WRITING THE SCIENCES DISSERTATION

Winter 2020

UCLA Graduate Writing Center

Overview of Workshop

- Dissertation Types/Common Structures
- General Introductions
- General Literature Review Chapters
- General Methods Chapters
- General Conclusions
- Revision Strategies
- Dissertation Abstracts

Dissertation types/common structures

Paltridge's Four Thesis Types

- Traditional Simple
- Traditional Complex
- Topic Based
- Compilation Based

Adapted from Brian Paltridge's *Thesis and dissertation writing: An examination of published advice and actual practice* (pp. 135, 138-141)

Traditional Simple

1. Introduction
2. Literature Review
3. Method
4. Results
5. Discussion
6. Conclusions

Adapted from Brian Paltridge's *Thesis and dissertation writing: An examination of published advice and actual practice* (pp. 135–138-141)

Traditional Simple Example

“Astronomy Sample” Handout

Chapter One: Introduction

Chapter Two: VERITAS Instrument

Chapter Three: Data Analysis

Chapter Four: Gamma-ray signatures of self annihilating Dark Matter

Chapter Five: Results

Chapter 6: Conclusions

Bibliography

2010. An Indirect Search for Dark Matter with VERITAS.

Topic Based

1. Introduction
2. Topic 1
3. Topic 2
4. Topic 3
5. Conclusions

Adapted from Brian Paltridge's *Thesis and dissertation writing: An examination of published advice and actual practice* (pp. 135, 138-141)

Topic Based Example

“Mathematics Sample” Handout

Chapter One: Introduction

I. Minimum-Error Quantum Detection

Chapter Two: The Theory of Minimum-Error Quantum Detection

Chapter Three: The Quadratically-Weighted Measurement

Chapter Four: The Generalized Holevo-Curlander Bounds

Chapter Five: Detection Bounds from Matrix Monotonicity

II. Channel Reversibility and Maximum Overlap

Chapter Six: Quantum Channels and Recovery Operations

Chapter Seven: The Maximum Overlap Problem

Chapter Eight: Approximate Channel Reversals

Chapter Nine: Matrix Monotonicity Bounds and Reimpell-Werner functionals

2010. Estimates in Quantum Detection and in the Theory of Quantum Recovery Channels.

Traditional Complex

1. Introduction
2. Literature Review
3. (Background Theory)
4. (General Method)
5. Study 1
   - Intro, Method, Results, Discussion
6. Study 2
7. Study 3
8. Discussion
9. Conclusions

Adapted from Brian Paltridge's *Thesis and dissertation writing: An examination of published advice and actual practice* (pp. 135–138-141)

Traditional Complex Example

"Oral Biology Sample" Handout

Chapter One: Introduction

Chapter Two: Cellular Signaling Pathways Involved in Gamma-Herpes Virus Reactivation

Chapter Three: Gamma-Herpes Virus Viral-Host Protein Interaction Network

Chapter Four: Functional Validation of the Gamma-Herpes Virus PPI Network

Chapter Five: Summary of Current and Prospective Works

Chapter Six: Materials and Methods

References

2010. Gamma-herpes Virus and Host Interaction: A Chemical Genomics and Functional Proteomics Study of Viral-Host Interaction.

Compilation Based

1. Introduction
2. (Background to the Study)
3. Research Article 1
   - Intro, Method, Results, Discussion, Conclusions
4. Research Article 2
   - Intro, Method, Results, Discussion, Conclusions
5. Research Article 3
   - Intro, Method, Results, Discussion, Conclusions
6. Conclusions

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Compilation Example

“Neuroscience Sample” Handout

Chapter 1: Overview and Specific Aims
Chapter 2: Background and Significance
Chapter 3: Cortical Thickness Correlates with Functional Activation During Verbal Working Memory in Typically Developing Children and Adolescents
Chapter 4: Neurodevelopmental Changes in Verbal Working Memory Load-Dependency: An fMRI Investigation
Chapter 5: Altered Frontal-Parietal Functioning During Verbal Working Memory in Children and Adolescents with Heavy Prenatal Alcohol Exposure
Chapter 6: Mapping Cerebellar Vermal Morphology and Cognitive Correlates in Prenatal Alcohol Exposure
Chapter 7: Summary and Conclusions

2008. Verbal Working Memory Development and the Cerebro-Cerebellar System: Structural and Functional Neuroimaging Studies in Children with and without Prenatal Alcohol Exposure.

Activity on Structure

- Review the outline of your dissertation
  - Which of the structures best reflects your outline?
  - What parts have been written?
  - What is left to write?
  - Do you have a writing plan for the order in which you will write chapters/sections of the dissertation?

