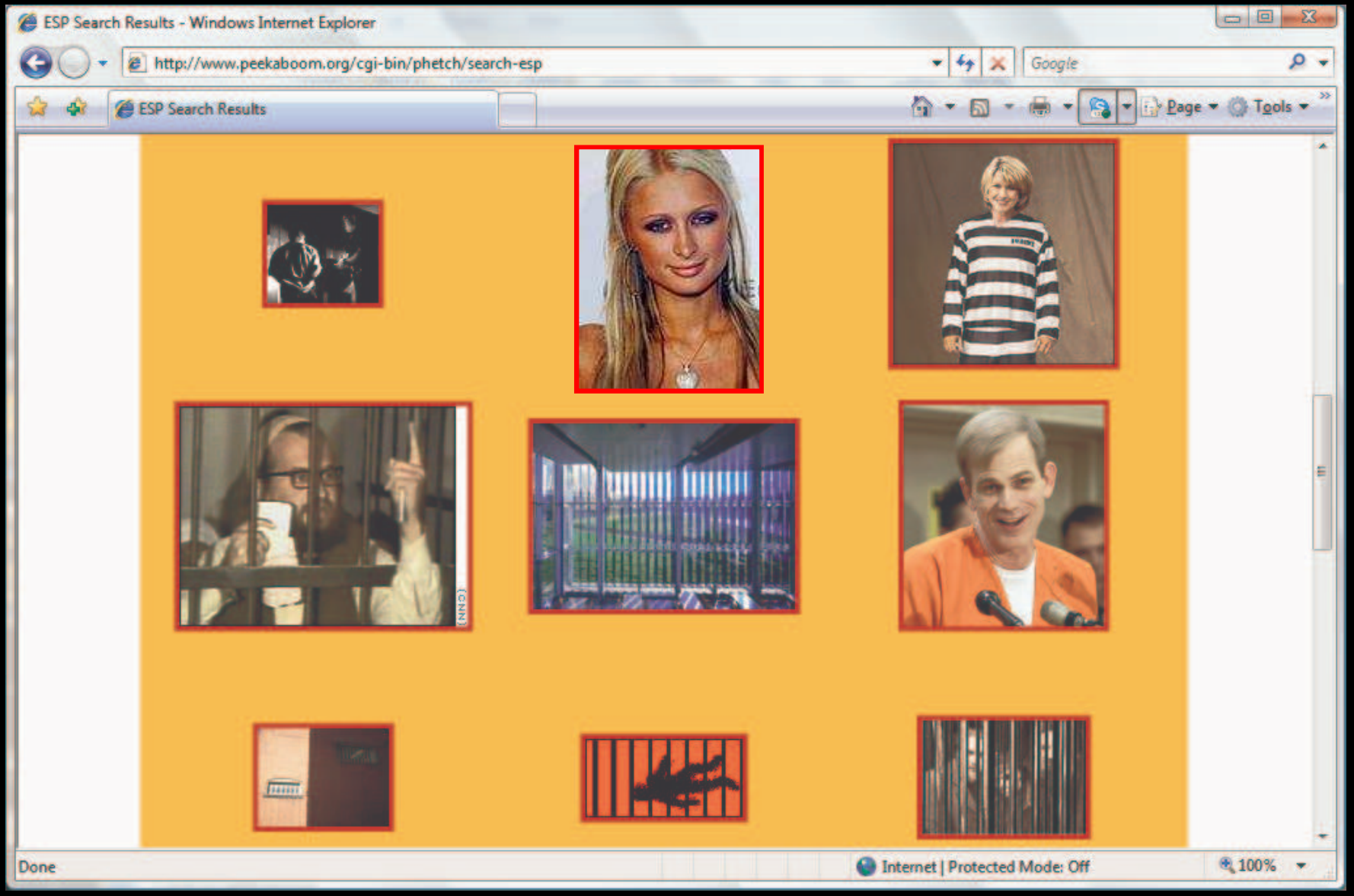


Search Results



Search Results




ESP Search Results - Windows Internet Explorer
http://www.peekaboom.org/cgi-bin/phetch/search-esp
Google
ESP Search Results
Page
Tools
Done
Internet | Protected Mode: Off
100%

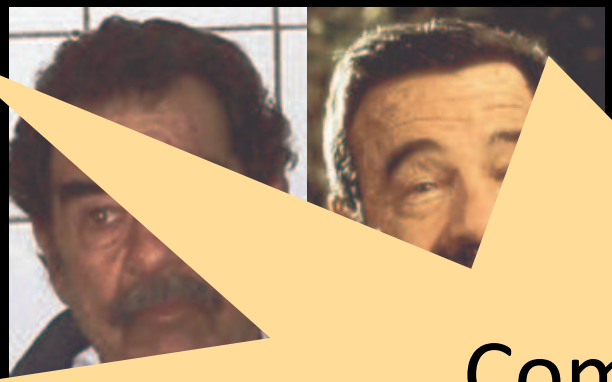
Sample Labels

beach
chairs
sea
people
man
woman
plant
ocean
talking
water
porch
sky
bell

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!

