

Human Computer Interaction and Eye Tracking

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Overview

- Recap of HCI lecture (+ finish HCI)
- Eye tracking
- Eye tracking and HCI
- Eye tracking and eLearning

WHAT IS HUMAN COMPUTER INTERACTION?

Some Design Principles

Partly based on Don Norman's The Design of Everyday Things, 2013

- Affordances
- Signifiers
- Mappings
- Feedback
- Constraints
- Conceptual model



Image taken from: <http://abcofdesign.com/images/coffeepot.gif>

Example

The screenshot shows a web browser window titled "HTML5 Contact Form". The page has a header "Contact Us" and a note "* Denotes Required Field". It contains four input fields: Name (John Doe), Email (john_doe@email.com), Website (http://johndoe.com), and a large Message area containing the text "Congratulations John Doe, you've completed this form!". Each field is highlighted with a green border and a green checkmark icon, indicating successful validation. A "Submit Form" button is at the bottom.

Name:	John Doe	✓
Email:	john_doe@email.com	✓
Website:	http://johndoe.com	✓
Message:	Congratulations John Doe, you've completed this form!	

Submit Form

User centred design

- System centred design
 - Functionality driven
 - Emphasis on correct system
 - No consideration to the user
- User centred design
 - Emphasis on the end user tasks
 - Usability considered
 - Highly iterative

MOST END-USERS ARE NOT
COMPUTER SCIENTISTS!

Usability

- Definitions :
 - “a measure of the **ease** with which a system can be learned and **used**, its **safety**, **effectiveness** and **efficiency**, and **attitude** of its users towards it”
(Preece et al., 1994)
 - “the extent to which a product can be used by specified users to achieve specified goals with **effectiveness**, **efficiency** and **satisfaction** in a specified context of use”
(ISO 9241-11)

Testing usability



Image taken from: <http://jennycham.co.uk/wp-content/uploads/2011/08/200911221250225481-292x300.jpg>

Measuring usability

- What are good metrics?
- Qualitative
 - Ask users
- Quantitative
 - Error rate
 - Speed

Iterative cycle of Human Centred Design

1. Observation
2. Generate ideas
3. Prototyping
4. Testing
5. Start again...

Observation

- How you get more accurate requirements!
- Often the people who commission for something to be made are not the end users
- Actually see how the user base performs the task
 - Find the true needs, motives, interests

Idea generation



Image taken from: <http://www.presentable.es/wp-content/uploads/2013/01/post-it-wall.jpg>

Prototyping

- Very useful for checking your requirements
- Can be quick and rudimentary
 - Pencil sketch, spreadsheet, PowerPoint slides, cardboard or foam models, Lego,...
- Wizard of OZ trials



Image taken from:

<http://tse2.mm.bing.net/th?id=OIP.M70befa61e79454592a39ed590ebbea1eo0&pid=15.1>

Testing

- Get people to try out the solution
- Gather quantitative and qualitative data
- How good were your requirements?

Now START AGAIN!!

What is HCI?

- Understand how humans interact with technology
- Ensuring the needs of people are met
- Creating understandable and usable products

WHAT IS EYE TRACKING?

Eye tracking overview

- Specialty equipment
- Measuring the point of gaze
- Measures what humans look at and for how long

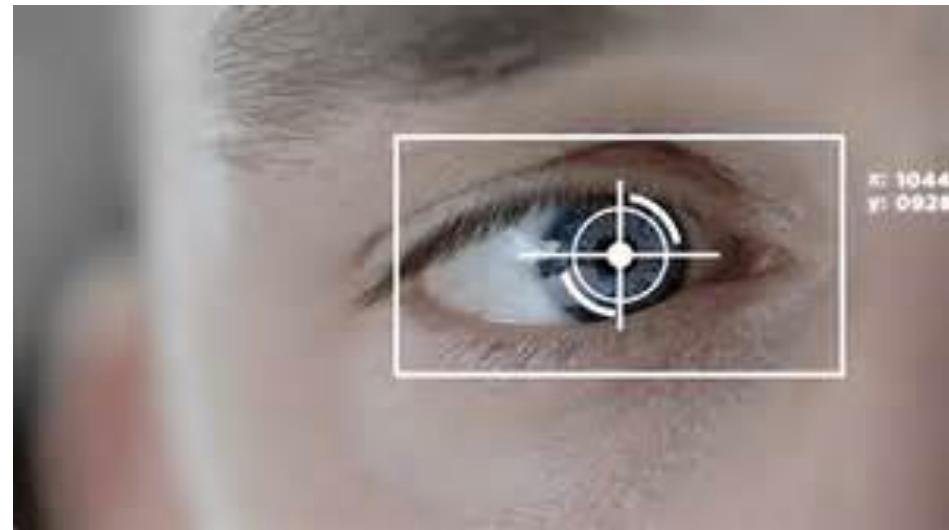
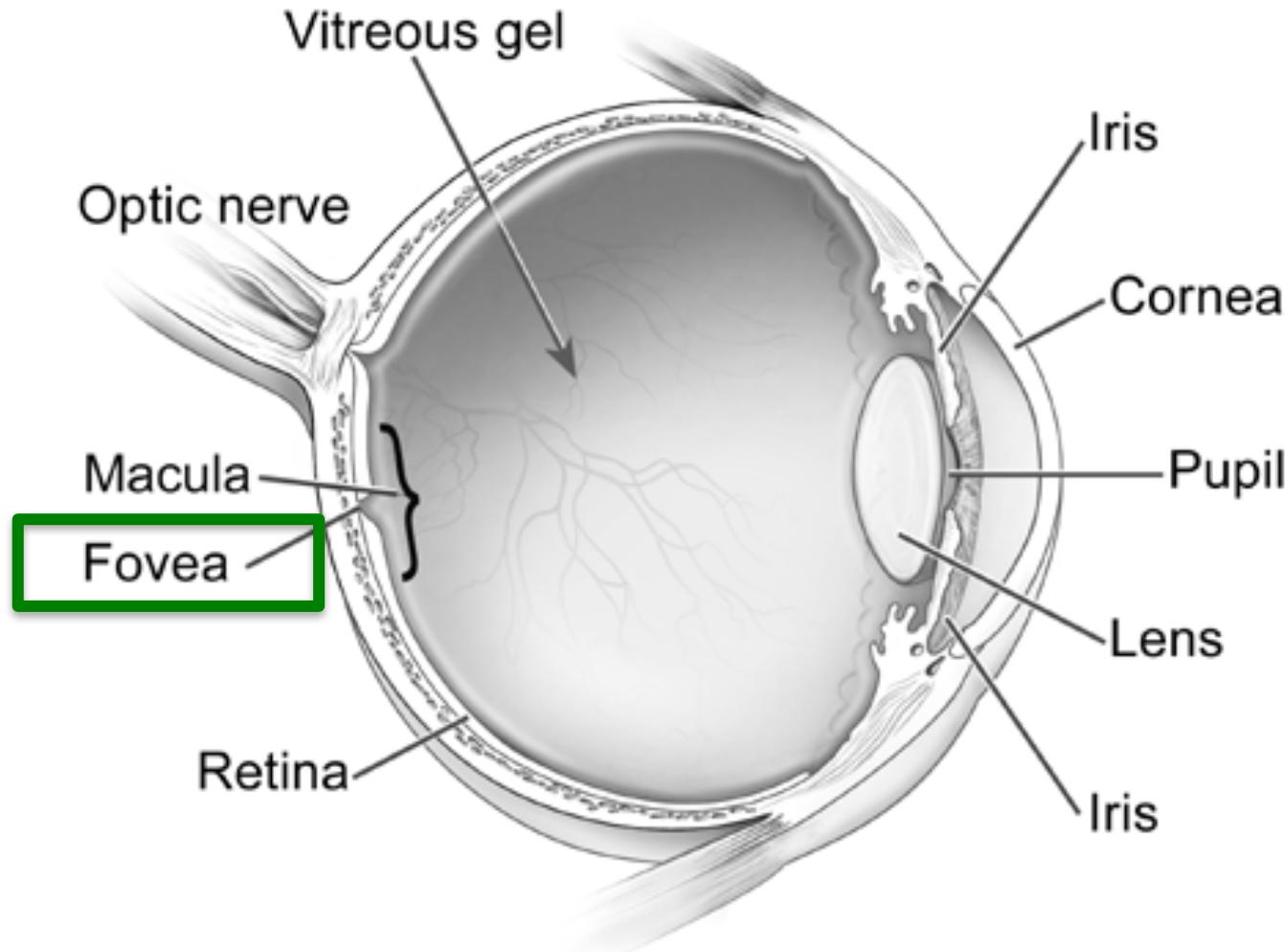


Image taken from: <http://technologyadvice.com/wp-content/uploads/2014/03/Eye-Tribe-Eye-Photo.png>

The anatomy of the eye



How much do we really see?

