



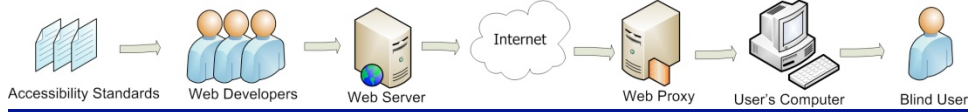
# Social Accessibility

**Jeffrey P. Bigham**

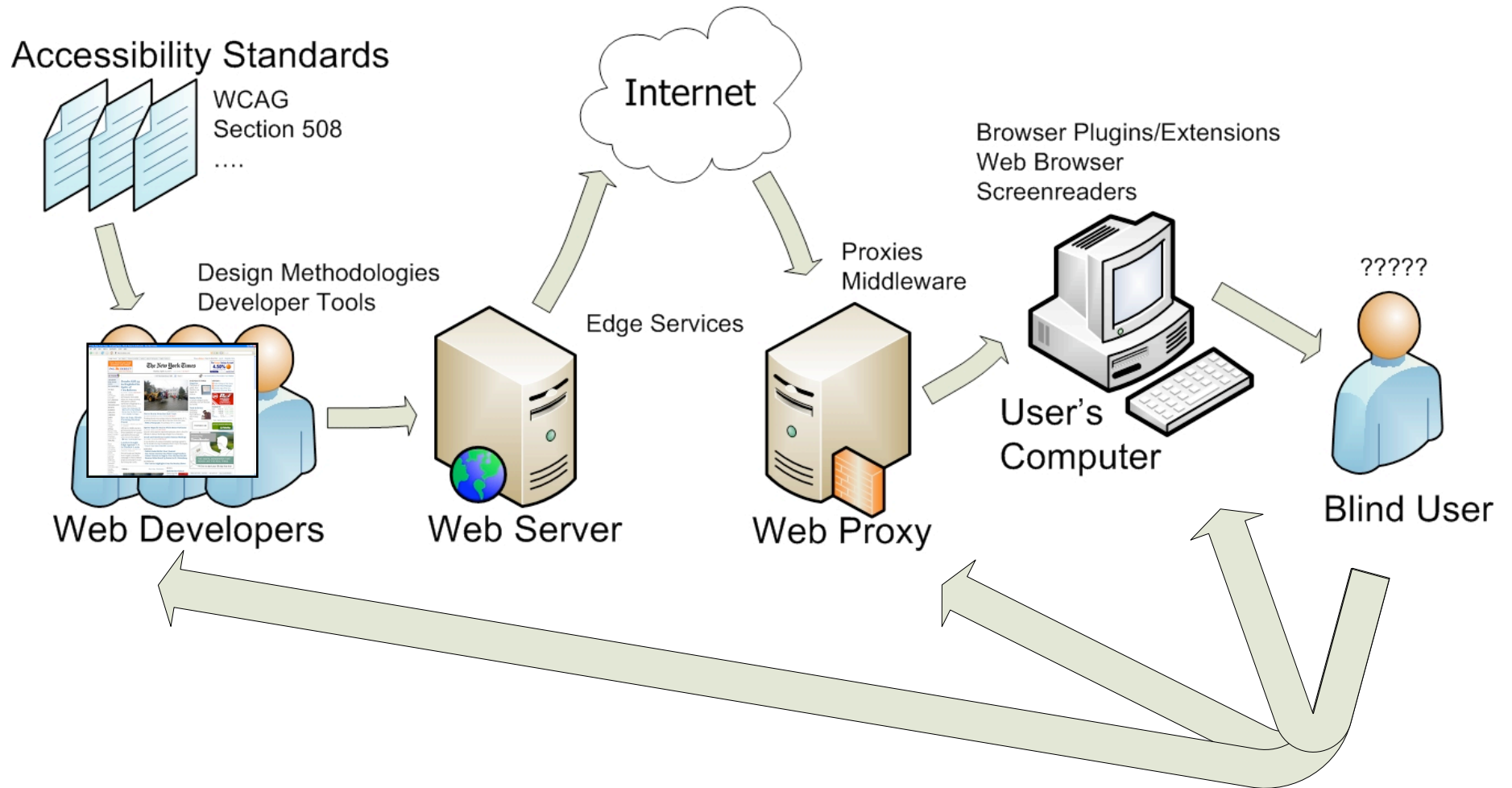
**Ph.D. Candidate, Computer Science & Engineering**



**University of Washington  
Seattle, Washington, USA  
[webinsight.cs.washington.edu](http://webinsight.cs.washington.edu)**



## Accessible Content Production





# Independent Accessibility

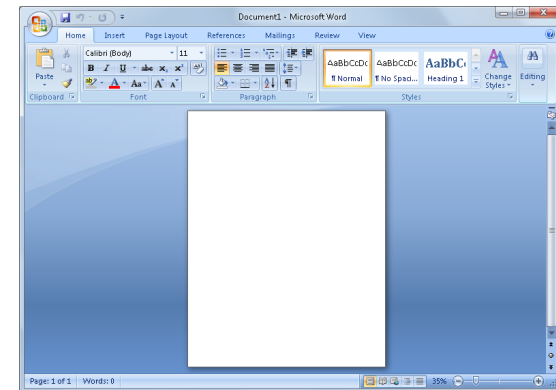




## History: JAWS Scripts

Adapts Screen Readers to work with Existing Applications

```
alien()  
{  
    // they will be 2x2 in size  
    width = 2;  
    height = 2;  
  
    // lets lay them out across the top of the map  
    for int i = 0 to 5 by 1  
    {  
        alien[i]'s location = make point( mainLevel's width/5 *  
                                           i , mainLevel's height);  
    }  
  
    // we will set their AI to dumb_ai,  
    // a movement class we will define  
    ai = dumb_ai;  
}
```







# Outline

- Introduction

- **Motivating Studies**  
Can we rely only on developers?