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."

“There are 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”

The ESP Game is an "Algorithm"

Input: an image

Output: set of keywords

Games With A Purpose

Running a computation in people's brains instead of silicon processors

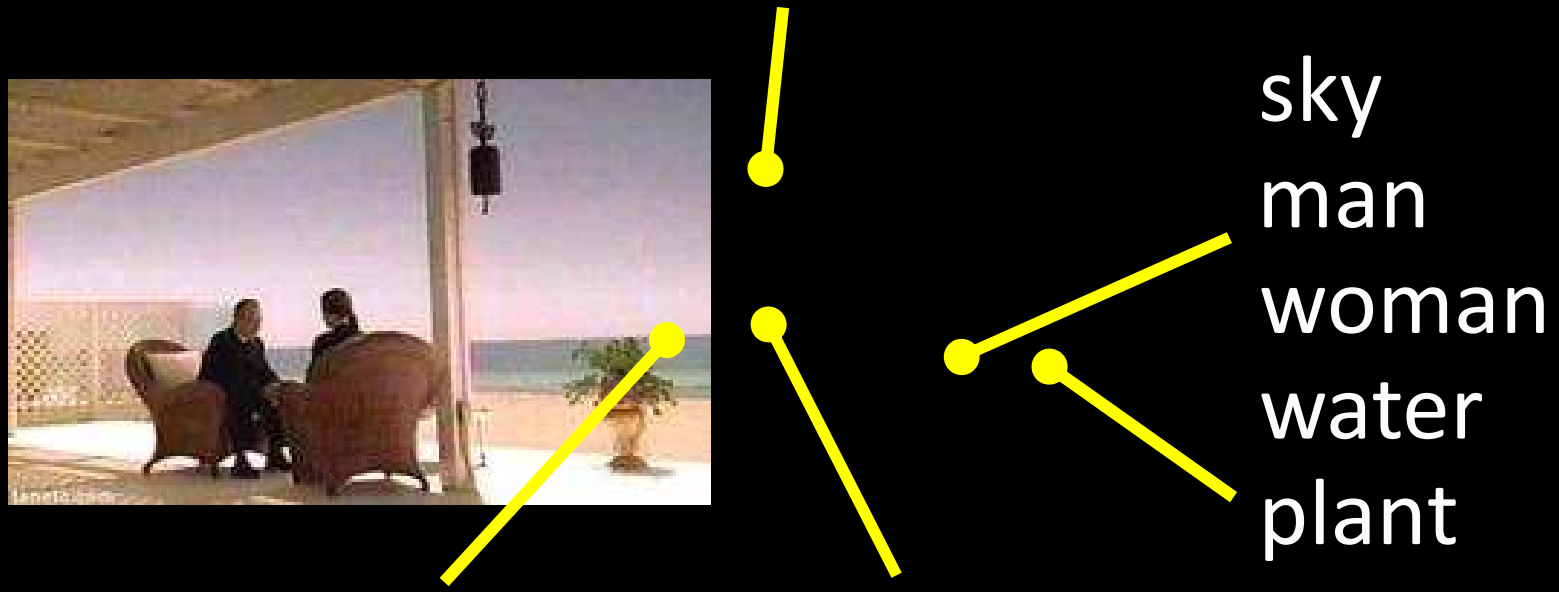