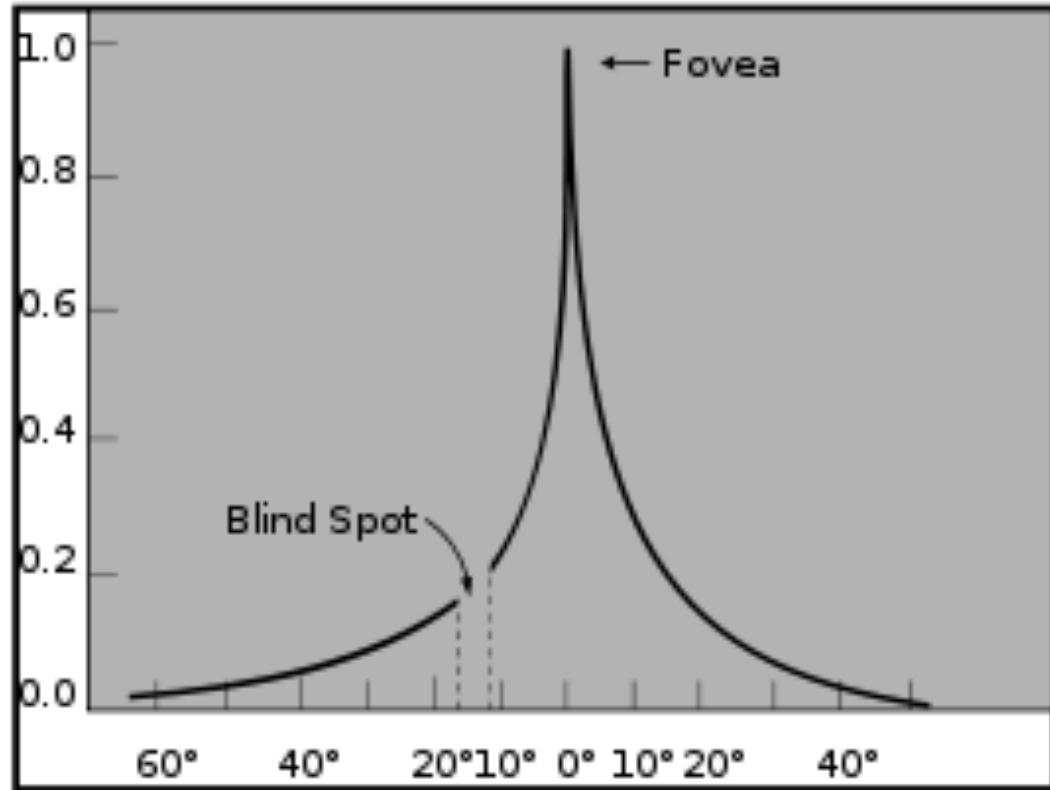


Image taken from:

https://en.wikipedia.org/wiki/Fovea_centralis

Image taken from EAGLEMAN, D. 2011.

Incognito: The secret lives of the brain, New York, Vintage Books. Page 26.

The
illusion of
of "seeing"

The first eye trackers

- The first “eye tracker” was Louis Emile Javal in 1879
 - Direct observation
- Edmund Huey developed one of the first eye trackers in the early 1900’s
 - Contact lens based
 - Acted as a pointer
- Both for reading analysis!

Eye trackers

- Capture where the eye is looking
- Contact lens based
- Infrared video based
- Electric potential measurement

Infrared video-based tracking

- Non-intrusive
- Measures eye rotation
- Uses IR-light (invisible to human eye)
 - causes bright or dark pupil, which helps the system to recognize pupil from video image
- The two features of eye are tracked used to track the eye and calculate eye rotation
 - corneal reflection
 - pupil
 - can use more features



Common set up

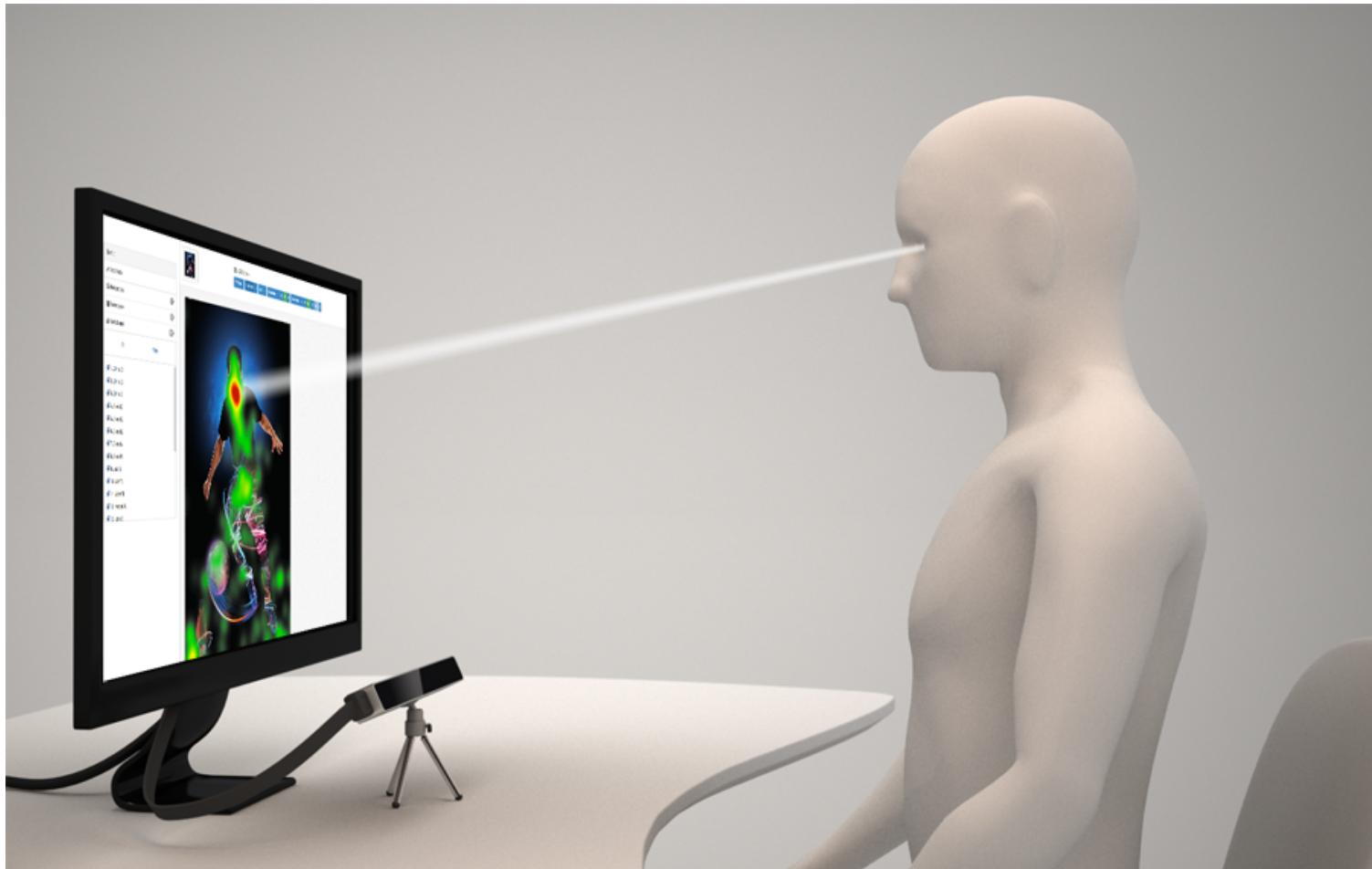
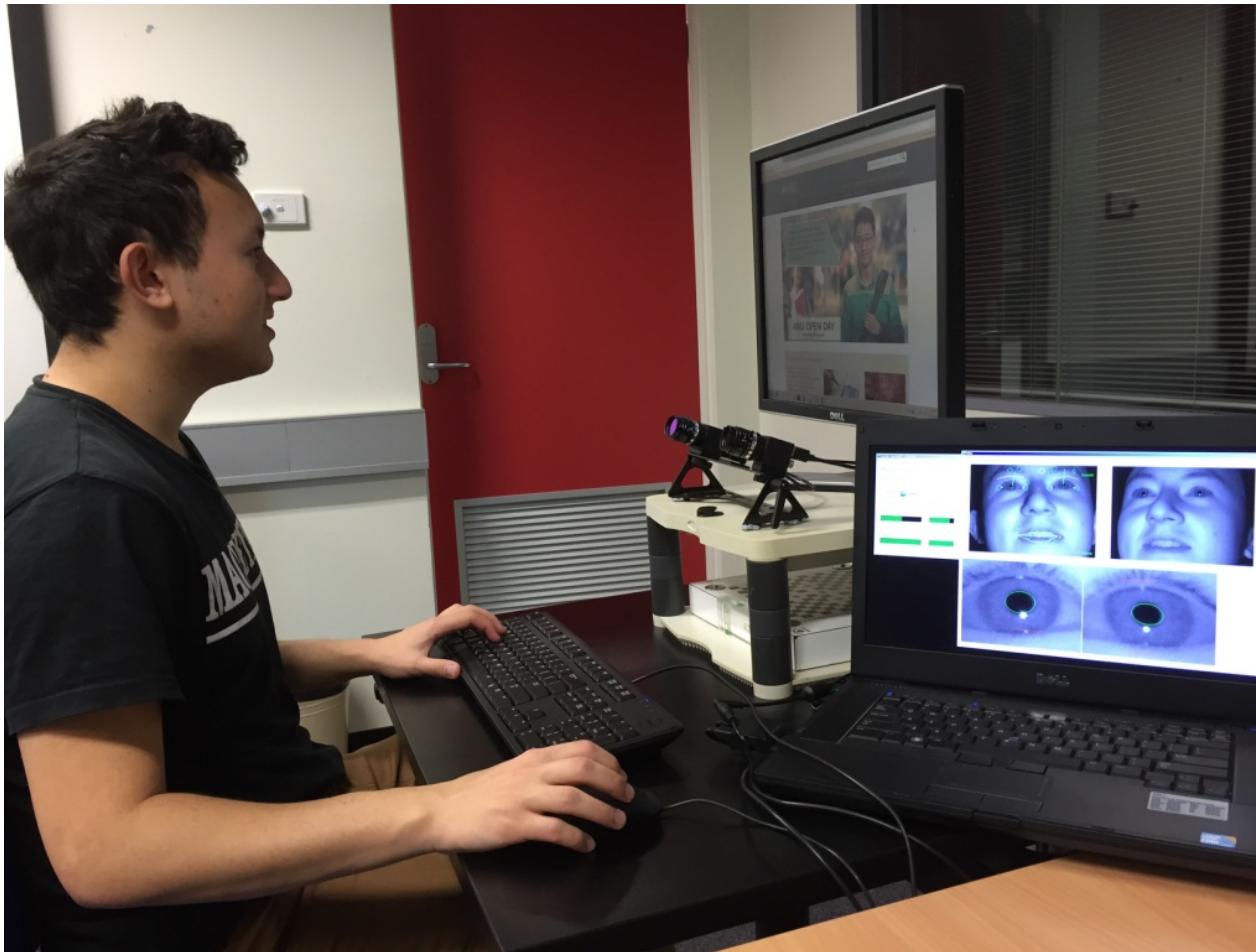