- Scripting Accessibility

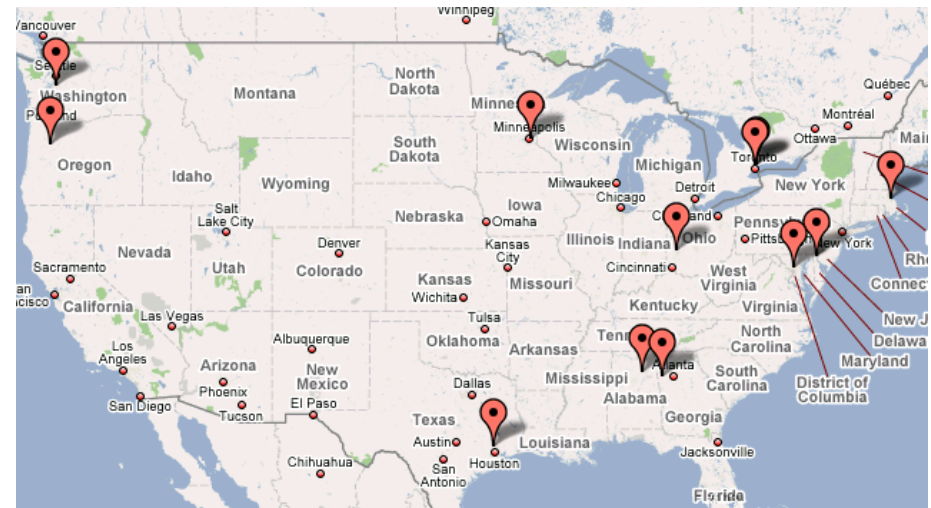
- End User Tools



## Blind vs Sighted User Study

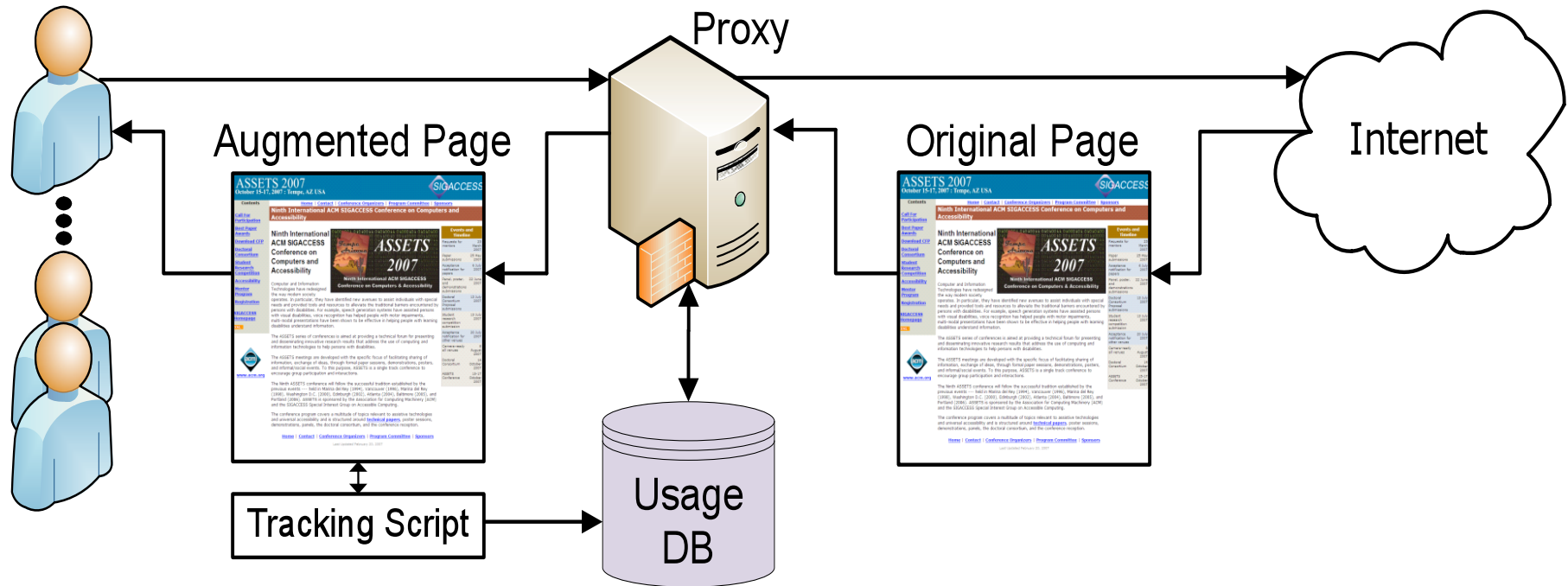
- 10 Blind and 10 Sighted (Ages 18-63)
- Observed for One Week
- Either Internet Explorer or Firefox
- Blind participants used JAWS

- 21,442 Pages
- 4,204,904 Events



**Geographic Diversity of Users**

## A Proxy-Based System

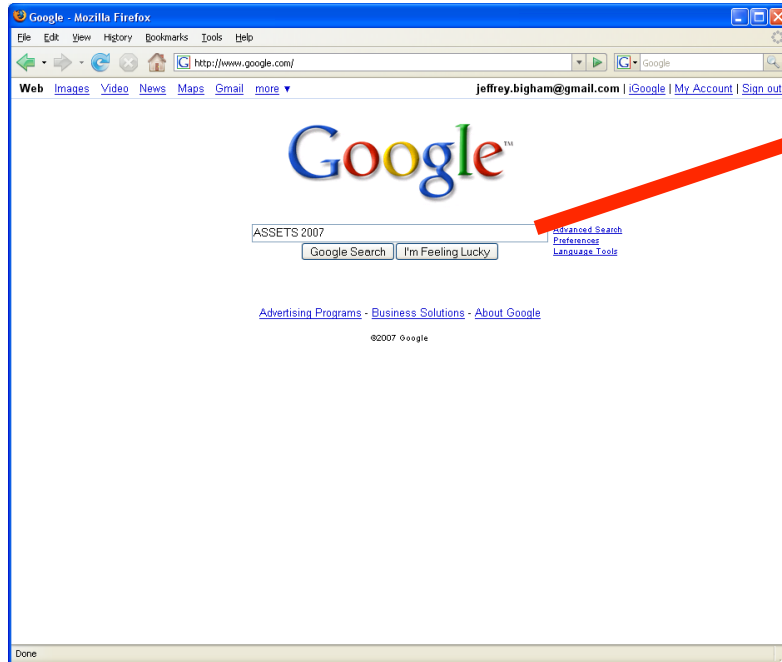


- Used UsaProxy<sup>1</sup>

[1] Richard Atterer *et al.* Knowing the User's Every Move - User Activity Tracking for Website Usability Evaluation and Implicit Interaction. WWW 2007



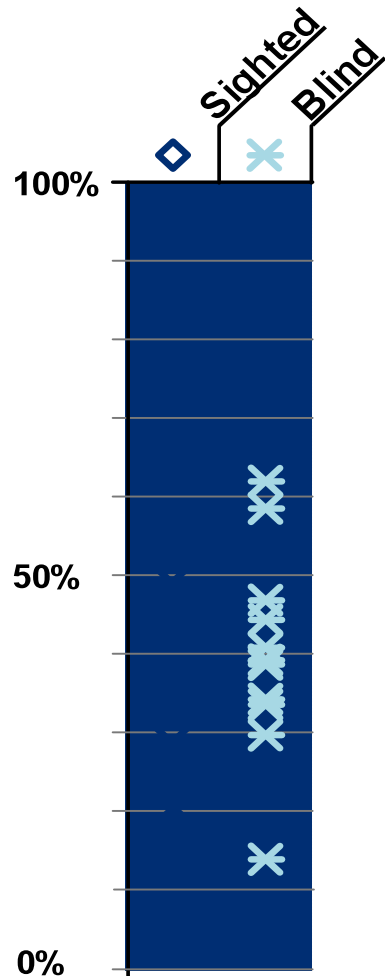
## Using Google



Task	Blind	Sighted
Entering Query	74.6 sec. ( $p < 0.01$ )	34.5 sec.
Selecting Result	155.1 sec. ( $p < 0.0001$ )	34.8 sec.



