Introduction to Research Methods

L5:
Writing a Paper / Thesis

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Outline

- Scope of a paper
- Telling a story
- Organization of a paper / thesis
- Typical components of a write-up
- Some advices and checklist

- Seminar assignments: Overview of a MSc thesis

Based on:

1. J. Zobel, *Writing for Computer Science*, Springer, 2014
2. Ad Lagendijk, *Survival Guide for Scientists*: Writing-Presentation-E-mail, UvA Press, 2008
3. http://www.sciencesurvivalblog.com/

The scope of a paper / thesis (1/2)

- Is there a single, clearly articulated research question or goal?
- Which results are the most surprising?
- What is the one result that other researchers might adopt in their work?
- Which aspect of your work is of greater impact or of greater interest?
- Are the other outcomes independent enough to be published separately later on? Are they interesting enough?

The scope of a paper / thesis (2/2)

- Is the contribution of the new work more obvious if the old approaches are described first, to set the context?
- What assumptions or definitions need to be formalized first?
- What is the key background work that has to be discussed?
- Who is the readership (specialists or a general audience)?
- Do you and your coauthors have an agreed methodology for sharing the work of completing the write-up?
- Are the roles of participants clear?

Telling a Story (1/2)

- A strong paper/thesis has a story-like flow: from foundation of knowledge to new ideas and results.
- An effective paper educates its readers, so it should have a logical flow and has the feel of narrative.
- A paper is alike to a guided tour through a gallery with rooms with something new in each.

Telling a Story (2/2)

- **A chain structure**:
  - problem statement,
  - previous solutions,
  - the new solution,
  - demonstration of the new solution.

- **By specificity**: appropriate for results which may be divided into several stages; first in general form, then – details.

- **By example**: the idea or results are first explained by applying it to some typical problem, then more formally, …

- **By complexity**: a simple case given first, then a complex one; a kind of tutorial: through small steps to the full result.

Organization of a paper

- Theses, journal articles, and conference papers have much the same organization; a standard structure allows readers to quickly discover the main results. The distinction is in emphasis.

- You need to:
  - Describe the work in the context of accepted scientific knowledge
  - State the idea that is being investigated, often as a theory or hypothesis
  - Explain what is new about the idea, what is being evaluated, what contribution the paper is making
  - Justify the idea (theory, concept) by methods such as proof or experiment

- Thesis is expected to be completed, rounded piece of work

Typical components of a write-up

- Title and author(s)
  - Sound and precise titles
  - Co-authoring issues (see http://provost.yale.edu/academic-integrity/authorship)
- Abstract
- Highlights
- Keywords

- Introduction
- Literature review, related work
- Body
- Conclusions

- Acknowledgements
- Bibliography – a complete list of papers, books, theses, reports
- Appendices – technical details, only occasionally necessary for a paper, useful in a thesis as a supporting material

Abstract

- Abstract – a single paragraph of about 50-200 words, with 5-element organization:
  - A general statement introducing the broad research area of the particular topic
  - An explanation of the specific problem (difficulty, obstacle, challenge)
  - A review of existing solutions and their limitations
  - An outline of the proposed new solution
  - A summary on evaluation and outcomes
- First draft of an abstract: start with 5 sentences
- The more specific abstract is, the more interesting it will be
- Self-contained and written for a broad readership

Introduction

- An expanded version of the abstract
- Motivation:
  - Why the problem is interesting
  - What the relevant scientific issues are
  - Why the approach taken is a good one
  - Why the outcomes are significant
- A paper is not a story in which the results are kept secrete until a surprise ending; the introduction should tell a reader what in the paper is new and what the outcomes are
- Method: research strategies and methods of data collection and evaluation, justification for the methods selected
- Structure of the paper / thesis

Body

- **Problem and requirements**: elaborated description and analysis of the problem addressed
  - defines the requirements on the artefact (based on the problem analysis),
  - describes the process of problem analysis and requirements elicitation,
  - application of research strategies and methods and the use of the knowledge base

- **Artefact**: often the main part of a design science paper,
  - explains the structure, behavior and function of the artefact (examples),
  - describes development process: alternatives and design rationale

- **Evaluation**: evaluation strategy and evaluation process, describes a demonstration of the artefact

- **Discussion**: identifies limitations in the study, discusses novelty, comparison to existing ones, practical and theoretical significance, ethical aspects, future research, reflection on research methods

Checklist: your approach to the work

- Are you maintaining a log and notebook?
- Do you work to an explicit schedule with dates and targets
- Do the deadlines have enough time for your advisor to provide feedback on your drafts?
- Do you have an effective approach to writing?
- How are results being selected for presentation? How do these results relate to your original aims?
- Have the results been critically analyzed?
- Do you know how your thesis will be examined?