Image taken from: <http://theeyetribe.com>

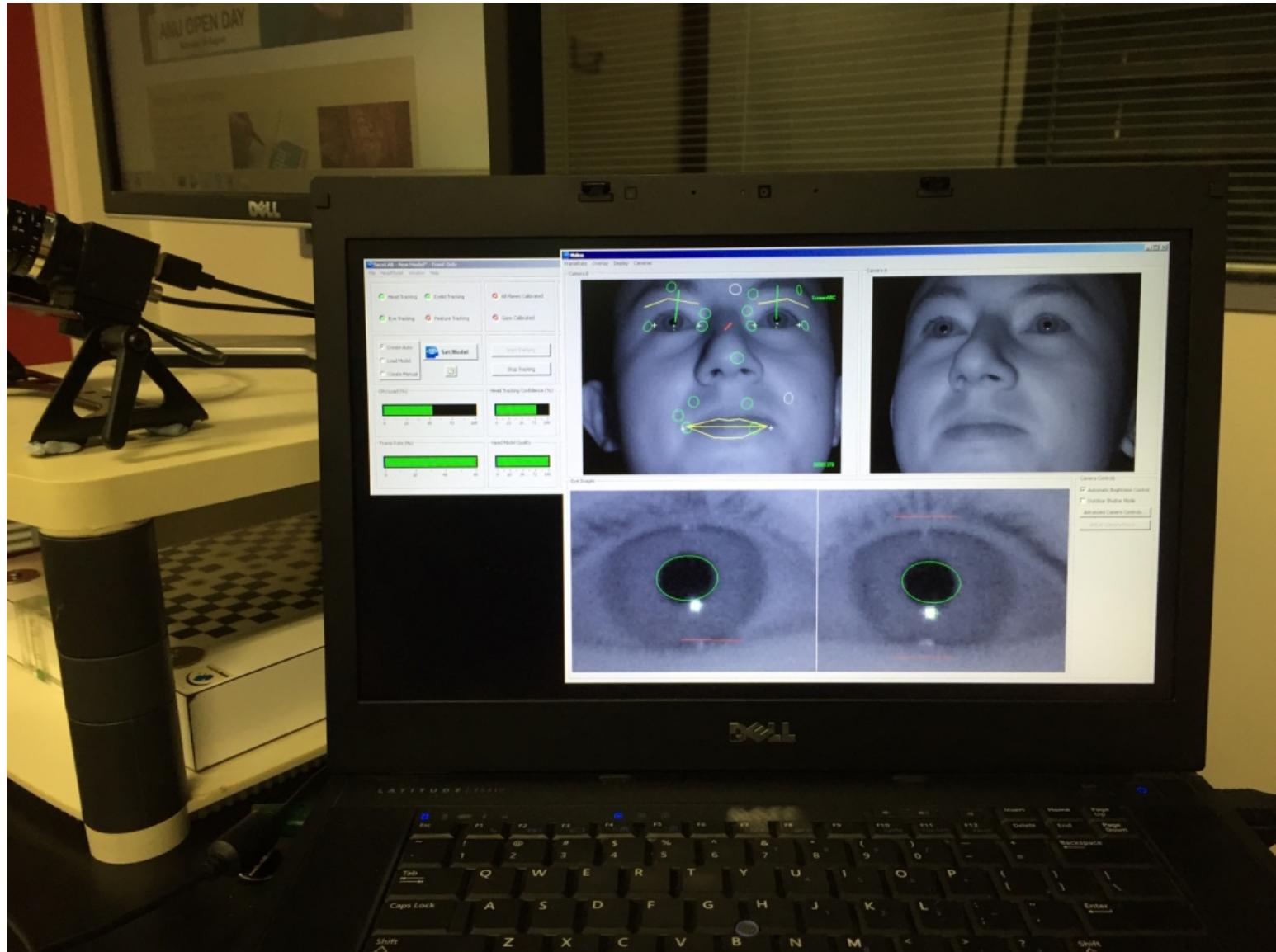
Seeing Machines faceLAB 5



Experiment setup



Experimenter view



EyeTribe



Calibration sequence

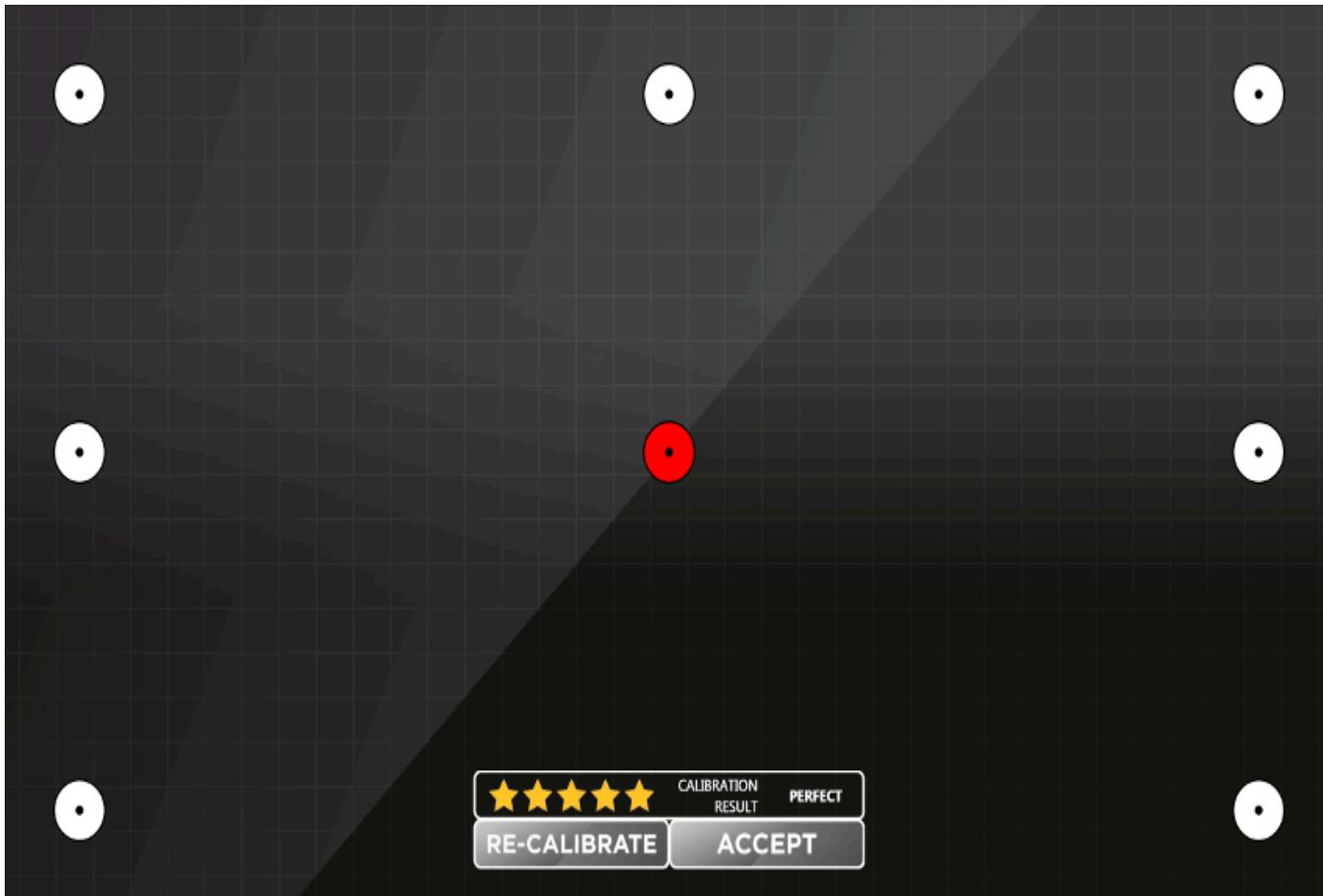


Image taken from: <http://dev.theeyetribe.com/general/>

Wearable eye trackers



Image taken from:

<http://tse4.mm.bing.net/th?id=OIP.M0030072cc47b0571764bb7f432c83902H0&pid=15.1>

Considerations

- Spatial Resolution
 - measurable change in eye position
- Accuracy
 - Typically 0.5-1 deg
- Temporal Resolution (sampling rate)
 - Number of recorded eye positions per second

Fixation identification

- Turn the signal into meaningful data
 - Fixations and saccades

Remember: fixations are when visual information is taken in!

- Spatial vs temporal algorithms

Presentation of eye tracking data

- Replay
- Static representation
- Heat maps
 - Blind zone maps



Reading analysis

- 1800's - Javal observed that reading was not smooth
- Beginning of reading analysis:
 - Which words does the eyes stop on?
 - How long does the eye stop?
 - When does the eye move back to already read word?
- 1970's – resurgence in eye tracking because of reading analysis

Reading analysis

- Eye movements were used to study how we read
- Models for generation of eye movements made to help understand:
 - how and why the eye moves
 - the cognitive processes involved in reading

Analysing reading behaviour

Regression

When a person is reading a sentence silently, the eye movements show that not every word is fixated. Every once in a while a regression (an eye movement that goes back in the text) is made to re-examine a word that may have not been fully understood the first time. This only happens with about 10% of the fixations, depending on how difficult the text is. The more difficult the higher the likelihood that regressions are made.

Fixation

Saccade

Reading and the fovea

during a saccade because the eyes are moving so
*