# Images & Appropriate Alt. Text



- Influenced Clicking Behavior:

## Appropriate Alternative Text

Blind	Sighted
<b>72.2%</b>	<b>34.0%</b>

(p < 0.01)

% of Images Assigned Appropriate Alternative Text on Visited Pages



## ■ Dynamic Content

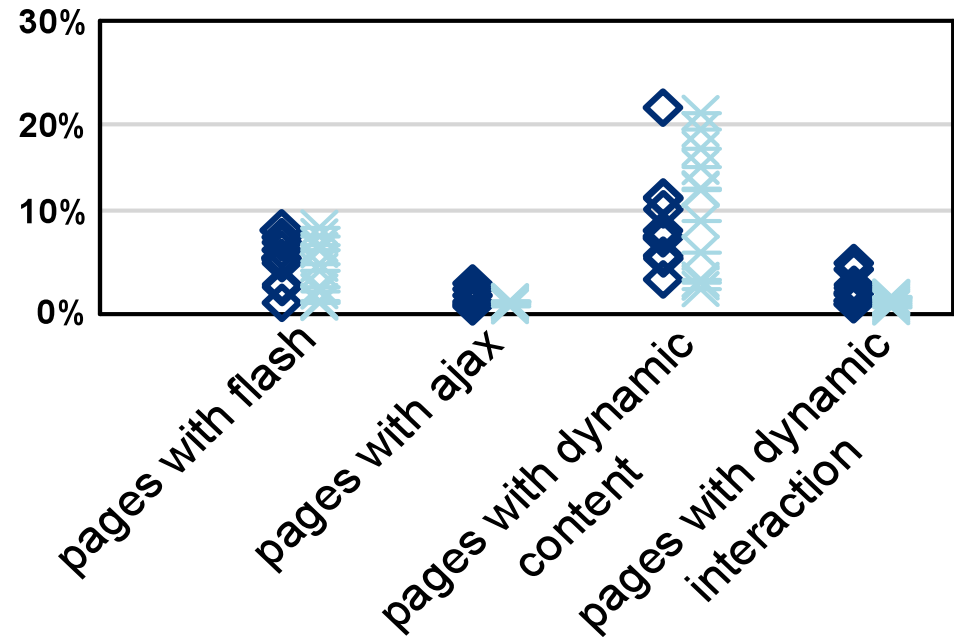
- 15.0x fewer pages viewed ( $p < 0.07$ )
- 19.3x fewer interactions with dynamic content ( $p < 0.01$ )

## ■ XMLHTTPRequest

- 7.5x fewer ( $p < 0.05$ )

## ■ Flash

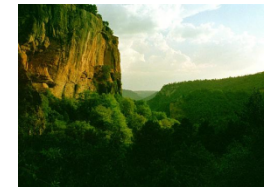
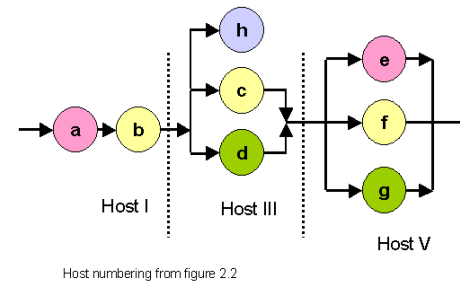
- **44.1%** were ads
- Blind participants used for sound content
- Only **5.6%** were main content





## Non-Visual Access to Images

- Images cannot be read

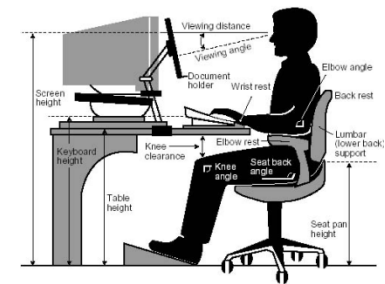


- W3C accessibility standards

- “Provide a text equivalent for every non-text element”

- What if no alternative text?

- Nothing
  - Filename (060315\_banner\_253x100.gif)
  - Link address (<http://www.cs.washington.edu>)



Association of Yale Alumni - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://www.aya.yale.edu/>

# AA ASSOCIATION OF YALE ALUMNI

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    - Lifelong Learning
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    - Yale Alumni Magazine
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    - Online Resources
    - Alumni Directory
    - Yale Career Network
    - Message Boards
    - Listservs
    - Virtual Yale Station
    - Student Programs
    - Summer Fellowship
    - Meet the AYA
    - About the AYA
    - Contact Us
    - Leadership Directory
    - Staff
    - @Yale
    - Yale Homepage
    - Giving to Yale
    - Athletics

### Yale News

#### Yale ranked among "Most Global Universities"

Newsweek magazine features an essay by President Richard C. Levin on how universities are expanding their global outreach. The Newsweek issue included a list of "The World's Most Global Universities," which ranked Yale in third place. [Click here for more.](#)

#### Margaret G. Warner '71 selected as New Alumni Fellow

PBS News Anchor Margaret Warner '71 has been elected as the New Alumni Fellow to the Yale Corporation. Warner's career in journalism spans more than three decades, during which she has covered important national and international issues for some of the country's leading news organizations. She has also served higher education institutions in several volunteer capacities. [Click here for more.](#)

#### Yale scientist honored in new stamp

is among four historic scientists honored in a new series of stamps from the U.S. Postal Service. [Click here for more.](#)

Nineteenth-century Yale researcher Josiah Willard Gibbs, who received the nation's first Ph.D. in engineering,

### Alumni News

#### Alumnus Wins 2006 Nobel Prize for Economics

Edmund S. Phelps '56 MA, '59 Ph.D., won the 2006 Nobel Prize in Economic Sciences on Monday for elucidating the relationship between unemployment and inflation. The Royal Swedish Academy of Sciences said Phelps' work has "deepened our understanding of the relation between short-run and long-run effects of economic policy." [Click here for more.](#)