Getting it wrong

- Irrelevance
  - I can not figure out what this paper is about?
  - Not appropriate journal / conference
  - No research question, no goals, no results
- Inconsistency
- Inadequacy
- Incompleteness
- Incomprehensibility
- Ignorance (authors')
- Ugliness – *if something looks terrible, then the author does not care about the content*

Seminar assignment

- Write an overview presenting your MSc thesis; the structure of the overview is given on the next slide, use the presentation template

- Visit

http://dice.cyfronet.pl/publications/filters/filter_MSc_Theses

MSc Thesis Overview

- **Heading** – as in a good journal paper:
  - Title
  - Author
  - Promoter
  - 5-7 keywords

- **Body** – a collection of sections that will be expanded in the course of your research (and this overview is meant to be a *living document*):
  1. **Introduction**: a general statement introducing the broad research area of the particular topic, motivation
  2. **Problem statement**: an explanation of the specific problem (obstacles, challenges), a research question, hypothesis, and research objectives
  3. **Methodology**
  4. **Related work**: a short review of existing solutions and their limitations
  5. **Solution**: an outline of the proposed new solution
  6. **Evaluation**: an idea about evaluation and outcomes
  7. **References**: 5-7 basic papers

  Write a short paragraph for each section (3-5 sentences)

„Microcosmos” by Wislawa Szymborska

When we first started looking through microscopes
a cold fear blew and it’s still blowing.
Life hitherto had been frantic enough
in all its shapes and dimensions.
Which is why it created small-scale creatures,
assorted tiny worms and flies,
but at least the naked human eye
could see them.

But then suddenly beneath the glass,
foreign to a fault
and so petite,
that what they occupy in space
can only charitably be called a spot.

The glass doesn’t even touch them,
they double and triple unobstructed,
with room to spare, willy-nilly.

To say they’re many isn’t saying much.
The stronger the microscope
the more exactly, avidly they’re multiplied.

They don’t even have decent innards.
They don’t know gender, childhood, age.
They may not even know they are—or aren’t.
Still they decide our life and death.

Some freeze in momentary stasis,
although we don’t know what their moment is.
Since they’re so minuscule themselves,
their duration may be
pulverized accordingly.

A windborne speck of dust is a meteor
from deepest space,
a fingerprint is a farflung labyrinth
where they may gather
for their mute parades,
their blind iliads and upanishads.

I’ve wanted to write about them for a long while,
but it’s a tricky subject,
always put off for later
and perhaps worthy of a better poet,
even more stunned by the world than I.
But time is short. I write.

Translated by Stanisław Barańczak and Clare Cavanagh, in
New York Review of Books, December 17, 2009
http://www.nybooks.com/articles/2009/12/17/microcosmos/

„The Three Oddest Words” by Wislawa Szymborska

When I pronounce the word Future,
the first syllable already belongs to the past.

When I pronounce the word Silence,
I destroy it.

When I pronounce the word Nothing,
I make something no non-being can hold.

Translated by transl. Clare Cavanagh and Stanisław Barańczak
https://www.youtube.com/watch?v=mRoaKvZ2zbo
W. Szymborska, *Trzy słowa najdziwniejsze* / z tomu 'Chwila' (2002)
Muzyka: E. Fitzgerald, L. Armstrong - Tenderly

Yet more reading

- Visit https://www.copernicuscenter.edu.pl/ and make a use of lectures and handbooks available at the Copernicus College, it's fascinating! https://www.copernicuscollege.pl/

- Max Tegmark, *Our Mathematical Universe. My Quest for Ultimate Nature of Reality, Penguin, 2014* https://www.penguin.co.uk/books/181883/our-mathematical-universe/

  and also

  http://www.proszynski.pl/Nasz_matematyczny_Wszechswiat__W_poszukiwaniu_prawdziwej_natury_rzeczywistosci-p-32923-.html