Normal Text

XXXXXX X XXXcade because the XXXX XXX XXXXXX XX
*

Moving Window

XXXXXX X XXXXXXXX XXXXXse the eyes are mXXXXX XX
*

during a saccade XXXXXXXX the eyes are moving so
*

Foveal Mask

during a saccade becausXXXXXXyes are moving so
*

during a saccade because the dogs are moving so
*

Boundary

during a saccade because the eyes are moving so
*

Image taken from (Rayner, 1998) examples of the moving window paradigm

Eye movements during reading

- Many words are not fixated
 - Content words are fixated about 85% of the time
 - Function words are fixated about 35% of the time
 - Frequency and predictability
- As word length increases, probability of fixation increases
 - 2-3 letter words are only fixated about 25% of the time
- Many other factors affect eye movements:
 - Typographical variables, line length, line spacing, print size and...

Eye movements & comprehension

- used to infer on-going cognitive processes that occur during reading
 - Processing difficulty influences eye movements
- reflect comprehension processes and failures
 - “*The old man the boat*”.
 - Lexical, phonological, syntactic ambiguity; anaphora & coreference; semantic relationships; etc.
- reflect text difficulty
 - Increased number of regressions and longer fixations observed as text difficulty increases

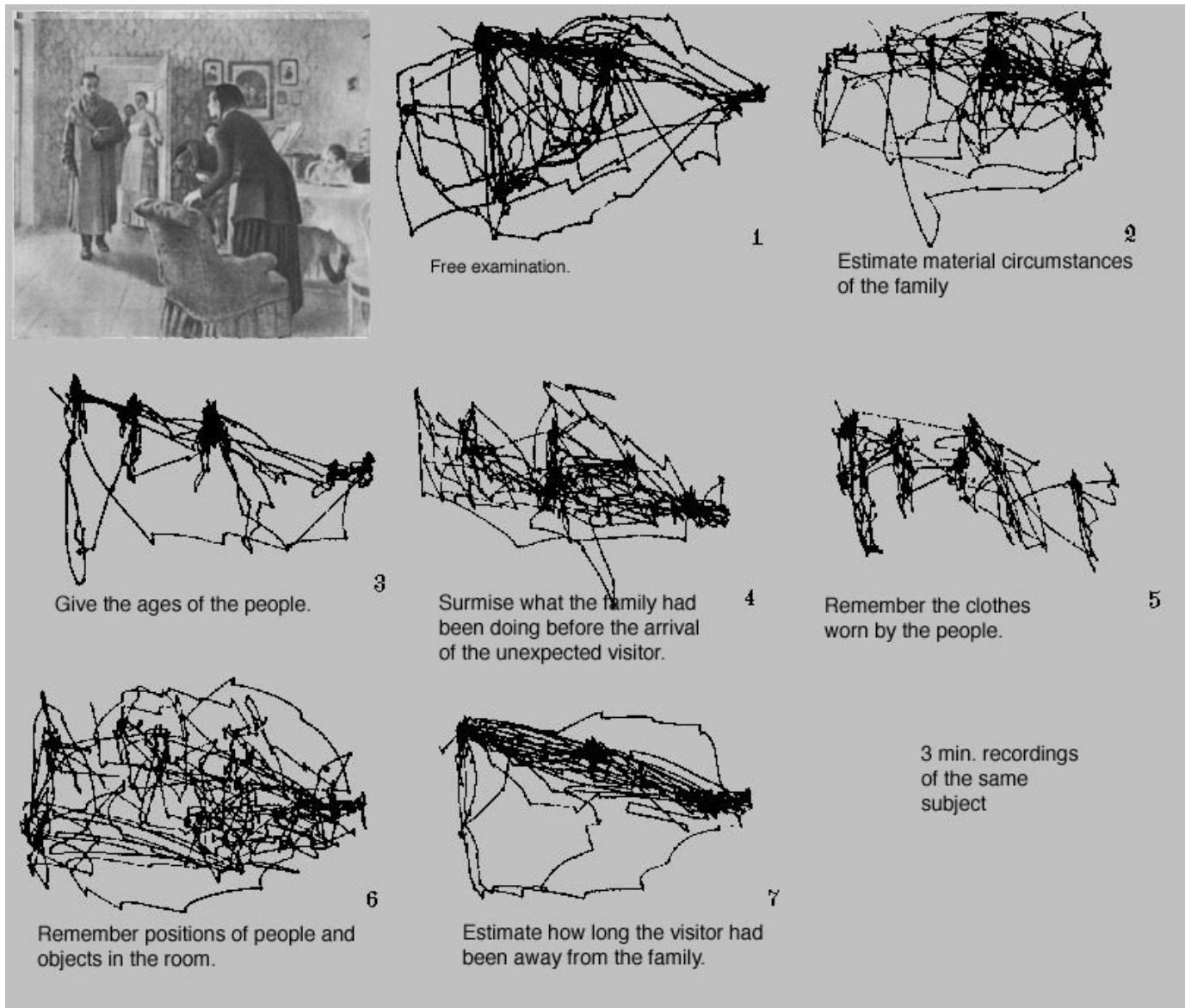
Scene perception

- Yarbus, in the 1960's, showed that an eye gaze was dependent upon the question they were asked

The visitor



The visitor



How Does Eye Tracking And HCI Fit Together?

Overview

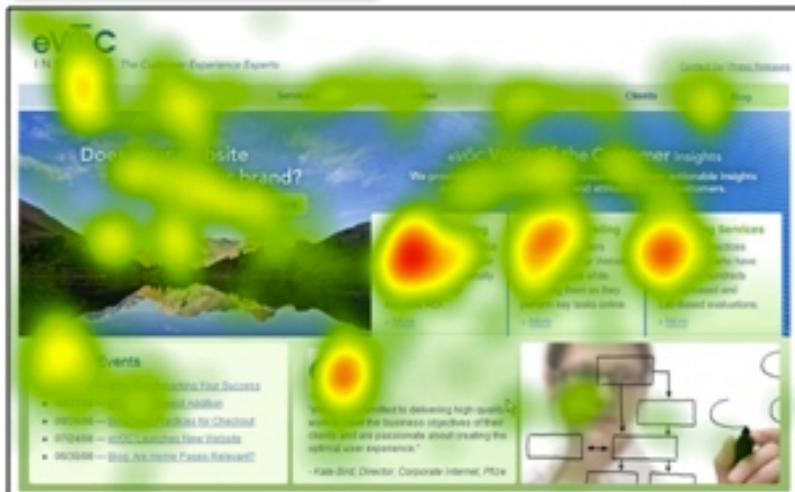
- Usability testing (and research into interfaces)
- Input
- Intelligent interfaces

Usability testing

- Eye tracking is useful for interface design and usability testing
 - Eye gaze shows attention and visual processing trail
 - Observe where people look in the interface
 - Do they look in the right areas? Do they ignore areas?
 - Under different situations where do they look?