#### Association of Yale Alumni Names Yale Medalists

The Yale Medal is the highest award presented by the Association of Yale Alumni, conferred to honor outstanding individual service to the University. This year's recipients are Philip G. Boyle '71; Hon. Howard M. Holtzmann '42, '47 JD; Frederick R. Mayer '50; Howard H. Newman '69, '69 MA; and Deborah Rose '72, '77 MPH, '89 PhD. [Click here for more.](#)

#### Olympian swimmer

#### AYA Launches Yale Career Network

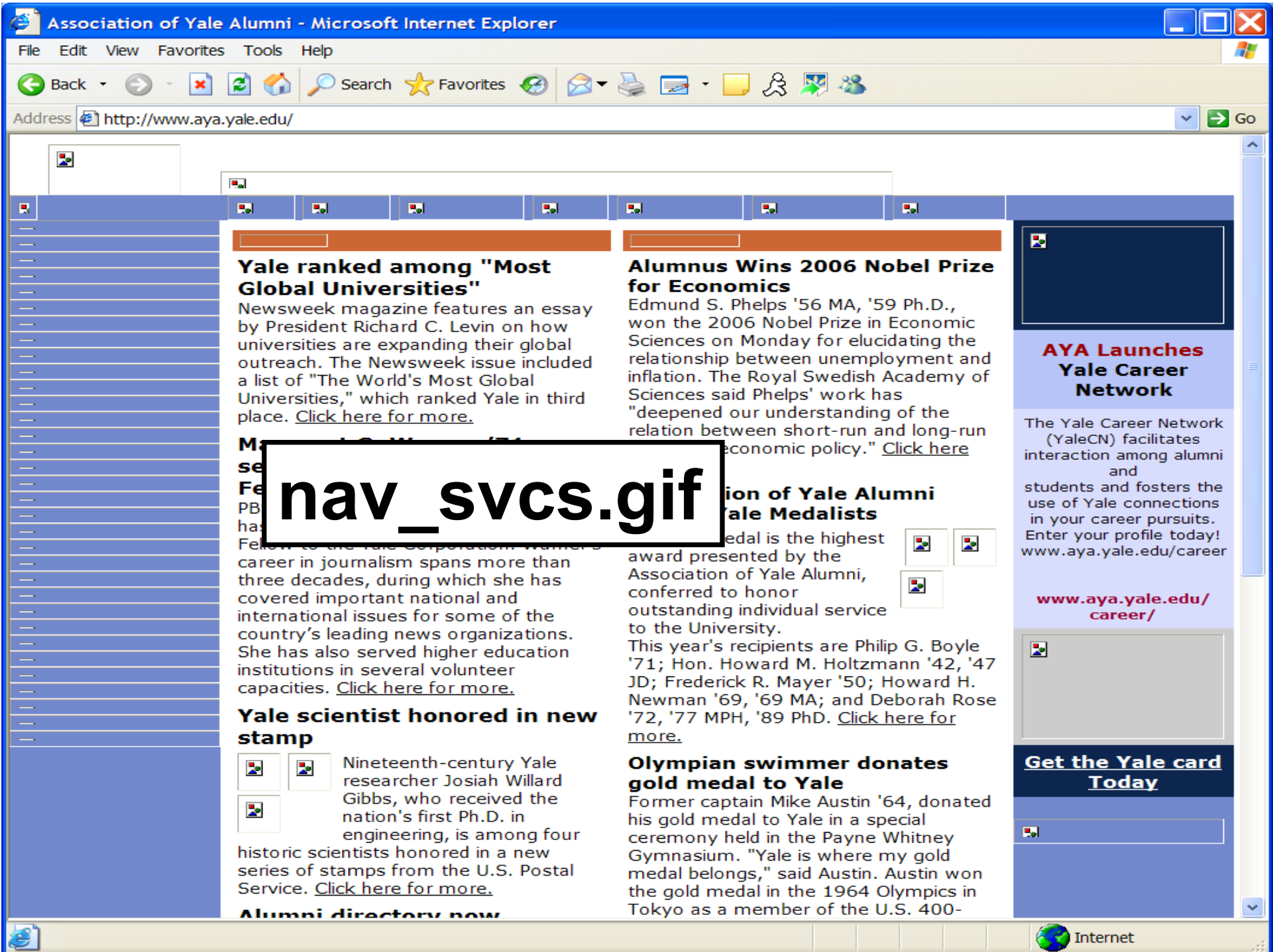
The Yale Career Network (YaleCN) facilitates interaction among alumni and fosters the use of Yale connections in your career pursuits. Enter your profile today! [www.aya.yale.edu/career](http://www.aya.yale.edu/career)

[www.aya.yale.edu/career/](http://www.aya.yale.edu/career/)

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Internet



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nav\_svcs.gif

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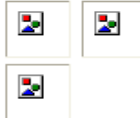
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### Olympian swimmer donates gold medal to Yale

Former captain Mike Austin '64, donated his gold medal to Yale in a special ceremony held in the Payne Whitney Gymnasium. "Yale is where my gold medal belongs," said Austin. Austin won the gold medal in the 1964 Olympics in Tokyo as a member of the U.S. 400-

### Yale scientist honored in new stamp



Nineteenth-century Yale researcher Josiah Willard Gibbs, who received the nation's first Ph.D. in engineering, is among four

historic scientists honored in a new series of stamps from the U.S. Postal Service. [Click here for more.](#)

### Alumni directory now

### AYA Launches Yale Career Network

The Yale Career Network (YaleCN) facilitates interaction among alumni and students and fosters the use of Yale connections in your career pursuits. Enter your profile today! [www.aya.yale.edu/career](http://www.aya.yale.edu/career)

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### Get the Yale card Today





# How large is the problem?



## Web Studies: All Images !=

- Significant images need alternative text

- Informative

- alt, title, and longdesc HTML attributes

```

```

- Insignificant images need empty alt text

```

```

- Automatic Determination?

- More than one color AND both dimensions > 10 pixels

- An associated action (clickable, etc.)