Other Games With A Purpose

Locating Objects in Images

ESP Game

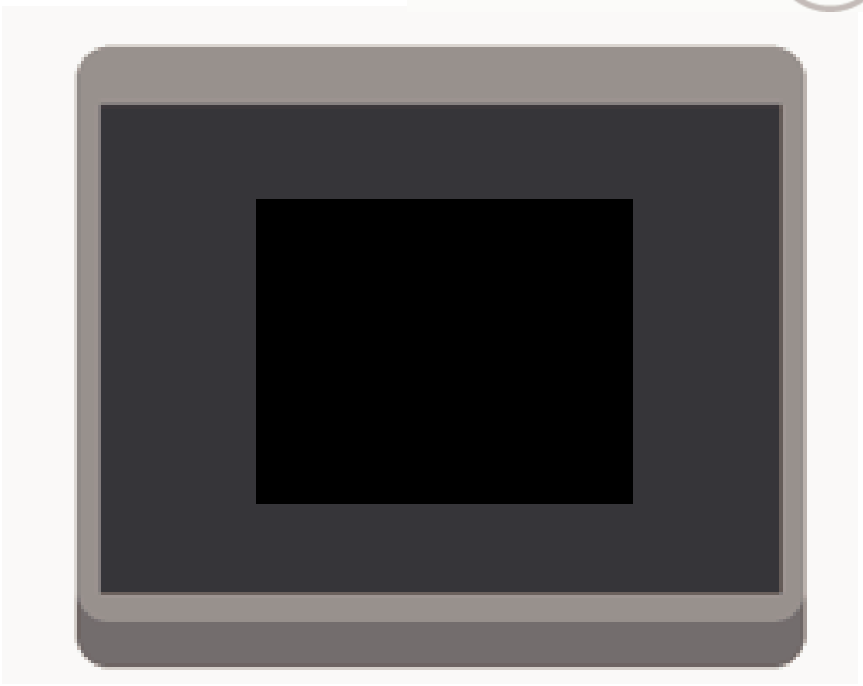
sky
man
woman
water
plant

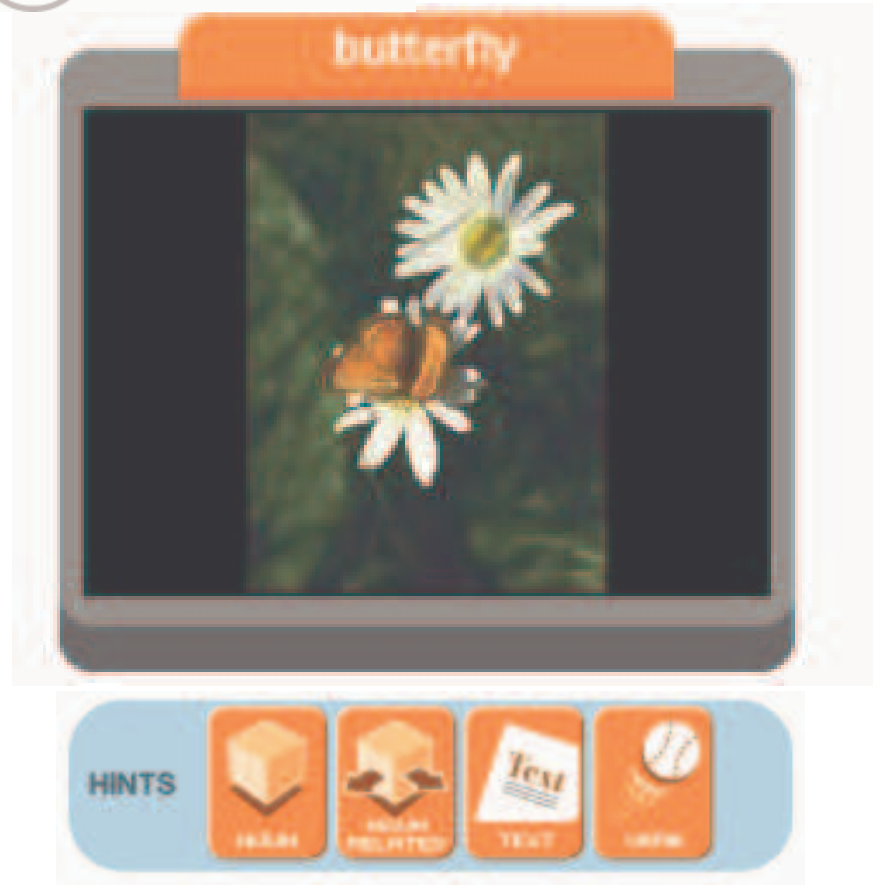
Locating Objects in Images



Such information would be extremely useful for computer vision research

Peekaboom





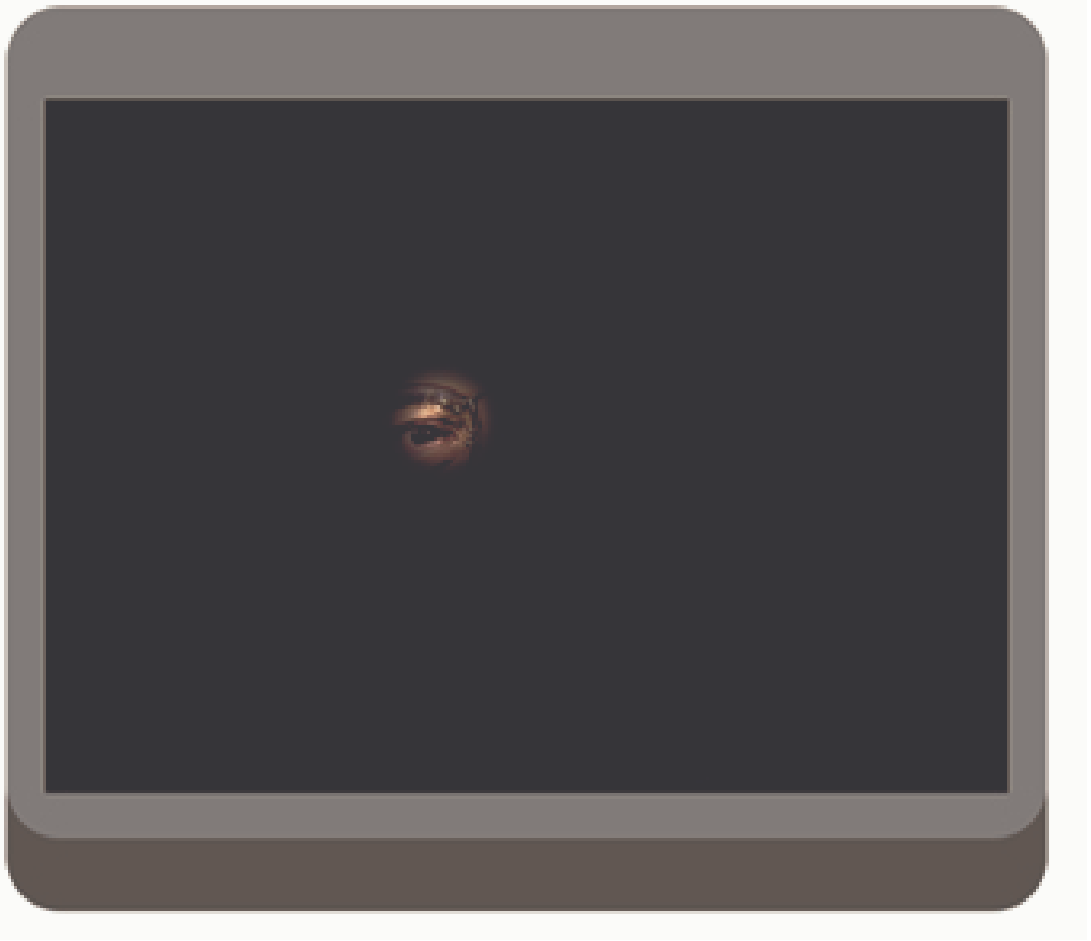
[CHI 2006]