Website example

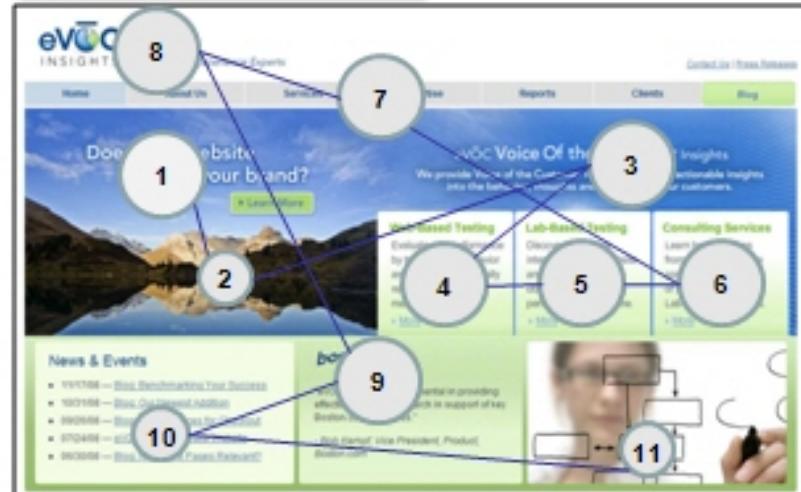
Aggregated Heat Map



Intensity of Viewers
Low → High

Sample	12
Time of Snapshot	20 sec

Chronological Gaze Plot



of Viewers Per Area
Low → High

Sample	12
Avg. Time on Page	20 sec

Image taken from: http://www.evocinsights.com/img/eVOC_Eye_Tracking_Data.jpg

Web search example

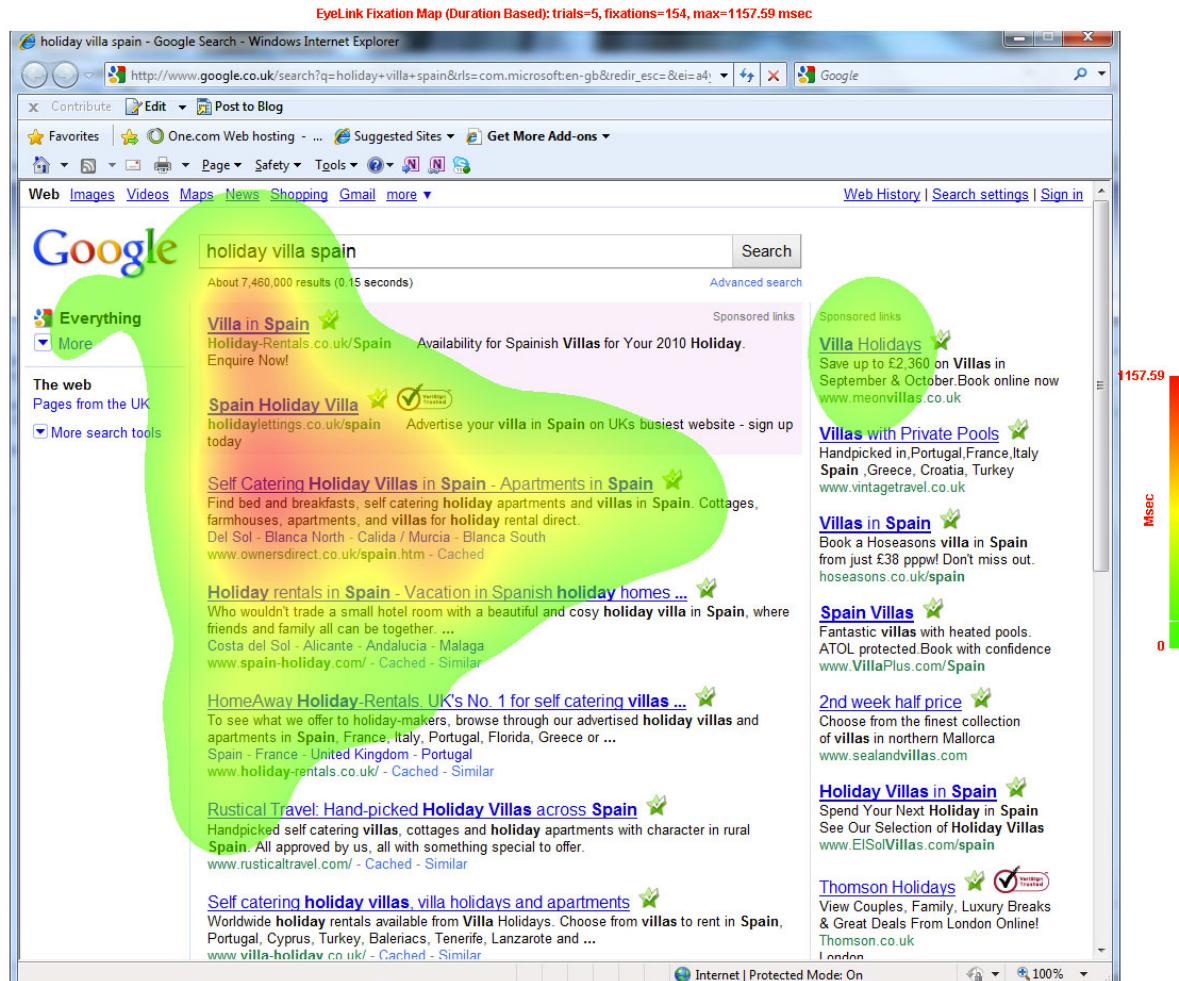


Image taken from: <http://www.website-design.it/wp-content/uploads/2012/08/Eye-tracking-Google-Image-by-University-of-Bournemouth.jpg>

Eye gaze as an input

- Target acquisition usually requires the user to look at the target first before actuating the cursor control
- Facilitates hands free operation
- natural, little conscious effort
- Can resolve RSI problems (repetitive stress injury)

Examples

- Keyboard (Salvucci and Anderson, 2001, Lankford, 2000)
- Clicking device (Murata, 2006, Lankford, 2000)

Pros & cons

- Pros
 - Fast and natural
 - The user most likely have to look at a visual stimuli, such as a button, anyway
- Cons
 - Over-response: “Midas Touch”
 - Under-response

Eye tracking on phones

- Samsung's Smart Scroll
- Amazon Fire Phone's stereoscopic view

Gaming

- Use eye gaze in gaming to (Isokoski et al., 2009):
 - dynamic rendering, added realism, control input, and therapeutic use
 - to create realism
 - more interaction

Intelligent Interfaces

- Indirect input + usability
- Interfaces that use the implicit information from eye tracking to
 - adapt to the user

“Rather than creating systems that see, think, and act as people do, we focus on expanding and augmenting people's capabilities”

~ Abigail Sellen,
Microsoft Research

Task Identification

- Task identification (Iqbal and Bailey, 2004, Salojarvi et al., 2005, Simola et al., 2008)
- Detect reading (Campbell and Maglio, 2001).
 - Detect reading and skimming (Buscher et al., 2008)

Examples

- Attention Assistant (Campbell & Maglio, 2003)
- Attentive Documents (Buscher et al., 2012)
 - Annotation of areas of text that are considered most important based on eye gaze
- Reading assistance
 - iDict (Hyrskykari et al., 2000)
 - The Reading Assistant (Sibert et al., 2000)

EYE TRACKING AND ELEARNING

Can eye tracking be used to support reading in eLearning?

- eLearning is becoming ubiquitous
 - Moodle, Blackboard, etc.
 - MOOCs
- Static, one size fits all
- but everyone is different!
 - Adaptive eLearning

Adaptive eLearning

- Predict the users state and dynamically change the environment to suit it
 - measured skill level (Chen, 2008)
 - learner style (Surjono, 2014, Mehigan et al., 2011, Spada et al., 2008)

Adaption methods

- User input
 - Questionnaires
 - Responses
- Biometric data
 - Mouse movements
 - Physiological signals (GSR, ECG, EEG)
 - Eye tracking!