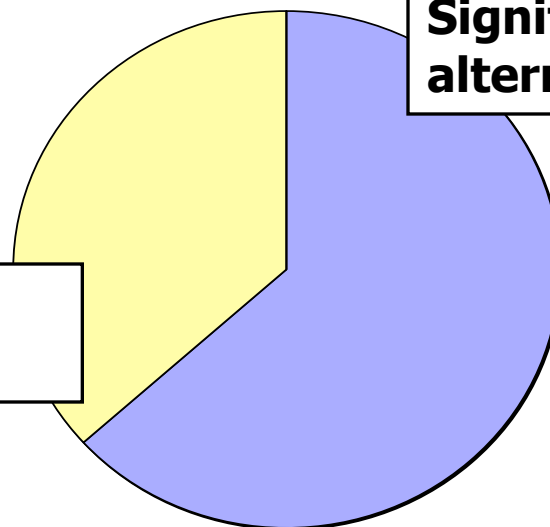


# Web Studies

- University of Washington CSE Department Traffic
  - ~1 week
  - 11,989,898 images.
  - 40.8% significant
  - 63.2% alt text

**Significant images without alternative text.**

**Significant images with alternative text.**







# Study Results

Group	Significant	Pages > 90%	Pages	Images
High-traffic	39.6%	21.8%	500	32913
Computer Science	52.5%	27.0%	158	4233
Universities	61.5%	51.5%	100	3910
U.S. Federal Agencies	74.8%	55.9%	137	5902
U.S. States	82.5%	52.9%	51	2707

Percentage of significant images provided alternative text, pages with over 90% of significant images provided alternative text, number of web sites in group, and number of images examined.



# Outline

- Introduction

- Accessibility

- **Scripting Accessibility**  
Coding Accessibility

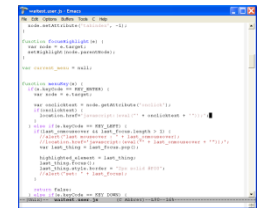
- End User Tools



# Greasemonkey<sup>1</sup>

## Firefox Extension

- Allows users to inject custom Javascript
  - Customize look and feel
  - Combine data from multiple sites
  - Alter pages to make them more accessible



[1] Greasemonkey Firefox Extension. <http://greasemonkey.mozdev.org>

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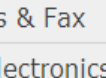
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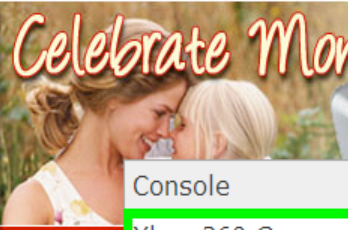
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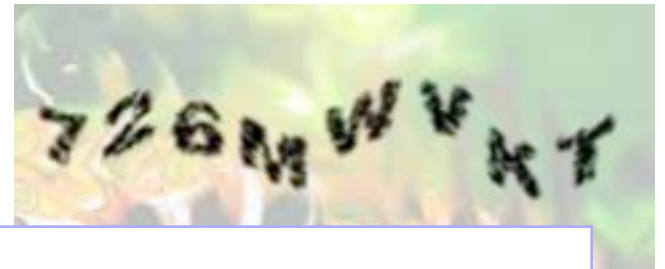


# AxsJAX

- <http://code.google.com/p/google-axsjax/>

# CAPTCHAs<sup>1</sup>

- Distorted characters
- Difficult for computers
- Humans can solve



1b.4 unsure




- Rely on visual perception
- Some groups are excluded

1. Completely Automated Public Turing Test to Tell Computers and Humans Apart

# Audio CAPTCHAs

- Same idea but with spoken characters

- CAPTCHA 1  → **S3CL92G4**

- CAPTCHA 2  → **1778223485**



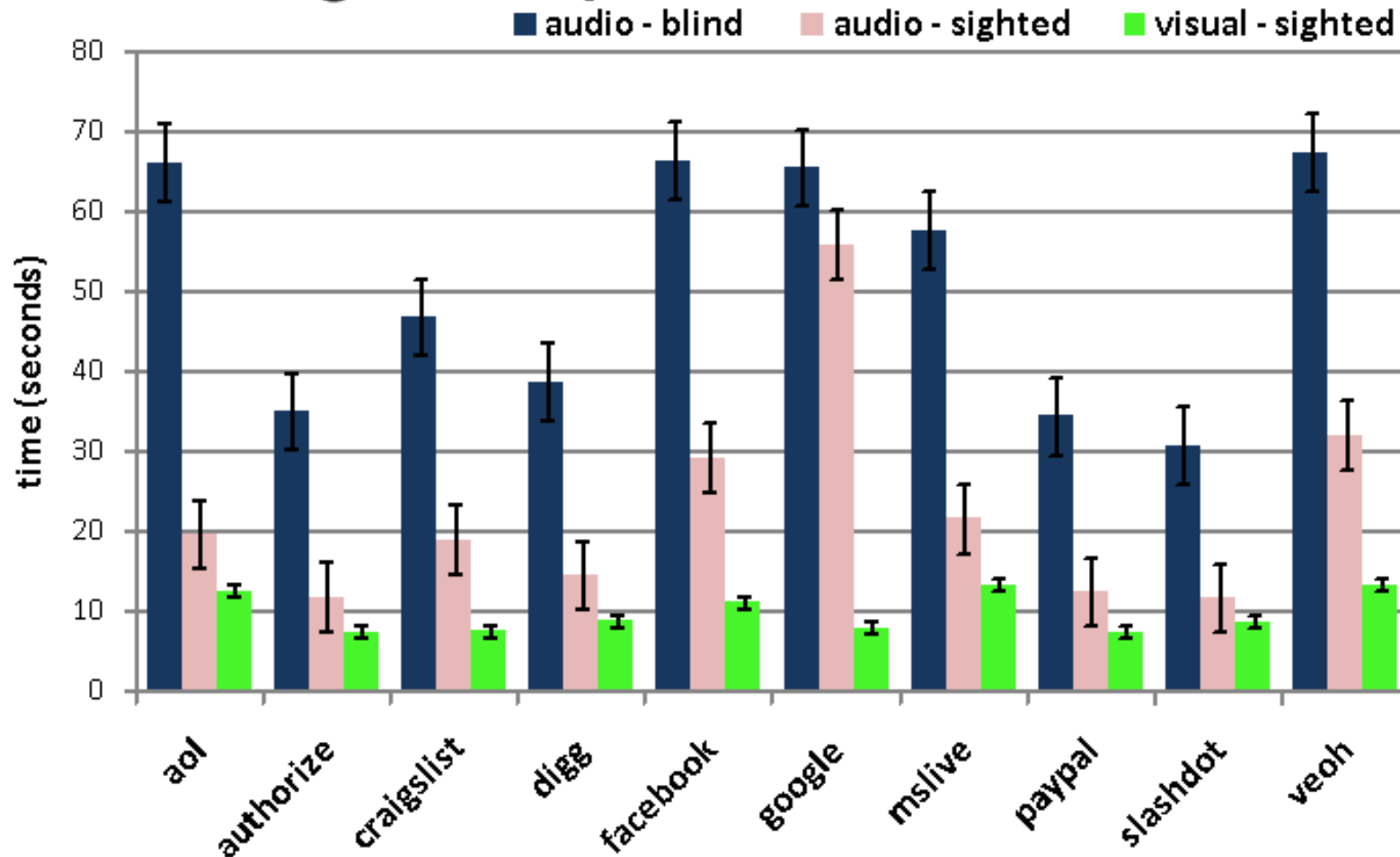


# Study Setup

- Collected 10 Examples from 10 Web Sites
  - Presented 1 from each site in random order
  