Peekaboom

Peekaboom

HINT

Noun



Peekaboom

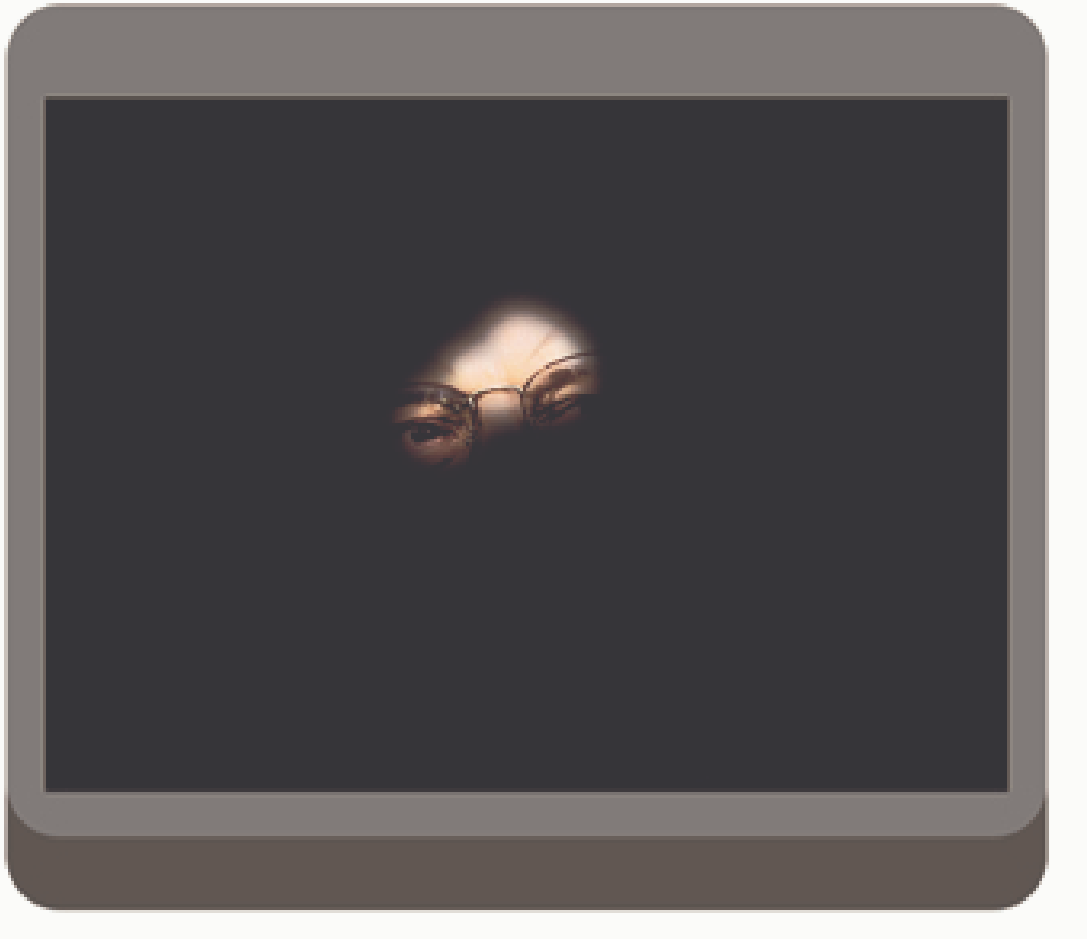
HINT

Noun

Peekaboom

HINT

Noun



Peekaboom

HINT

Noun

Peekaboom

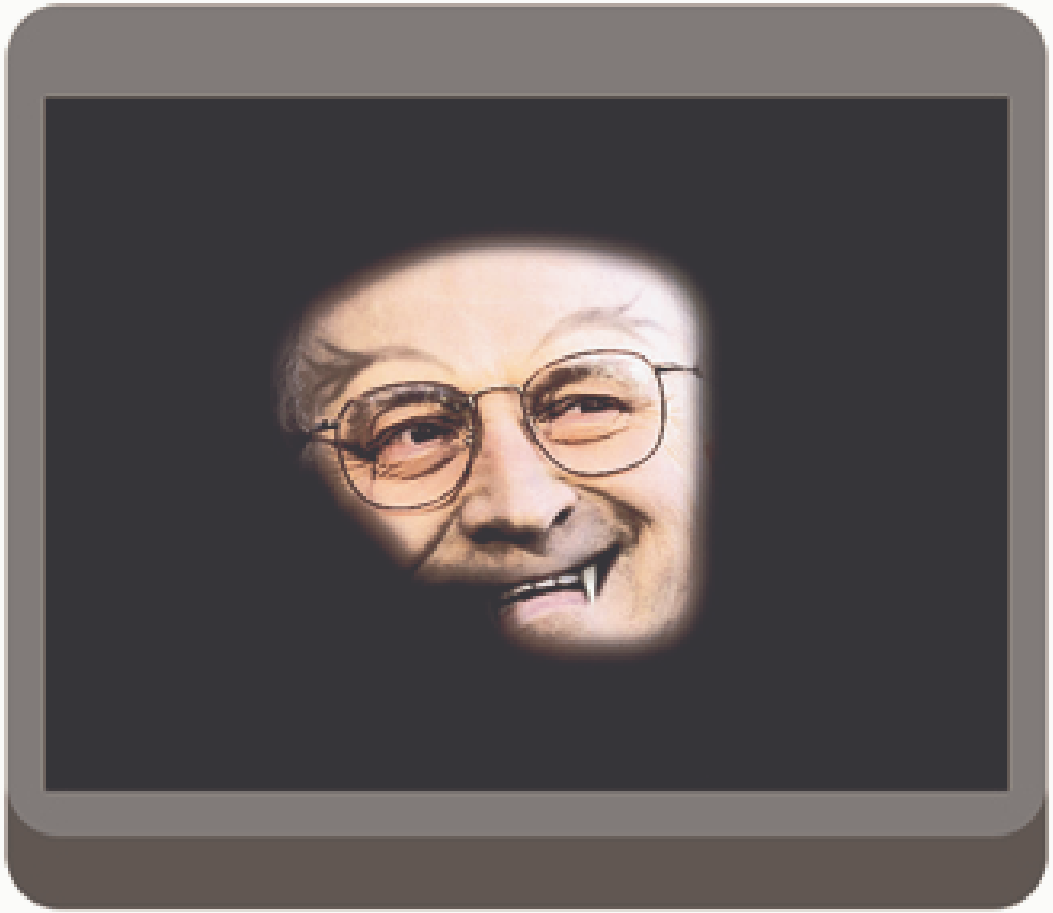
HINT

Noun

Peekaboom

HINT

Noun



Peekaboom

HINT

Noun

Peekaboom
TIME LEFT
1:29
SCORE
500
building
GUESSES
boom
CLICK THE IMAGE TO REVEAL AREAS TO YOUR PARTNER
RIGHT CLICK TO FREEZE AN AREA OF THE IMAGE
HINTS
Text
PASS

is Fun!

27,000 players
2,100,000 pieces of data

Many played over 120 hours in the first 10 days!

