How to read scientific papers

Introduction - Pervasive Computing Course 2010
IT University of Copenhagen - Aurélien Tabard

How to read scientific papers

Why so many papers?

Overview of papers reading.

How to go through your reading assignments?

- 1st, 2nd and 3rd pass.

Why so many papers?

Get you to know and understand the current state of the art
in the Pervasive and Ubiquitous computing field:

.: cover more than 20 years of research and exciting technology

.: present current questions within the field

.: create interesting new projects

How to Read a Paper

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ABSTRACT

Researchers spend a great deal of time reading research papers. However, this skill is rarely taught, leading to much wasted effort. This article outlines a practical and efficient *three-pass method* for reading research papers. I also describe how to use this method to do a literature survey.

Categories and Subject Descriptors: A.1 [Introductory and Survey]

General Terms: Documentation.

Keywords: Paper, Reading, Hints.

1. INTRODUCTION

Researchers must read papers for several reasons: to review them for a conference or a class, to keep current in their field, or for a literature survey of a new field. A typical researcher will likely spend hundreds of hours every year reading papers.

Learning to efficiently read a paper is a critical but rarely taught skill. Beginning graduate students, therefore, must learn on their own using trial and error. Students waste much effort in the process and are frequently driven to frustration.

For many years I have used a simple approach to efficiently read papers. This paper describes the 'three-pass' approach and its use in doing a literature survey.

2. THE THREE-PASS APPROACH

The key idea is that you should read the paper in up to three passes, instead of starting at the beginning and plowing your way to the end. Each pass accomplishes specific goals and builds upon the previous pass: The *first* pass gives you a general idea about the paper. The *second* pass lets you grasp the paper's content, but not its details. The *third* pass helps you understand the paper in depth.

2.1 The first pass

The first pass is a quick scan to get a bird's-eye view of the paper. You can also decide whether you need to do any more passes. This pass should take about five to ten minutes and consists of the following steps:

1. Carefully read the title, abstract, and introduction
2. Read the section and sub-section headings, but ignore everything else
3. Read the conclusions
4. Glance over the references, mentally ticking off the ones you've already read

At the end of the first pass, you should be able to answer the *five Cs*:

1. *Category*: What type of paper is this? A measurement paper? An analysis of an existing system? A description of a research prototype?
2. *Context*: Which other papers is it related to? Which theoretical bases were used to analyze the problem?
3. *Correctness*: Do the assumptions appear to be valid?
4. *Contributions*: What are the paper's main contributions?
5. *Clarity*: Is the paper well written?

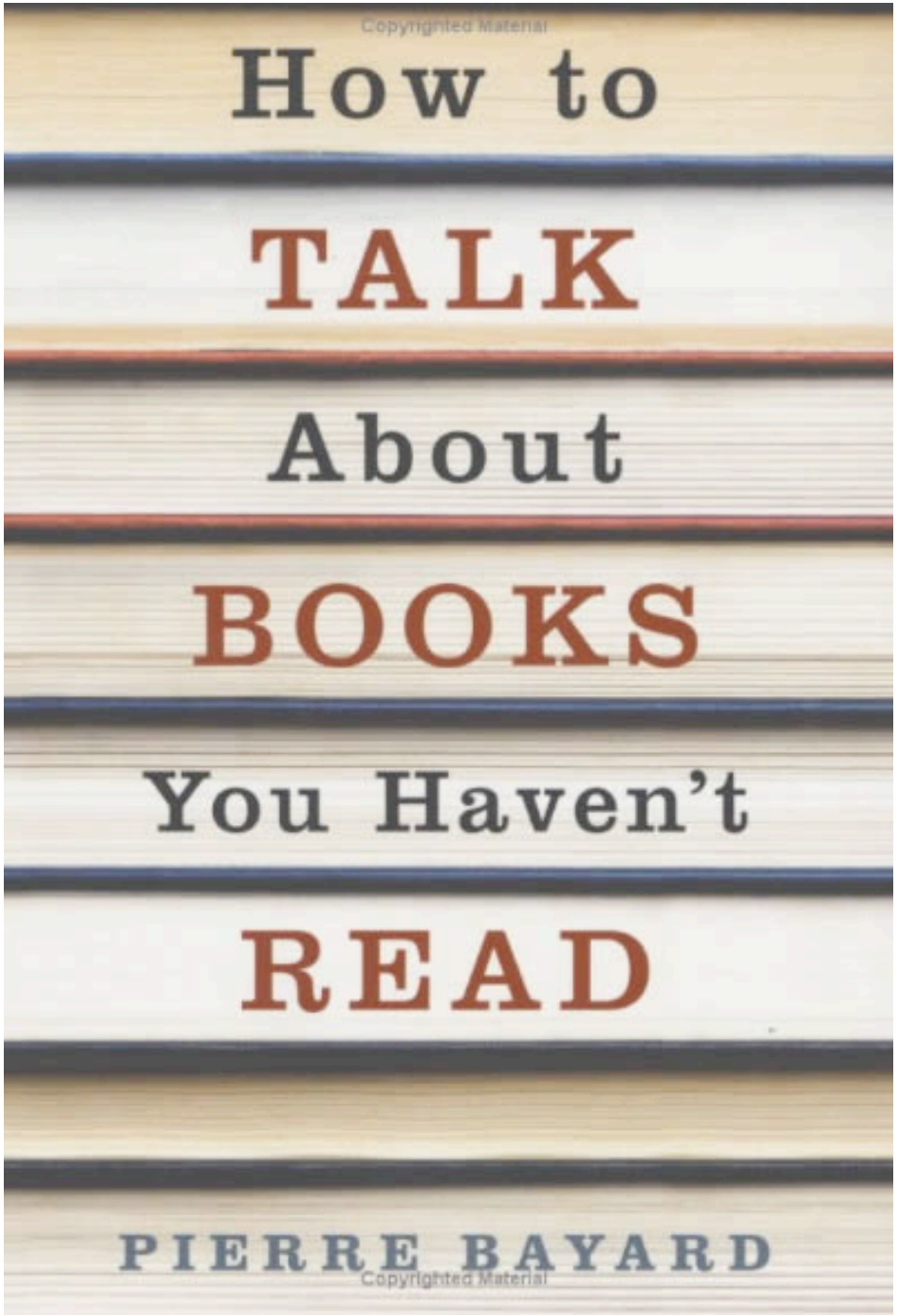
Using this information, you may choose not to read further. This could be because the paper doesn't interest you, or you don't know enough about the area to understand the paper, or that the authors make invalid assumptions. The first pass is adequate for papers that aren't in your research area, but may someday prove relevant.

