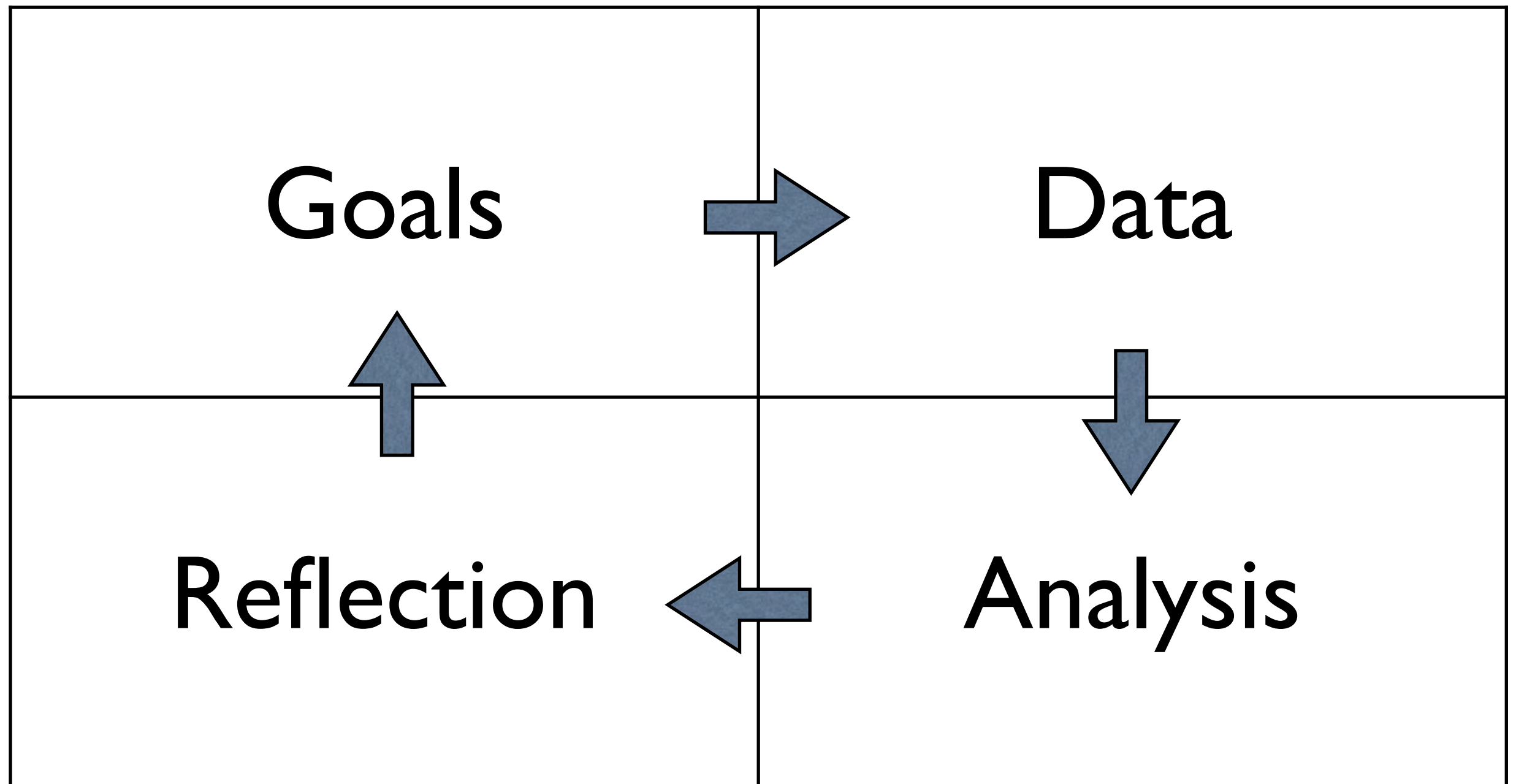# Research

- Background research
  - What have other people already done?
  - What needs should we address?
- Evaluation
  - Is this design/system what we want?

Research Skills

- Background research
  - Writing a **literature review**
  - **Data gathering** for requirements
- Evaluation
  - **Data gathering** for evaluation

The Research Cycle

(Holz et al. 2006)

The Research Cycle
1. Goals

- What do we want to achieve?

- Find out about a subject

- Investigate a situation

- Evaluate existing system

- Compare existing systems

- Change human behaviour

The Research Cycle
2. Data

- Where will we get the data from?

- How will we gather the data?