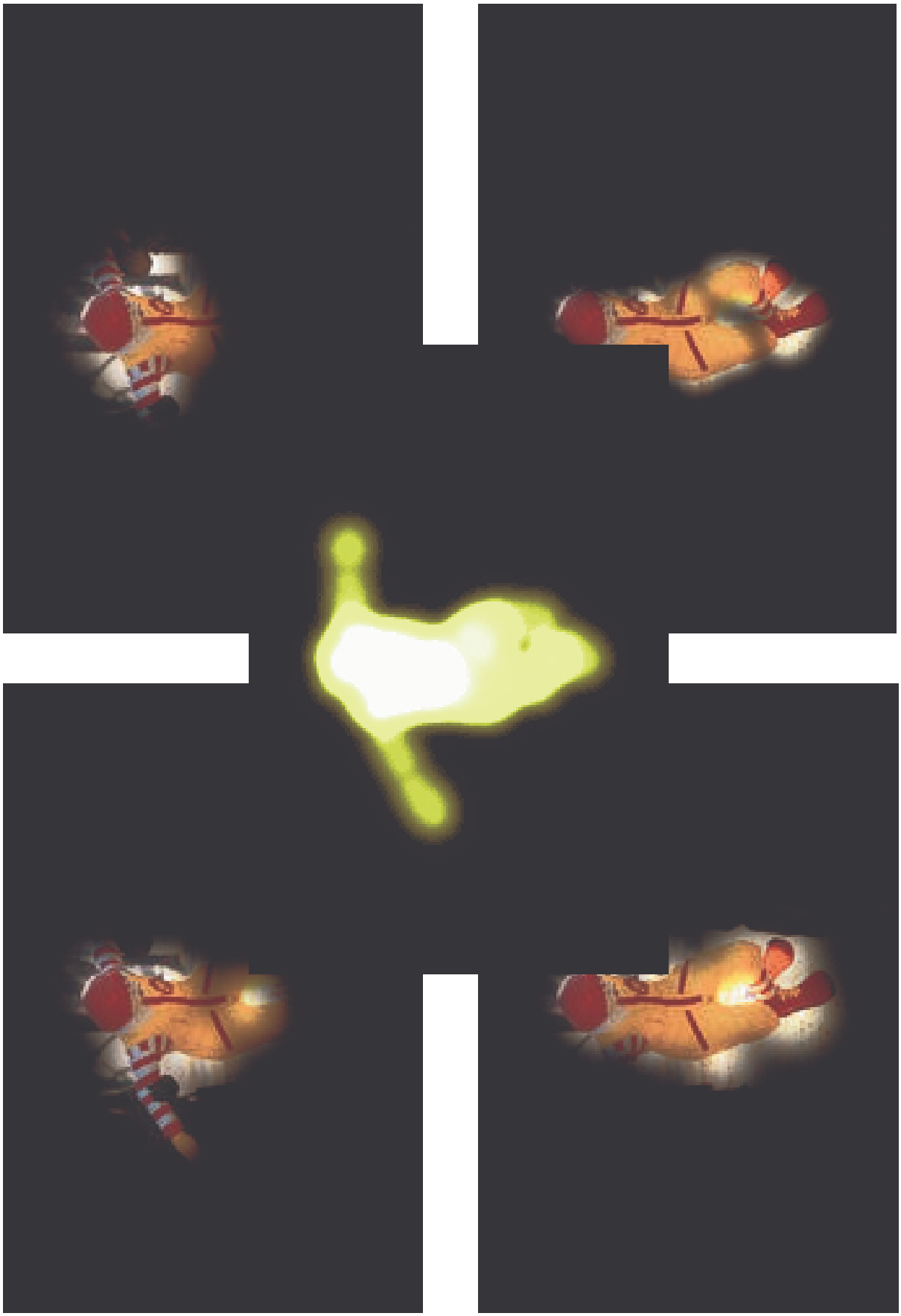
270 hours of game-play

Player Comments

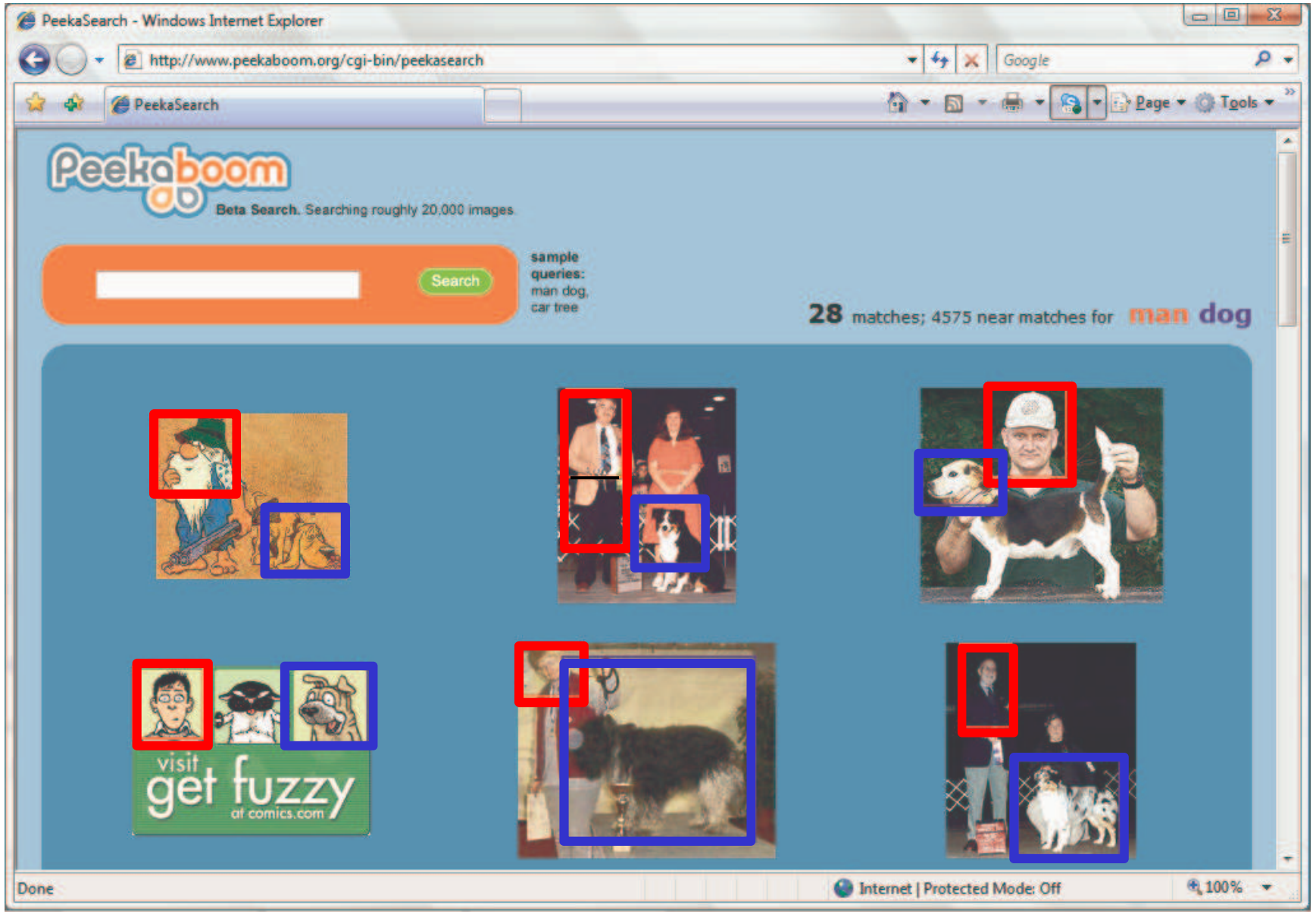
“Peekaboom gives the same feeling as combining gambling with charades while riding on a roller coaster.