Examples

- AdeLE (Adaptive e-Learning with Eye-Tracking) is (Gütl et al., 2005)
- e5Learning (enhanced exploitation of eyes for effective eLearning)
 - uses eye gaze metrics to identify the students' emotional state (Calvi et al., 2008).
- Gaze Tutor
 - uses eye gaze to determine the user's level of stimulation to alter the environment to stimulate the user (D'Mello et al., 2012)

Text based learning

- Use eye gaze to dynamically change the text based on
 - Reading behaviour
 - Comprehension
- Provide feedback
 - Student learning behaviour
 - How good the materials are

User study

- Tutorial in ANU eLearning environment, called Wattle
- Try different presentations
 - Is one better than another?
 - Can we predict reading comprehension?

What is Wattle?

The screenshot shows the Australian National University's Wattle course site for COMP1710 - Web Development and Design - Sem 1 2013 copy 1. The page includes a navigation bar, a sidebar with important information like course availability and a calendar, and a main content area with course details, forums, and links to other university resources.

Navigation

Australian National University

Wattle > My courses

You are logged in as **Leana Copeland** ([Logout](#)) | English (en)

Important Wattle Information

Wattle Course site availability

Wattle course sites are generally released to students **one week** before teaching commences.

If your course site does not appear when you log in:

- Check ISIS – note that ISIS indicates your official enrolments.
- Wait a day – new enrolments will have Wattle access one full working day after the enrolment is completed in ISIS.
- Check with your lecturer – some sites are released earlier or later than the standard date.

Calendar

April 2015

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Wattle Support

COMP1710 - Web Development and Design - Sem 1 2013 copy 1

Weeks/Topics: 0 updated (13 total)	Semester 1, 2013
Quizzes: 0 updated (2 total)	
Files: 0 updated (10 total)	

College of Engineering & Computer Science (CECS) / Community Site

COMP4660/COMP8420 - Bio-inspired Computing: Applications and Interfaces - Sem 1 2013

Weeks/Topics: 0 updated (13 total)	Semester 1, 2013
Assignments (2,2): 0 updated (3 total)	
Forum posts: 0 updated (6 total)	
Quizzes: 0 updated (3 total)	
Files: 0 updated (48 total)	

Computer Science Student Portal 2014

Weeks/Topics: 1 updated (1 total)	The new portal for Computer Science students.
Assignments (2,2): 1 updated (1 total)	
Forum posts: 71 updated (71 total)	

Engineering Undergraduate Program Portal

Weeks/Topics: 1 updated (4 total)	COURSE ADVICE APPOINTMENTS
Assignments (2,2): 1 updated (1 total)	Please contact Jasmine.Nikolic@anu.edu.au
Forum posts: 38 updated (38 total)	

Teaching Quality Program - CECS Tutors

Weeks/Topics: 1 updated (20 total)	CECS Tutors website
Forum posts: 3 updated (33 total)	

College of Engineering & Computer Science (CECS) / Semester 1, 2015

COMP1710/COMP6780 - Web Development and Design - Sem 1 2015

Weeks/Topics: 0 updated (22 total)	Tom's Wattle site for COMP1710/COMP6780
Quizzes: 0 updated (8 total)	

Help with Wattle

- Wattle Introduction Guide for Lecturers
- Wattle Guide for Students
- Wattle Support via IT Service Desk or phone (02) 612 54321, select option 1, 5 Mon-Fri: 9am-5pm
- Moodle After-hours support Phone 1300 544 894 Mon-Fri: 5pm-10pm Sat-Sun: 9am-5pm
- Teaching Innovations, Practices, Information and Tools (TIPIT)

Resources

- Timetable
- Programs and Courses
- ANU Email
- ISIS
- Library
- Help with your studies:
 - ASLC
 - ILP
- Health and Wellbeing:
 - Health
 - Counselling
 - Dean of Students
 - Student Life
- ANU Policies
- Student F

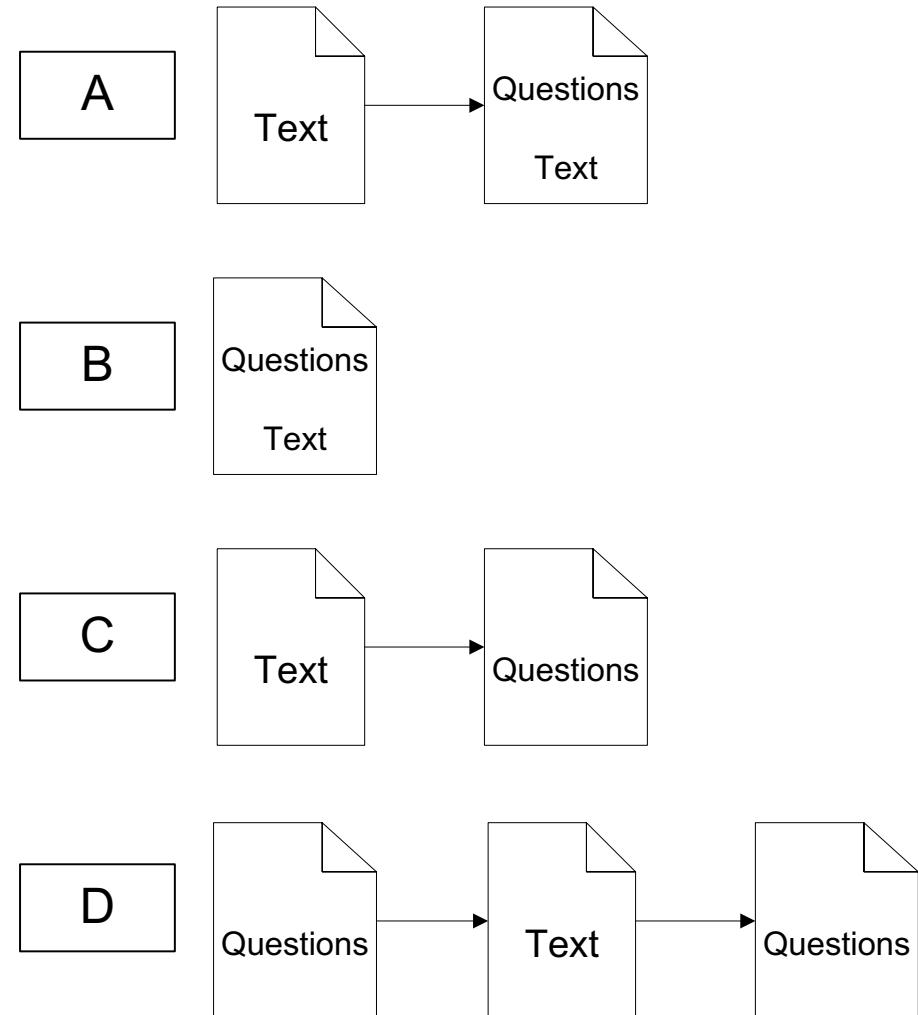
New messages (4)

Go to messages ignore

Copyright - for

User Study

- Between-subjects design
 - Each participant shown 1 of 4 presentation sequences →
- Two questions per text page:
 - Multiple-choice
 - cloze



Example of reading behaviour for text only page

Format A

The World Wide Web

The World Wide Web (WWW), often commonly known as the Web, is a widely used information system that enables locating and viewing of a variety of multimedia based files including text documents, audio, visual and graphic files.

Sir Tim Berners-Lee wrote a proposal in 1989 based on earlier concepts of hypertext systems for what eventually became the Web. It was Berners-Lee who built the first web browser, web server and web pages, which are the main components of the Web, and he is now the Director of the Web Consortium (W3C) which is the main international standards organization for the Web.

The Web is essentially a big graph made up of billions of web pages and hyperlinks. A Web page is a document or information that can be viewed using a web browser. Web pages can contain content such as text, images, videos, audio, as well as hyperlinks which enable navigation to other Web pages. Web pages are generally formatted in HyperText Markup Language (HTML). HTML provides the ability to embed images, create interactive forms, and a means of structuring documents [2]. Readings, paragraphs, lists, links, and so on. Although some formatting and presentation of information can be handled by HTML, it is generally the Cascading Style Sheets (CSS) that are used to define the appearance and layout of the web pages.

Scripts can be embedded into HTML that affect the behaviour of a Web page. This allows the content of Web pages to be dynamically generated. These are termed dynamic Web pages and refer to Web content that is based on user input. Examples of these types of Web pages are on websites for flight status or stock exchange rates. Usually dynamic Web pages are assembled at the time of a request from a browser and typically their URL has a ? character in it. Scripts to create dynamic Web pages can be written in languages such as JavaScript and Ajax.

Web pages are requested and served from Web servers using the Hypertext Transfer Protocol (HTTP). For example, when you enter a Uniform Resource Locator (URL) in your browser, this actually sends an HTTP request command to a Web server directing it to fetch and transmit the requested Web page. HTTP is an application layer protocol designed within the framework of the Internet protocol suite. This means that it presumes there is an underlying transport layer protocol such as the Transmission Control Protocol (TCP).