  - Read, observe, ask, measure, experiment, model

- Is the context important?

  - In "the field" / "the wild" (natural context)

  - In "the laboratory" (artificial context)

The Research Cycle
3. Analysis

- What do we do with the data?

- Identify themes/patterns/trends

- Calculate statistical descriptions or tests

- Visualise or express in media

- Create frameworks/taxonomies

The Research Cycle
4. Reflection

- Have we achieved our goal?

- Evaluate results

- Identify limitations

- Draw conclusions (based on evidence)

- Speculate (due to insufficient evidence)

- Propose future goals

Wide vs. Narrow Paragraphs

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Beymer et al., Wide vs. Narrow Paragraphs: An Eye Tracking Analysis, INTERACT 2005

Research Example
Wide vs. Narrow Paragraphs

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Beymer et al., Wide vs. Narrow Paragraphs: An Eye Tracking Analysis, INTERACT 2005

Research Example
Literature Review

1. Goal What do we already know about reading behaviour with computer screens?	**2. Data** *Read the relevant literature* From typography, psychology etc.
4. Reflection Draw conclusions about reading behaviour. Identify limitations: literature contradictory & used outdated technology.	**3. Analysis** *Identify themes* Critiqued the literature and collated information.

Beymer et al., Wide vs. Narrow Paragraphs: An Eye Tracking Analysis, INTERACT 2005

Research Example
Original Research

1. Goal Compare existing systems: does line length affect way people read a web page?	**2. Data** Laboratory measurements: two reading conditions, collect eye-tracking data, comprehension test
4. Reflection Concluded reading behaviour different between wide and narrow text. Limitations: no explanation for why narrow increases retention, not able to recommend width	**3. Analysis** Calculate various metrics on eye movement over text. Statistical test for significant difference between conditions.

Beymer et al., Wide vs. Narrow Paragraphs: An Eye Tracking Analysis, INTERACT 2005

Data Gathering
for Requirements

- Once you know who your users are you need to **research** their **needs**.

- Gather data on your users, tasks etc.

- Requirements arise from **interpreting** the data to increase your **understanding**

- Requirements can be **justified** by this data.

Data Gathering

Key Issues

- Set goals: what do we want to know?

- Identify participants: how will we **sample** the wider population?

- Informed consent? Who is in control?

- Triangulation: multiple perspectives?

- Pilot studies: will this work?

Data Gathering
Techniques

- Questionnaires

- Interviews

- Focus Groups

- Direct and indirect observation

- Documentation

- Contextual enquiry

Questionnaires

- A series of questions
- Types of answer
  - ▸ YES or NO
  - ▸ multiple choice
  - ▸ make a comment
- Often used in conjunction with other techniques.
- Give quantitative or qualitative data.
- Good for answering specific questions from a large, dispersed group of people.

Post Test Satisfaction Questionnaire

Please complete the following questionnaire

1. To the best of my ability, I followed the instructions telling me how to vote

☐ Yes
☐ No

2. I am confident I was able to vote this ballot exactly as instructed

☐ Agree
☐ Disagree
☐ Don't Know

3.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	1	**2**	**3**	**4**	**5**
I found that voting on this machine was unnecessarily difficult					
I felt confident that I used this voting machine correctly					

Data Gathering Techniques
Interviews

- Conversation can be structured, unstructured or semi-structured.

- Can use props, e.g. scenarios, prototypes.

- Good for exploring complex issues.

- Time consuming/infeasible visiting many people.

Focus Groups

- Group interviews.

- Stakeholders get to see each other's views.

- Build consensus, expose conflicts.

- Group think: dissenting views get suppressed.

- **Workshops**: stakeholders and developers work on together, e.g. on requirements

Data Gathering Techniques
Direct Observation

- Spend time with stakeholders in their day-to-day tasks, observing work as it happens.

- Gain insights into stakeholders' tasks.

- Good for understanding the nature and context of the tasks.

- Requires time and commitment from a member of the design team, and it can result in a huge amount of data

- Ethnography: combines participation and observation.

Indirect Observation

- Logging

    - Capture data automatically during user interaction

- Diaries

    - Ask users to record details of interaction in a daily/weekly diary

Documentation & Similar Systems

- Information about users often written down in manuals etc. or reflected in existing systems.

- Find out steps involved in an activity and any rules governing a task.

- May not reflect reality, not to be used in isolation.

- No stakeholder time, which is a limiting factor on the other techniques.

Data Gathering Techniques
Which Approach?