The good points are that you increase your intelligence, don't lose all your money and you don't fall off the ride.
The bad point is that you look at your watch and eight hours have just disappeared!”

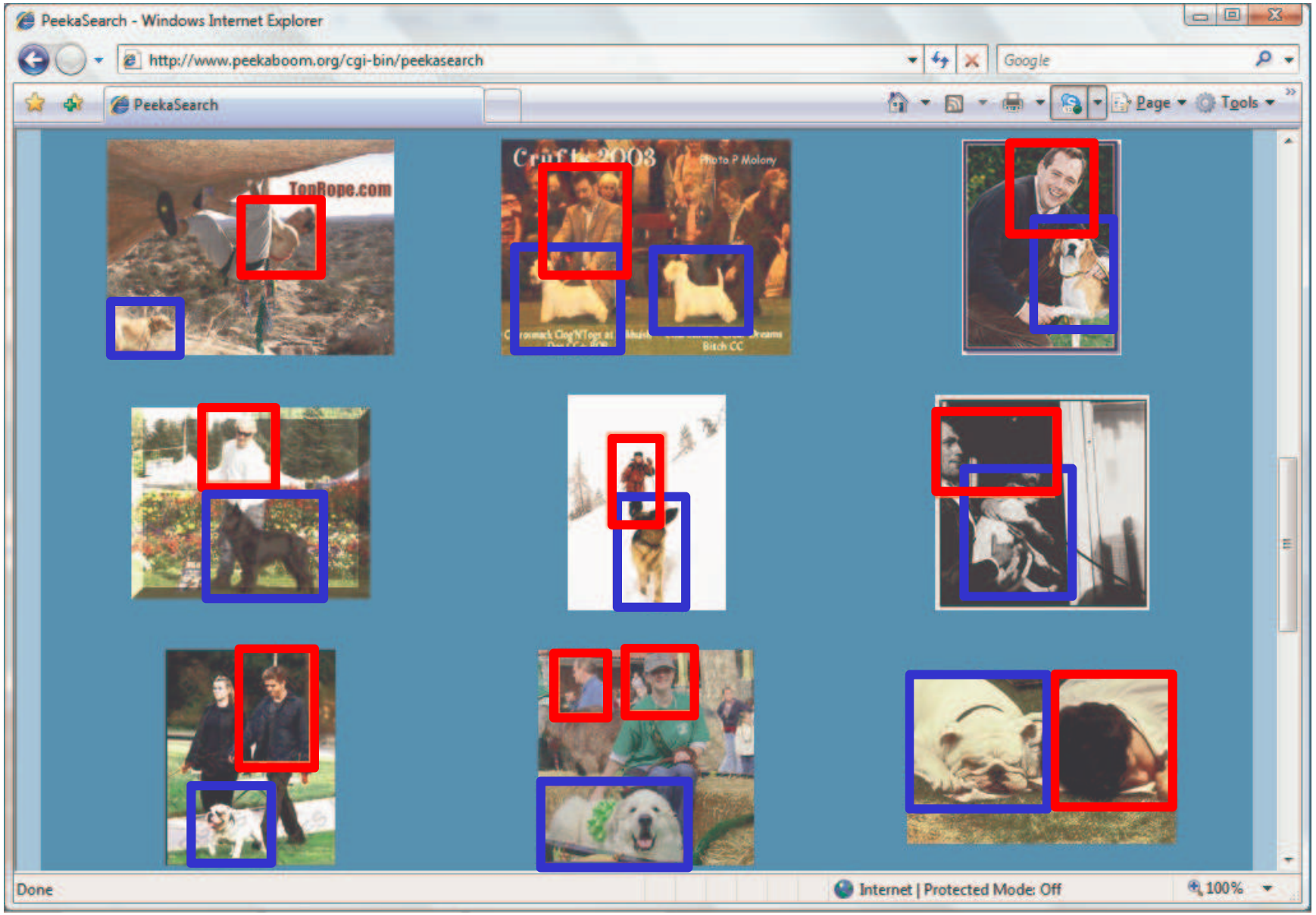
“One unfortunate side effect of playing so much in such a short time was a mild case of carpal tunnel syndrome in my right hand and forearm”