Format C

Web Search Basics

A Web search engine is a program that is designed to search for information on the World Wide Web for a user query and return a set of results to the user. In short, a Web search engine performs the following tasks: Web crawling, indexing, calculating relevancy and rankings, and serving results back to the user. Web search engines need to store information about a lot of Web pages for effective and efficient search. They get this information by Web crawlers that record information from the HTML of a Web page and follow every link from the Web page. The data collected by the Web crawlers about Web pages they visit get stored in an index database so that it can be used when users make queries.

To serve its users, Web search engines must take user input in the form of a query, which are usually keywords that they wish to find information or Web sites on. The search engine examines its index and then provides a listing of the most suitable Web pages given the search criteria the user has given as input. The results of a text-based search are the document's title as well as a short excerpt of text from the page or document, or an image in the case of image search, or a location in the case of location based search.

Of course, just because the keywords that a user has queried appear on a Web page does not mean that it is an appropriate result to return to the user because some other pages may be more relevant or reliable than others. Search engines rank results based upon different ranking methods before they are returned to the user so that the most relevant results are returned towards the beginning of the list or ranked higher in the search results.

Advertising revenue to some extent supports most commercial search engines and is what made a lot of search engine companies quite profitable. Search engines allow advertisers to pay to have their listings ranked higher in search results. Also, search engines feature related ads next to the search engine results for a query. Every time a user clicks on one of these ads the search engine is paid. This way search engines can maintain their credentials with their users and the advertisers – users get their search results and advertisers have their ads placed towards the best search results.

Format D

Web Search Basics

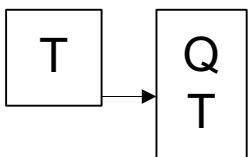
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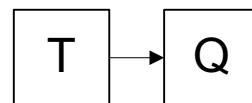
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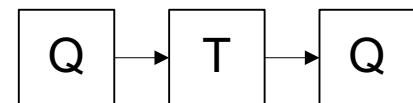
B



C



D



Example of reading behaviour for Questions and text page

Format A

Which of the following is false:

Select one:

- a. Web crawlers start at the home page of the search engine.
- b. Web crawlers build lists of words found on a web page.
- c. Web crawler behaviour is dictated by a set of policies.
- d. Web crawlers are also called Web spiders.

Web crawlers are automated programs responsible for methodically scanning through web pages and creating an index of information so that users can make queries on it later.

Web Crawling

Web crawling is the first step that a search engine takes to return results of a search query to a user. This step is invisible and most people do not know that it exists. This is the step in which a search engine identifies that a file or document exists. Since automated programs or scripts, colloquially called Web spiders and crawlers, perform Web crawling whereby a list of words and notes about where they were found is generated. These Web spiders build lists of words found on Web pages by methodically scanning through web pages and creating an index from the information they scanned. Web crawlers are not only used by search engines, but are used by linguists and market researchers or anyone trying to find information from the Internet in an organised manner.

Web crawlers usually start at popular sites and servers where they index the words on the pages and follow every link within the site. The crawler eventually builds an index based on its own system of weighting. For example, words in titles or headings may be deemed more important. This data is encoded to save space and stored for users to access through search queries.

There are limits to how much a web crawler can download at any one time and given that there is a large amount of rapidly changing data web crawlers have access to, the behaviour of a web crawler can determine how efficient and how up-to-date the information that is collected and stored. There are several policies that contribute to the behaviour of a web crawler. The selection policy of a web crawler determines which pages to download and the revisit policy determines when the web crawler checks for changes to the pages. The politeness policy determines how the Web crawlers avoid overloading Web sites, and the parallelization policy coordinates distributed Web crawlers.

Different search engines employ Web crawlers that record different types of words on Web pages. Different approaches are usually an attempt to make the spider operate faster, allow users to search more efficiently, or both. For example, some Web crawlers will keep track of the words in the title, sub-headings and links while others will keep track of the 100 most frequently used words on the page. The early Google search engine was built with only a few crawlers that could keep around 300 connections to Web pages open at any one time.

Format B

Which of the following is false:

Select one:

- a. Web crawlers build lists of words found on a web page.
- b. Web crawlers start at the home page of the search engine.
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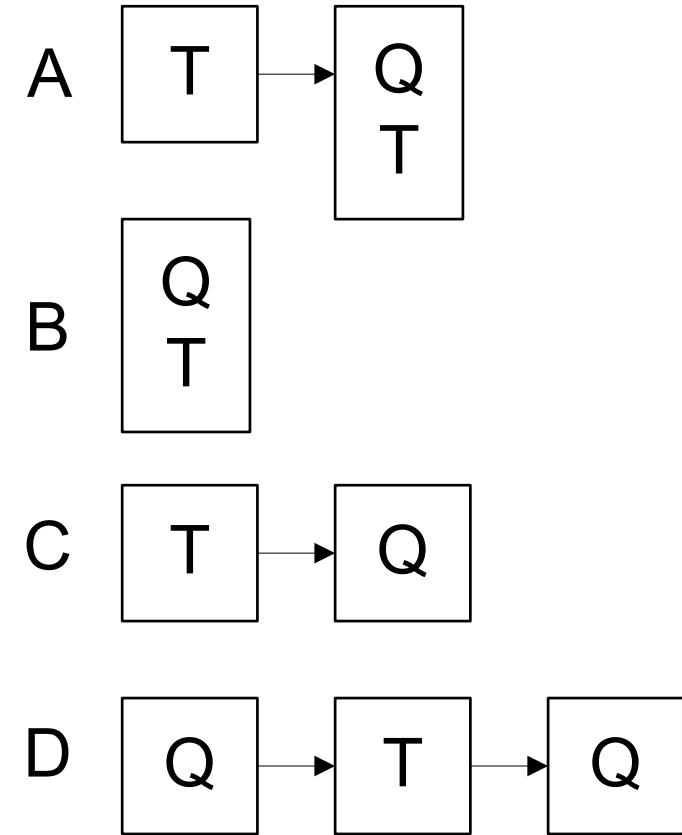
Web crawlers usually start at popular sites and servers where they index the words on the pages and follow every link within the site. The crawler eventually builds an index based on its own system of weighting. For example, words in titles or headings may be deemed more important. This data is encoded to save space and stored for users to access through search queries.

There are limits to how much a web crawler can download at any one time and given that there is a large amount of rapidly changing data web crawlers have access to, the behaviour of a web crawler can determine how efficient and how up-to-date the information that is collected and stored. There are several policies that contribute to the behaviour of a web crawler. The selection policy of a web crawler determines which pages to download and the revisit policy determines when the web crawler checks for changes to the pages. The politeness policy determines how the Web crawlers avoid overloading Web sites, and the parallelization policy coordinates distributed Web crawlers.

Different search engines employ Web crawlers that record different types of words on Web pages. Different approaches are usually an attempt to make the spider operate faster, allow users to search more efficiently, or both. For example, some Web crawlers will keep track of the words in the title, sub-headings and links while others will keep track of the 100 most frequently used words on the page. The early Google search engine was built with only a few crawlers that could keep around 300 connections to Web pages open at any one time.

Effect on overall performance

- No difference in quiz scores between:
 - Formats A & B
 - Formats C & D
 - A & B > C & D
- Format A took the longest
- Format C & D:
 - strong positive correlation ($r=0.9$ & $r=0.8$, respectively) between quiz score & subjective understanding score



Answer-seeking behaviour

Quiz navigation

i 1	2 i	i 3	4
i 5	6 i	i 7	
8 i	9 10 i	i 11	
12 i	i 13 14 i	i 15	16 i
i 17	18	i 19	

Finish attempt ...

Question 17
Not yet answered
Marked out of 1.00
Flag question

Search engine optimisation (SEO) is:

Select one.

a. the process of making search engines faster.

b. the process of making search engines return more relevant results.

c. the process of making a web site or page more highly ranked.

d. The process of making search engines more profitable.

Question 18
Not yet answered
Marked out of 1.00
Flag question

There are two types of SEO, white hat SEO are techniques that are approved and recommended by search engines and black hat SEO are techniques that involve deception.

Information
Flag question

Search Engine Optimisation

Search engines allow companies or individuals to pay to have their Web pages placed at the top of search results for certain queries. This is not the only way to ensure a web page tops the search results for a given query. The alternative is to use search engine optimisation (SEO) which is the process of getting a website or web page to rank higher in the search results for certain queries and hence increase visibility and visitors to the site.

SEO considers how search engines work, what people search for, and which search terms are used. The first step of SEO is to get indexed by a leading search engine. These search engines use web crawlers to find pages and offer either free or paid submission of pages. Web crawlers look at a number of different factors when crawling a site so the search engines index not every page. However, web crawlers intentionally avoid some content because the owner has specified it not to be indexed. This is done through the robots.txt file in the root directory of the domain. Typically pages such as shopping carts and user-specific content are prevented from being indexed because search engines such as Google consider those pages as search spam. Finally, there are a number of ways to increase the visibility of a webpage within the search results, such as by cross-linking web pages on a website to provide more links to most important pages. Other methods include writing content that includes frequently searched keyword phrase because that will make the page or site relevant to a wider variety of search queries. Also, updating content to give additional weight to a site because web crawlers will have to visit the site or page more frequently.