▶ Amount of time

▶ Risk associated with findings

▶ Knowledge the analyst requires

▶ Amount, detail and type of data (qualitative/ quantitative)

▶ How will you analyse data?

▶ Will the analysis tell meet your goals?

▶ How complex are the user activities you are trying to understand?

Technique	Good for	Data	Advantages	Disadvantages
Interview	Exploring issues	Mostly qualitative	Guided, personal	Time-consuming, artificial
Focus group	Multiple viewpoints	Mostly qualitative	Consensus, conflict, contact	Dominant characters
Questionnaire	Specific questions	Quantitative & qualitative	Scales well	Lack of / unexpected responses
Direct field observation	Understanding context of use	Mostly qualitative	Deep insight	Time-consuming, loads of data
Direct lab observation	Capturing details of use	Quantitative & qualitative	Focus on detail	Artificial, limited relevance
Logging	Automated gathering	Quantitative	Natural, observe over time	Loads of data
Diaries	Undisturbed use	Qualitative	Natural, observe over time	Relying on people's memory

Problems with Data Gathering
Working with Stakeholders

- **Identifying** stakeholders: users, managers, developers, customer reps?

- **Involving** stakeholders: workshops, interviews, workplace studies, co-opt stakeholders onto the development team.

- Political problems or changes in organisation, dominance or availability of certain stakeholders.

- Finding real users, not convenient users.

Problems with Data Gathering
Working with Information

- Keep track of multiple versions of requirements.

- Who owns requirements?

- Balancing functional and usability demands.

- Communication between parties: in your team, with client/users, between users.

- Domain knowledge can be distributed and implicit: can be difficult for people to articulate.

Some Basic Guidelines

- Focus on identifying the stakeholders' needs.

- Involve all the stakeholder groups.

- Involve more than one representative from each stakeholder group.

- Use a combination of data gathering techniques.

- Think about how you will analyse the data before you gather it.

Some Basic Guidelines

- Run a **pilot** data gathering session.

- Support the process with props such as prototypes and task descriptions.

- Think through how you will record the data.

- You will need to make compromises. But first, think what data gathering you would do **really** like to do if anything were possible.

Internet-Mediated Research

- Data gathering from stakeholders **online**

  - Recruit participants

  - Administer materials

  - Collect data

- Can be much more convenient...

- ...but be aware of potential disadvantages.

SurveyMonkey®

Market Research Template

1. How important is convenience when choosing this type of product?

- ◯ Extremely important
- ◯ Very important
- ◯ Moderately important
- ◯ Slightly important
- ◯ Not at all important

2. What do you like most about competing products currently available from other companies?

[text box]

3. What changes would most improve competing products currently available from other companies?

[text box]

4. If you are not likely to use our new product, why not?

- ◯ Do not need a product like this
- ◯ Do not want a product like this

Example from www.surveymonkey.com

Internet-Mediated Research
Advantages of IMR

- Can gather large volumes of data relatively cheaply

- Reducing timescale of research

- Cross-cultural research more feasible

- Participants may be more candid when researcher is not physically present

- Non-intrusive observation studies can be carried out that were previously difficult e.g. sentiment analysis

- Advantages of researcher anonymity, e.g. can manipulate subject's beliefs about their gender

Internet-Mediated Research
Sample Bias

- Are Internet samples biased, e.g. primarily technologically-proficient, educated, white middle-class professional males?

- If anything, the evidence is that internet samples are more representative of population as a whole.

- Rise of social networking means Internet no longer dominated by geeks. Danger of "people like you."

- Traditional surveys often used undergraduate students as subjects, so they had their own bias.

Internet-Mediated Research
Sampling Procedures

- Post participation requests to mailing lists, discussion forums etc.

- State clearly the affiliation of the study (i.e. Goldsmiths) to give it credibility.

- Gather information about demographics of participants (age, gender, region, occupation etc).

Internet-Mediated Research
Lack of Control

- Researcher can't be sure of identity of subject.

- Subject may have been distracted, watching TV, drinking etc. while filling out questionnaire

- In fact studies have found that these are not serious issues (Hewson 2003).

- Even in "traditional" research there has to be some trust in the subjects.

Internet-Mediated Research
Maximising Control

- Give clear, explicit instructions and emphasize importance of sticking to instructions

- Gather information which may help detect multiple submissions: IP address, time, browser type

- Avoid factors which may cause variations in subjects' experience: downloading large files, cross-browser issues

- Pilot study on a range of platforms before proceeding to the actual procedure.

The Elevator Pitch

- Get into your groups.