Ronald



Peekaboom + Segmentation


PeekaSearch - Windows Internet Explorer
http://www.peekaboom.org/cgi-bin/peekasearch
Google
PeekaSearch
Page
Tools
Peekaboom
Beta Search. Searching roughly 20,000 images
Search
sample queries: man dog, car tree
28 matches; 4575 near matches for man dog
visit get fuzzy at comics.com
Done
Internet | Protected Mode: Off
100%


PeekaSearch - Windows Internet Explorer
http://www.peekaboom.org/cgi-bin/peekasearch
Google
PeekaSearch
Page
Tools
TopRope.com
Photo P Molony
Done
Internet | Protected Mode: Off
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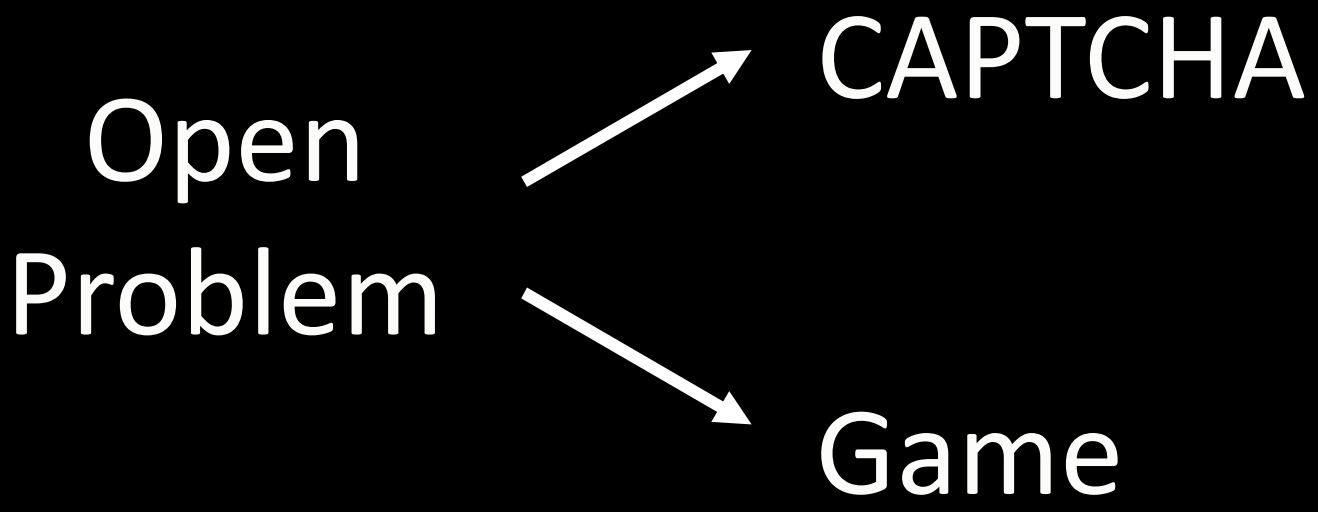
The Power Of Human Cycles



MATRIX

www.recaptcha.net

www.espgame.org

www.peekaboom.org

Peekaboom Crew
Luis von Ahn
Roy Liu

reCAPTCHA Crew
Luis von Ahn
Ben Maurer
Mike Crawford

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David Stork
Latanya Sweeney