- 162 Participants
  - 89 Blind Web Users
    - Solved Audio CAPTCHAs
  - 73 Sighted Web Users
    - Solved Audio CAPTCHAs
    - Solved Visual CAPTCHAs



## Average Time per CAPTCHA

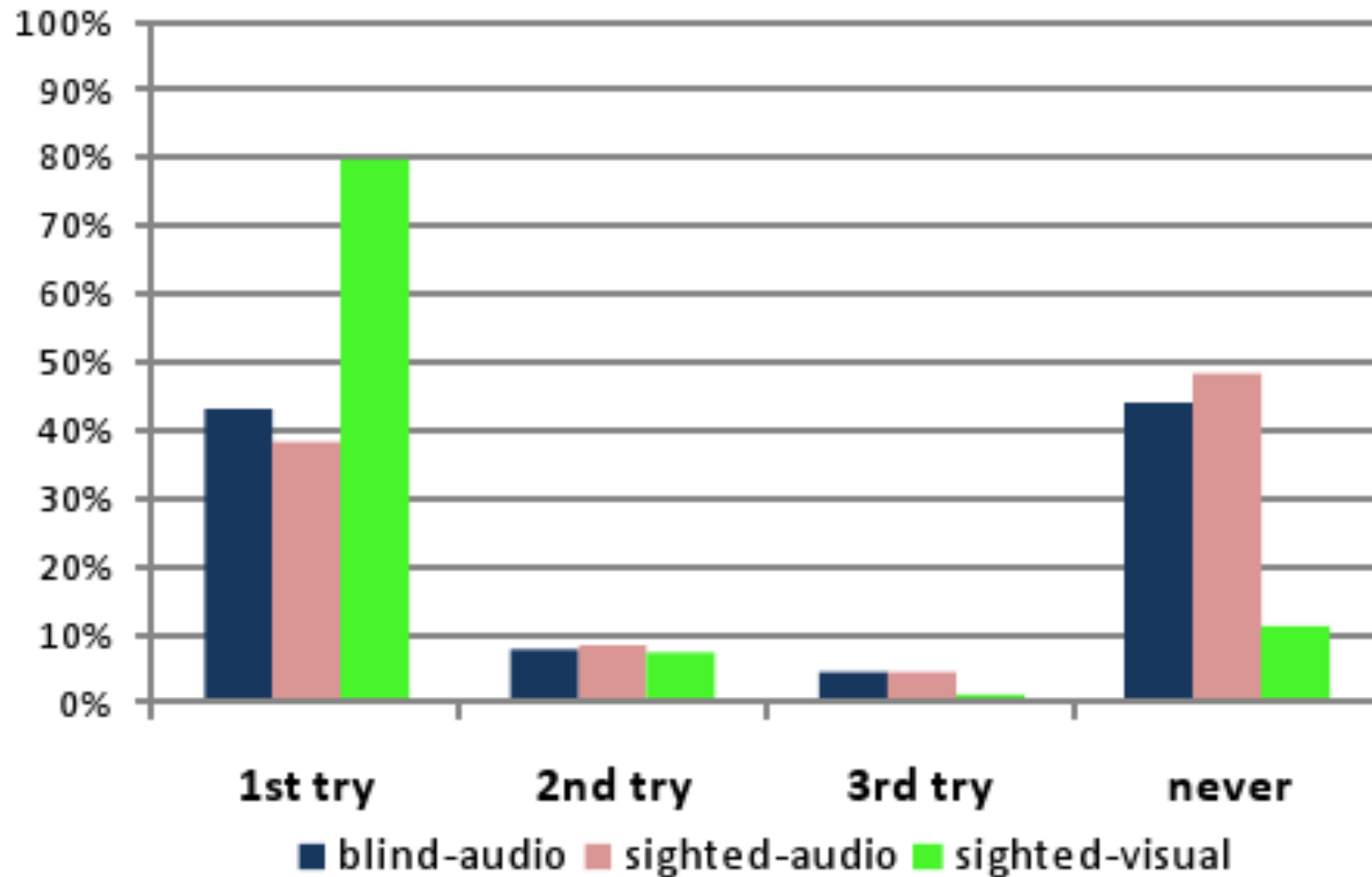


**Visual CAPTCHAs Significantly Faster than Audio CAPTCHAs**





## Percentage of CAPTCHAs answered correctly per attempt



# Interface to Solving CAPTCHAs

## Security Check

To prevent registration fraud, type the code in the image.

\*Image:



[Can't see this image?](#)

\*Code in Image:



Audio Numbers - Mozilla Firefox

<https://accountservices.passport.net/hiphelp.srf?int=reg&w>

**Type the numbers you hear**  
In the box below, type the numbers you hear, and then click Continue. The numbers you typed will appear under the picture on the page.

If you can't

**Notes:**

- Your co
- The audio file is intentionally distorted to prevent automated programs from reading it
- If the file plays in another program, remember the numbers, return to this page, and then type them in the field below.

**Play Audio**

Numbers you hear:

**Continue**

Done

**If the file plays in another program, remember the numbers, return to this page, and then type in the field below.**

hipaudio.srf (audio/wav Object) - Mozilla Firefox

<http://hip.passport.net/hipaudio.srf?int=reg&chlg=4SdMo5>

Done

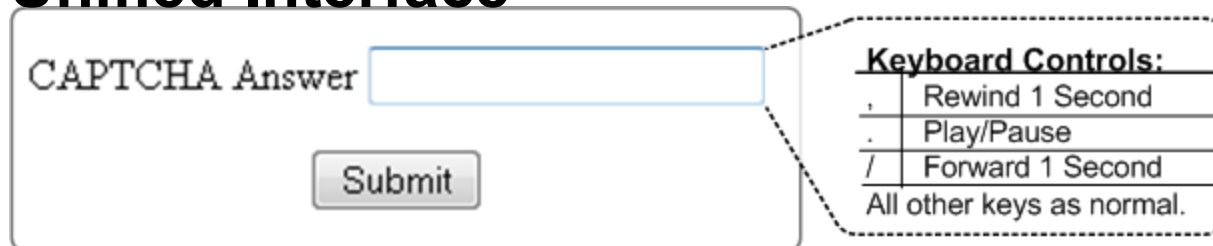


# Compared 2 Interfaces

## Original Interface



## Unified Interface





# Results

- 59% Higher Success Rate ( $p < .0001$ )
  
- Integrated Into Existing CAPTCHAs
  - Greasemonkey Script Adds to Existing Pages
  
- Lesson Applies to
  - New CAPTCHAs
  - New Techniques



# Outline

- Introduction
- Motivating Studies
- Scripting Accessibility

- **End User Tools**  
Do you need to program to improve content?