- Nominate **one person** to give a **one minute** "elevator pitch" of your group's project idea.

- It <u>doesn't</u> have to be your final idea!

- Focus on **needs**: who needs it, why it is needed, very briefly how it will address those needs.

Literature Review

- The **literature**: what has already been published on a subject

- A **literature review** (or **literature survey**)…

  - Identifies key <u>sources</u>

  - Discusses a selection of <u>sources</u>

  - Uses them to <u>summarise</u> the relevant background work.

Literature Review
Benefits

- Allows the reader to judge your work in context.

- An opportunity to motivate your work.

- Helps you understand through reading/writing.

- Helps you focus on interesting area.

- Evidence you can reference later on.

Sources

- Key sources should be academic papers (i.e. refereed, peer reviewed) from journals/conferences, and books. This is **reliable knowledge** (…?)

- News articles, reviews, sales material etc are useful for specific **facts/opinions**.

- Some sources you can use to explore/understand the literature but should <u>not</u> be included in your review, e.g. Wikipedia.

Finding Sources

- Obvious starting points: Libraries, Google, Wikipedia

- Academic search engines

    - Google Scholar http://scholar.google.co.uk/

    - Citeseer http://citeseerx.ist.psu.edu/

- Multiple lines of enquiry: don't stop after one search! Be persistent.

- **Chaining**: given an article, follow up any relevant articles that it mentions.

- Ignore most of what you find, be very selective.

Critical Evaluation
(Dawson 2009, p103)

- Is the author a recognised authority in this area?

- How clearly are the key terms defined?

- Are the conclusions properly supported by the data? Are alternative conclusions consistent with the evidence presented?

- Is the work replicable? Is it reported clearly enough that someone else could repeat the study?

- Can you differentiate fact from unsubstantiated opinion?

- Do you agree with the assertions in this article? Are there counter-arguments?

- Does the article contradict other viewpoints or support the status quo?

- What references does it use? Are they reliable and up to date?

Internet Sources

- The internet is typically a way to find sources, not a source itself.

- Unreliable and potentially embarrassing, e.g. *The Leveson Report* cut-and-pasted an incorrect fact from Wikipedia.

- Transient: web pages get (re)moved.

- Some online material is peer-reviewed.

- Most is not. You need to **evaluate** it.

Evaluating Websites

- What is the neighbourhood of this website like?

- What is the author/publisher's background?

- How biased do they seem?

- Is this website recognised by others?

- Is the content thorough?

- How current is the content?

Ohio State Uni. guide, http://liblearn.osu.edu/tutor/les1/

Referencing

- The sources you use for your literature survey should be...

- **Cited** in the text of your report.

> Voom cleans up snow (Seuss 1958).

- Listed in a **bibliography** at the end.