Incidentally, when you write a paper, you can expect most reviewers (and readers) to make only one pass over it. Take care to choose coherent section and sub-section titles and to write concise and comprehensive abstracts. If a reviewer cannot understand the gist after one pass, the paper will likely be rejected; if a reader cannot understand the highlights of the paper after five minutes, the paper will likely never be read.

2.2 The second pass

In the second pass, read the paper with greater care, but ignore details such as proofs. It helps to jot down the key points, or to make comments in the margins, as you read.

1. Look carefully at the figures, diagrams and other illustrations in the paper. Pay special attention to graphs. Are the axes properly labeled? Are results shown with error bars, so that conclusions are statistically significant? Common mistakes like these will separate rushed, shoddy work from the truly excellent.
2. Remember to mark relevant unread references for further reading (this is a good way to learn more about the background of the paper).



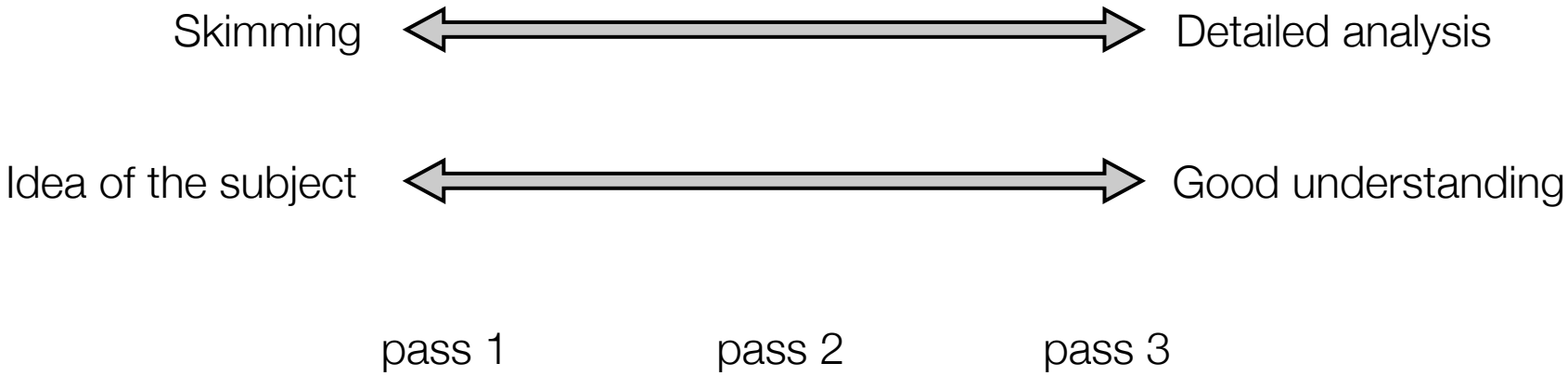
Disclaimer

You need to know the domain first!

...hence read

How to read scientific papers

Navigate between:



Active reading

.: Get rid of distractions

.: Get a pen

.: Jump around, re-read, go backwards - These are not novels

.: Talk to others

Papers' structures

Textbook

Vision / Overview

Technical paper

.: Abstract

.: Intro

.: Related work

.: System description

.: Evaluation

.: Results

.: Discussion

.: Conclusion

.: References

Questions to keep in mind

.: What questions does the paper address?

.: Is the problem relevant?

.: What are the main conclusions of the paper?

.: What evidence supports those conclusions?

.: Do the data actually support the conclusions?

.: What is the quality of the evidence?

.: Why are the conclusions important?

Pass 1 - Overview

Get a general idea

Situate the article within the *Universal Library.*

Pass 1 - Overview

Title + Authors

.: What is this about + Where does it come from

Abstract

.: What was done, what is the contribution

Sub-sections titles, figures

.: What is the paper structure / contribution

Medium (textbook, major journal/conference, workshop)

.: Who is the audience?

References

.: Is it a serious paper

Pass 2 - Get the authors message

Introduction + Conclusion

.: What is the problem (look for However)

.: How are the authors solving it

.: What are the authors' contributions

Discussion

.: What are the insights, the limitations, the relevance of the work.

Pass 3 - careful reading

From beginning to end ...

... or backwards

.: Read actively, use pens

.: Talk to other students

.: Get help from related work papers if it gets too complicated

.: Come back to it later

Living with it

Research papers summarize months or years of work in a few pages

Come back, re-read, question, re-discover.

Plenty of other ways of reading...

Objectives

.: Literature review

.: Survey

.: Reviewing articles for colleagues, journal or conferences

Other sources:

.: Books

.: Patents

.: Web content