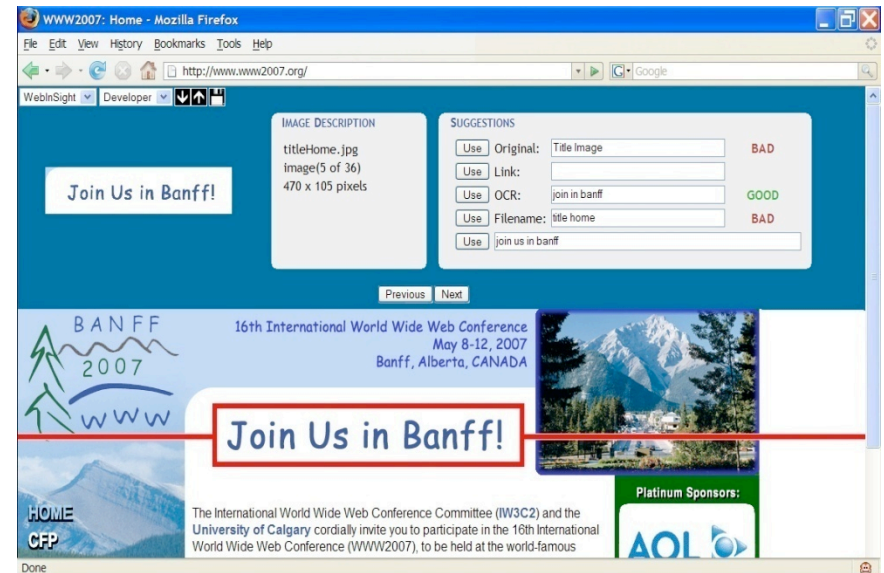


# Accessmonkey

*Scripting Accessibility*

- Preserves Greasemonkey Features
- Multiple browsers and platforms
- Framework for users and developers

- Web Developers
  - Separate Interface
  - Edit and save









# Example

- Making a Dynamic Menu Accessible
  - Adding keyboard shortcuts
  - Adding ARIA
  
- Done before screen readers supported it



# Writing Scripts

- Who can write scripts?
  - Anyone who can write Javascript
  - Those who would directly benefit (and friends)
  - Web Developers
  
- Developer interface
  - Implementations provide area
  - Allows users to toggle user/dev mode

Association of Yale Alumni - Mozilla Firefox

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http://www.aya.yale.edu/

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The ballots for this year's election of an Alumni Fellow to the Yale Corporation have been emailed and mailed out as of April 2 and all electors should have received their ballots. All graduates of the first degree of five or more years' standing and all persons who have been admitted to any degree higher than the first in the University, whether honorary or in course, may vote. Eligible electors who did not receive an official ballot may make written application to the Secretary of the University for a replacement. Information regarding the election procedure is available on the [Secretary's website](#).

You may also obtain information on the candidates, Sandy Warner '68 B.A. and Mimi Gardner Gates '81 Ph.D., by clicking on the pdf available on the [election voting website](#). **The deadline for casting your ballot is 11:59 PM, EDT, on May 27, 2007.**

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We have received reports of fraudulent letters sent to alumni asking for updated contact information. The letter contains an email address of [alumniyale@popmail.com](mailto:alumniyale@popmail.com) and is fraudulent. If you receive an email or letter of this kind, do not respond as it is not authorized by Yale. Please contact us at [AYA@yale.edu](mailto:AYA@yale.edu) if you have questions.

#### Yale Boasts Five Rhodes Scholars

Four Yale College seniors and one student in the Yale Graduate School are among the 32 Americans who will study at Oxford University next year as Rhodes Scholars. The four members of the Class of 2007 selected as Rhodes Scholars are Avi Feller, Whitney Haring-Smith, Maya Shankar and Amia P. Srinivasan. Doctoral student Aaron F. Mertz is Yale's fifth Rhodes recipient. [Click here for more.](#)

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- DVDFab Platinum
- DVDFabPlatinum3098.exe
- exodus\_0.9.1.0.exe
- festival.exe
- festival\_client.exe
- framework.jpg
- generals.ppt
- generals\_old.ppt
- google2007.ppt
- google\_news.png
- Graduate Student Self Assessment Form.doc
- heirarchy.jpg
- HSindex(2).swf
- HSindex.swf
- INGDIRECT1099TaxForm.png
- IRSForm1098-T.png
- JProbeforWindowsEXEFormat\_700(2).exe
- MiscCommands.htm
- muffin-0.9.3a.jar
- noproxy.txt

File name: index.html

Save as type:

Save Cancel

**2007**  
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Warner '68 B.A. and Mimi Gardner Gates '81 Ph.D., by clicking on the pdf available on the [election voting website](#). **The deadline for casting your ballot is 11:59 PM, EDT, on May 27, 2007.**

### Yale Podcasts Now Available

**Alumnus Wins 2006 Nobel Prize for Economics**  
Edmund S. Phelps '56 MA, '59 Ph.D., won the 2006 Nobel Prize in Economic Sciences on Monday for elucidating the relationship between unemployment and inflation. The Royal Swedish

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YALE CHASE





# More than Manual Annotation

- Removes dependence on Web Developers
  - Users independently improve content
- Collaborative Accessibility
- Harnessing Human Power
  - Amazon Mechanical Turk<sup>1</sup>
  - ESP Game<sup>2</sup>