There are two categories of SEO techniques, which are term white hat and black hat SEO. The white hat SEO techniques are ones that are approved and recommended by a search engines guidelines, and involves no deception. Using white hat techniques tends to produce results that will last longer. Black hat SEO techniques are techniques of which search engines do not approve and involve deception. An example of black hat SEO is hidden text, which is either text coloured similar to the background or positioned off screen. Once the search engine realises that a site is using black hat techniques it may be banned either temporarily or permanently.

Next

Multiple-choice vs. cloze

- Participants refer back to the text significantly more when answering the cloze questions compared to the multiple-choice questions
 - Cloze questions make students read more!

What this all means

- Presentation of text and evaluation resources impacts reading behaviour & learning outcomes
- Can be manipulated to promote:
 - reading -> non-direct reading goals
 - accurate self-assessment of understanding
 - learning of concepts being assessed
- Effective feedback tool!

Can we mitigate distractions during reading?

- Digital environments can be very distracting
 - Alerts, advertising, social media, Instant messaging (IM), emails, notifications, etc.
- What effect does this have on reading?



User Study

- Easy vs hard text
- Visually distracting environment
- 2 mitigation signals

The “distracting” environment

Working with Digital Images

Digital images come in many forms; photographs, icons, clipart, graphs, diagrams and sketches to name a few. They have many sources including scanning, photography, born digital art and video stills.

Digital images can be either vector or raster graphics. Vector graphics are created using mathematic descriptions such as lines and curves. The vector graphics we know best are fonts, but they are also used for clipart and icons. Raster graphics images are better known as bitmaps. Bitmaps include the digital photographs we know as JPGs, TIFFs and PNGs. They store a dot matrix of individual pixels to compose an image. Raster graphics are more common than vector graphics even though they are not as compact and cannot be scaled as well to different sizes.

Digital cameras arrived in Australia in 1998, and rapidly overtook conventional photography. Today digital photographs are the most prevalent type of digital image. Over the years cameras have been included in many devices including mobile phones and tablets. Millions of digital photos find their way onto websites every day as media content, where they provide communication, information and entertainment.

Digital cameras work by registering the light that falls on the camera sensor when the shutter button is pressed. Camera sensors are normally CCDs (Charge Coupled Devices) or CMOSs (Complementary Metal-Oxide Semiconductors). Together with other hardware and software within the camera, sensors record a series of bits known as pixels. Pixels (short for picture elements) store information about the light that fell on the sensor. The camera or your computer then assembles the pixels into an image that you can see.

Digital photographs are an assemblage of information your camera stores about the pixels that make up the image. The quality and quantity of the information is dependent upon the bit depth and resolution respectively, which construct the pixels that form your image.

A screenshot of a web browser window titled "phpsite-leanaco.rhcloud.com". The main content area displays a list of names and their status, with a small green dot indicating "Mobile". The names listed are Aygul Jameson, Husni Sharmila, Helka Samuil, Secundinus Ilse, Aydin Unnur, Angra Mainyu, Alphonsine Joak, and Husni Sharmila again. To the right of the list is a large, detailed photograph of a meerkat standing upright and looking to the right. The entire browser window is framed by a white border.

Name	Status
Aygul Jameson	Mobile
Husni Sharmila	Mobile
Helka Samuil	Mobile
Secundinus Ilse	Mobile
Aydin Unnur	Mobile
Angra Mainyu	Mobile
Angra Mainyu	Mobile
Alphonsine Joak	Mobile
Husni Sharmila	Mobile

Mitigation signal A

Working with Digital Images

Digital images come in many forms; photographs, icons, clipart, graphs, diagrams and sketches to name a few. They have many sources including scanning, photography, born digital art and video stills.

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Mitigation signal B

Working with Digital Images

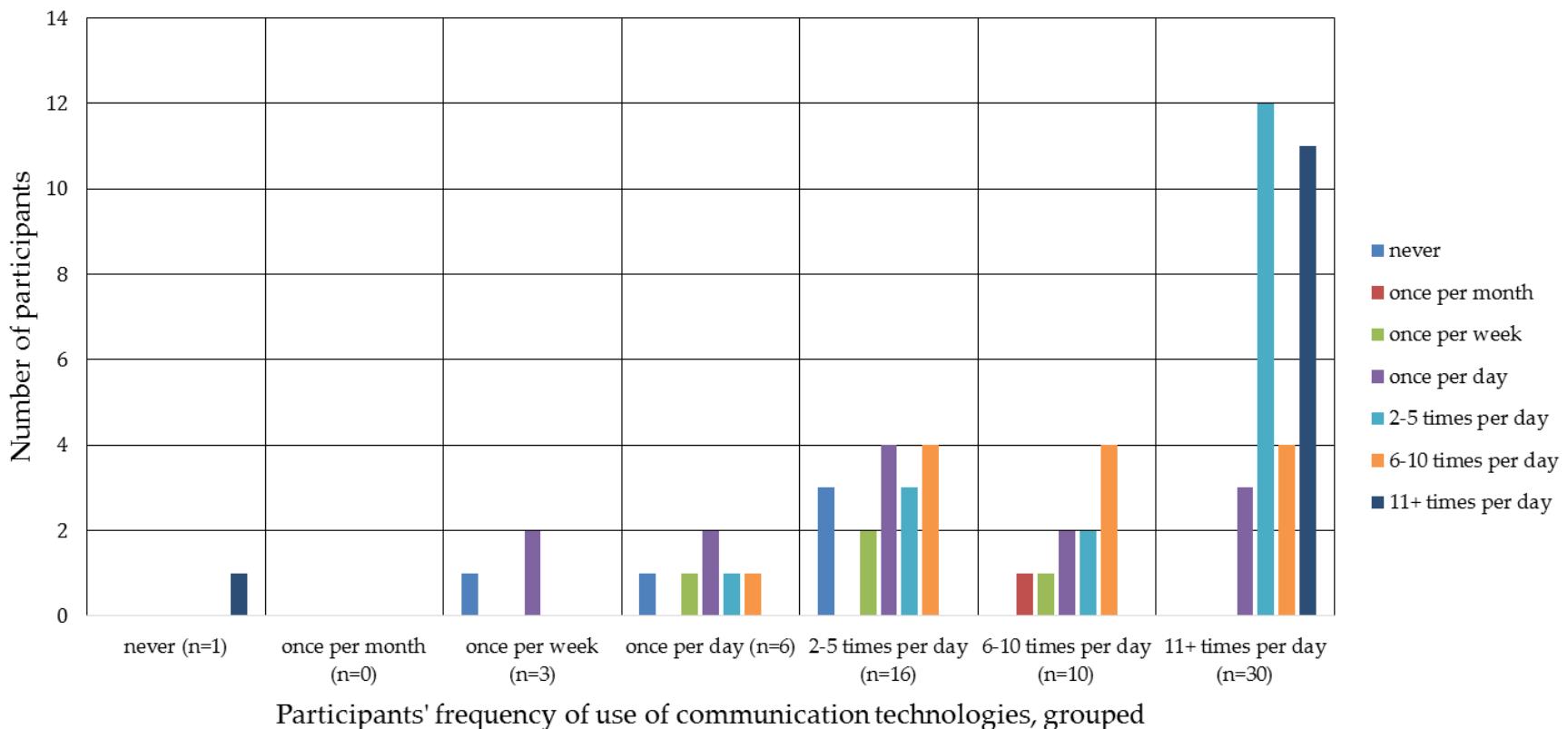
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Digital images can be either vector or raster graphics. Vector graphics are created using mathematic descriptions such as lines and curves. The vector graphics we know best are fonts, but they are also used for clipart and icons. Raster graphics images are better known as bitmaps. Bitmaps include the digital photographs we know as JPGs, TIFFs and PNGs. They store a dot matrix of individual pixels to compose an image. *Raster* graphics are more common than vector graphics even though they are not as compact and cannot be scale as well to different sizes.

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How distracted do students think they are?

Distracted by communication technologies, grouped by frequency of use of communication technologies



Results

- Neither mitigation signal nor text difficulty affected reading time or comprehension
- BUT... The eye gaze showed that distraction rate was very low!
 - ~4 distractions
 - only 2% of fixations on distractions

What did the participants think

- 82% of participants stated that they were distracted whilst reading
 - However of the 18% most stated something about the images changing
- Most did not see the greyed out signal
- Most stated that the yellow highlighting was helpful

Where to next?

- Adaptive content generation
- Document annotation
 - Comprehension
 - Reading metrics
 - Distraction metrics

Where to next?

- Adaptive content generation
- Document annotation
 - Comprehension
 - Reading metrics
 - Distraction metrics



ou