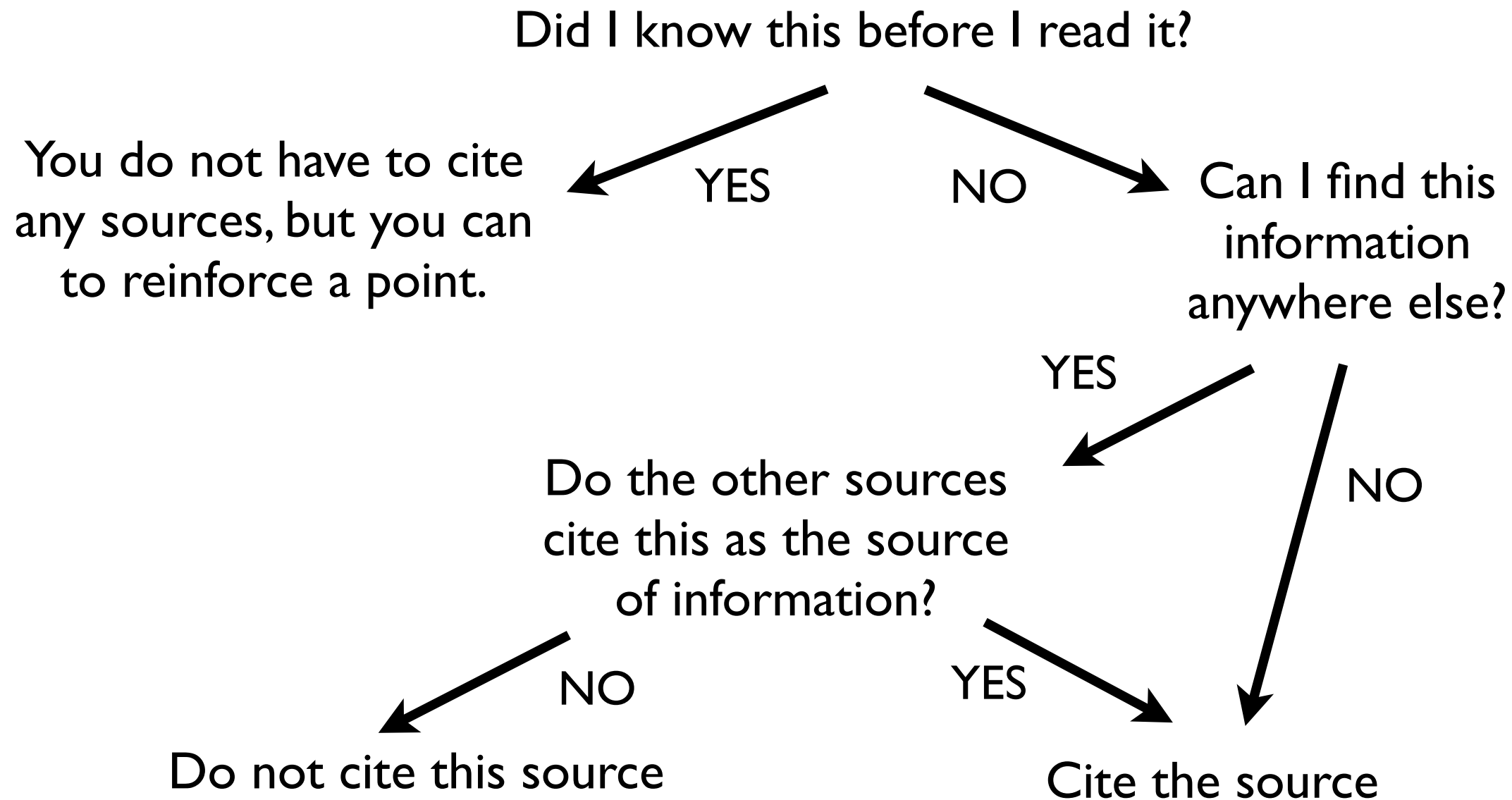> T. Seuss (1958), *The Cat In The Hat Comes Back*. Random House.

Why Reference?

- Avoid **plagiarism**: do not present other people's work as if it is your own.

- Failure to cite other people's work appropriately may be classed as deliberate plagiarism or poor academic practice, both of which carry penalties.

- Support and validate your arguments.

- Identify sources, so that people reading your work can further their own studies.

When to Reference?

- If you summarise anyone else's ideas or words then reference the source.

- If you use a direct quotation then put it in quotation marks and properly reference the source. Limit the amount of direct quotations you use.

- Don't over-reference: no need to cite source if something is well known throughout field.

When to Reference?

Did I know this before I read it?

YES → You do not have to cite any sources, but you can to reinforce a point.

NO → Can I find this information anywhere else?

YES → Do the other sources cite this as the source of information?

NO → Cite the source

NO → Do not cite this source

YES → Cite the source

How **Not** To Reference

- All from standard textbooks or lecture notes.

- Obscure or outdated references.

- References in text do not match bibliography.

- Cite at end of paragraph, not where relevant.

- Imprecise: can't find source, or page for quote.

- List of URLs without author, title, date visited.

The Harvard System

- Commonly used and easily understandable style of referencing. How to cite in text and format bibliography.

> Phillips (1999) suggests that generational change is inevitable and continuous.

or

> Generational change is inevitable and continuous (Phillips 1999).

- See http://education.exeter.ac.uk/dll/studyskills/ harvard_referencing.htm

- Also P. Stocks "Compiling a Bibliography" on learn.gold

Readings

- **Data gathering**
  - Rogers, Sharp & Preece, chap. 7 + 10.4 (ESSENTIAL)
  - Taylor, chapter 9.

- **Referencing**
  - Readings from slides and...
  - Hewson (2003) on learn.gold (discusses psychology, but also applies to computing)
  - Taylor (2012), chapters 3 and 6.

Bibliography

- C. Dawson (2009), *Introduction to Research Methods*. How To Books Ltd.

- C. Hewson (2003), "Conducting Research on the Internet", *The Psychologist* 16(6):290-293.

- Rogers, Sharp & Preece (2011), *Interaction Design: Beyond Human-Computer Interaction*, 3rd ed. Wiley.

- T. Taylor (2012), *International Programme Project Guide*. University of London.