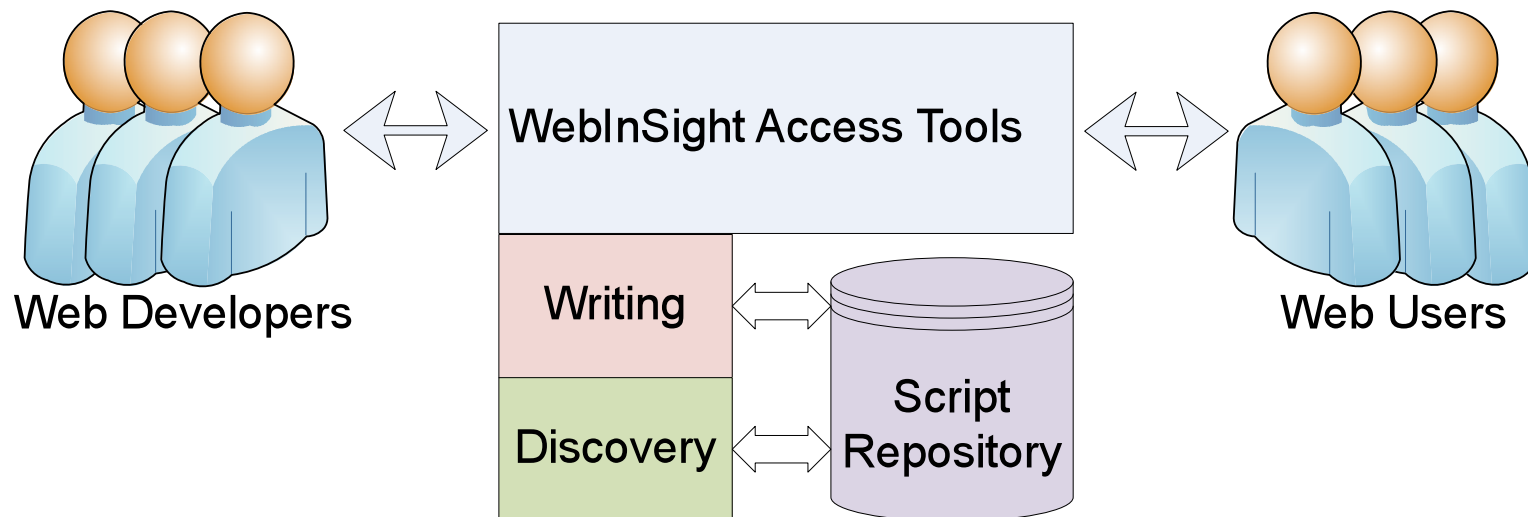
[1] <http://www.mturk.com/>

[2] von Ahn *et al.* **Labeling Image with a Computer Game.** (CHI '04).



# Next Steps

- WebInSight Access Tools
  - Script Writing
  - Script Discovery





# Easier Script Writing

- Existing tools
  - Programming-by-Demonstration
    - Web Macros<sup>1</sup>, WebVCR<sup>2</sup>, PLOW<sup>3</sup>, etc.
    - Platypus
  - Not targeted for improving accessibility
  - Visual interfaces

[1] Safonov *et al.* Web macros by example: users managing the www of applications.

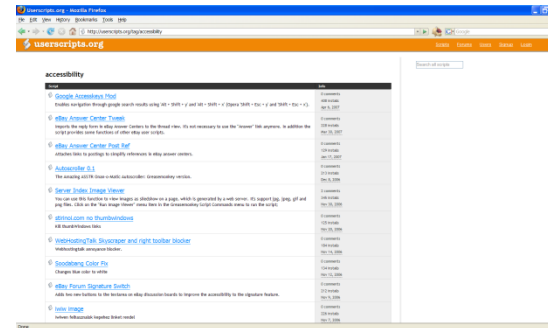
[2] Anupam *et al.* Automating web navigation with WebVCR.

[3] Jung *et al.* One-shot procedure learning from instruction and observation.



# Script Discovery

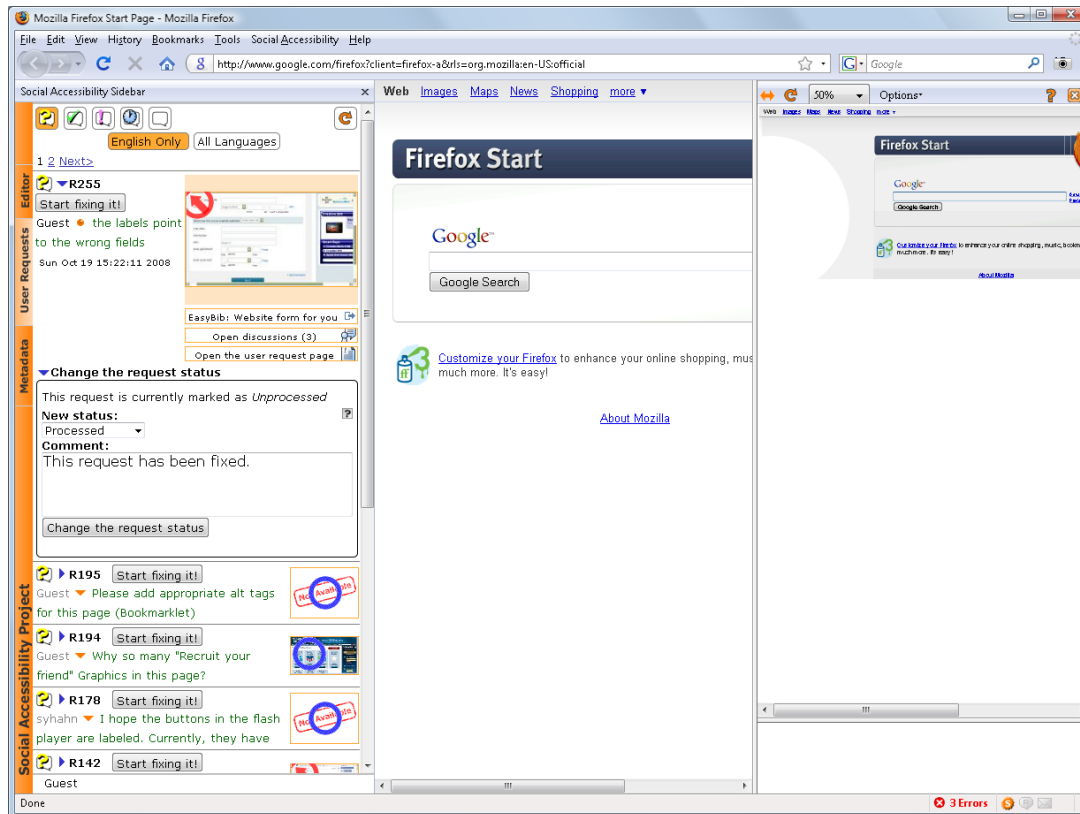
- Online Repository
  - User-contributed scripts
- Discover As-You-Go
  - Finds Applicable Scripts as a User Browses
  - Find even if you can't write
- Challenges
  - Usability
  - Maintaining Security





# IBM Social Accessibility

- <http://jp.youtube.com/watch?v=iRB72rXXyXo>





# WebVisum

- Social Tagging
- Solves CAPTCHAs
- <http://www.webvisum.com/>



# Conclusion

- Make Accessible Content
- But, it's important to have an alternative
- Combine Incentive with Ability to Change







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