- Note: We recommend writing the body of the dissertation before writing global introductions, backgrounds/literature reviews, or conclusions

Writing Global Introductions/Backgrounds

Writing Global Introductions/Backgrounds

Things to Consider

- How do studies relate to one another? Build on one another? Is there a narrative that can be woven across the chapters?
- Is a systematic or narrative review related to your research a viable publication option?
- Does it make sense to have the background/lit review as part of the introduction chapter, or as its own chapter?
- How do you want to approach repetition across the introductions/background for individual chapters versus the introduction/background for the whole dissertation? (There are different options, but some repetition OK)

Writing Global Introductions/Backgrounds

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Language that Introduces Research

Move 1: *Establishing a Research Territory*

- Show that the general research area is important, central, interesting, problematic, or relevant in some way
- Introduce and review items of previous research in the area

Move 2: *Creating a Niche*

- Indicate a gap in the previous research, or extend previous knowledge in some way

Move 3*: Occupying the Niche*

- Outline purposes or state the nature of the proposed research
- List research questions or hypotheses
- Announce principal findings
- State the value of the proposed research (significance)
- Indicate the structure of the research paper

John Swales' "Creating a Research Space" (CARS) approach to introductions

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Move 1 Language: Establishing Research Territory

Indicating Centrality, Importance

Recently, there has been growing interest in . . . .

The study of . . . has become an important aspect of . . . .

Many recent studies have addressed . . . .

Summarizing Previous Research

Previous studies have suggested that . . . .

Various investigations have explored the relationship between . . . and . . . .

These findings were further supported by later studies that showed . . . .

Examples taken or adapted from John Swales' *Aspects of Article Introductions*

Move 2 Language: Establishing the Research Gaps

Negative Openings / Quasi-negative subject

However, little information . . .

little attention . . .

little data . . .

little research . . .

However, few studies . . .

few investigations . . .

few researchers . . .

No studies/None of the prior studies have . . . .

(but be careful with negative statements)

Examples taken or adapted from Swales and Feak's *Academic Writing for Graduate Students*

Move 2: Establishing the Research Gaps

Contrastive statements

The research has tended to focus on . . ., rather than on . . .

These studies have emphasized . . ., as opposed to . . .

Although considerable research has been devoted to . . ., rather less attention has been paid to . . .

Raise a question, hypothesis, or need

However, it remains unclear whether . . .

It would thus be of interest to learn how . . .

If these results could be confirmed, they would provide strong evidence for . . .

The findings suggest that this approach might be less effective when . . .

It would seem, therefore, that further investigations are needed in order to . . .

Adapted from “Writing Thesis and Dissertation Proposals” from Penn State University’s Graduate Writing Center

Move 3 Language: Filling the Research Gap

Indicating what the present study accomplishes

- Referring to the type of *text*—"This paper…"
  - paper, article, thesis, report, research note
- Referring to type of *investigation*—"This study…"
  - experiment, investigation, study, survey
- Referring to the text usually in present tense
- Referring to the investigation can be in either tense (past as you have already performed the study or present to make it seem new or current)

Examples taken or adapted from Swales and Feak's *Academic Writing for Graduate Students*

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John Swales' "Creating a Research Space" (CARS) approach to introductions

Cognitive development is a dynamic and prolonged process, extending from infancy through late adolescence and beyond. The acquisition of new cognitive capacities is a complex process, but on the most basic level includes the acquisition of visual perception abilities during infancy, sophisticated language facilities during early childhood, and reasoning and problem solving abilities during late adolescence. These cognitive changes are thought to be related to maturational changes in brain structure that unfold based on both genetic and environmental factors. Because of the availability of noninvasive Imaging tools such as Magnetic Resonance Imaging (MRI), much progress has been made in characterizing normative structural brain development in recent years. These studies are vital for understanding atypical brain and cognitive development among children with neurodevelopmental disorders, and also for parsing how environmental factors such as schooling and home life can influence cognitive development. In comparison, few studies have examined relationships between brain structure and brain function. Understanding developmental changes in function-structure relationships is of fundamental importance in the field or developmental cognitive neuroscience, as it may help elucidate the specific neurobiological changes underlying the maturation of a variety of cognitive processes.

Move 1

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Move 2

Move 3

Some Organizational Options for Lit Reviews

Topical (most common)

- Breaks up lit review into a number of subfields, subject areas, or approaches and discusses each individually

Distant-to-Close

- A kind of topical organization that starts with studies of general relevance to topic and ends with studies most relevant to topic

Chronological

- Reviews studies chronologically from older to most recent

Debate

- Emphasizes opposing positions in field, especially long-term

Seminal Study

- Starts with focused engagement and analysis of 1-2 key studies relevant to your project

Some Organizational Options for Lit Reviews

Topical (most common)

- Breaks up lit review into a number of subfields, subject areas, or approaches and discusses each individually

Language Patterns

- Three important areas of this fields have received attention: A, B, C
- A has been approached from two perspectives F and G
- The most important developments for B have been
- C has also been an important area of study in this field

Some Organizational Options for Lit Reviews

Distant-to-Close

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Language Patterns

- Method/Model M (somewhat similar to current research) addresses…
- Drawing upon method/model N (more similar to current research) can help…
- This study applies the procedure used in method/model O (most similar to current research) to…

Some Organizational Options for Lit Reviews

Chronological

- Reviews studies chronologically from older to most recent

Language Patterns

- This subject was first studied by X, who argued/found…
- In (date), Y modified/extended/contradicted X's work by…
- Today, research by Z represents the current state of the field.

Some Organizational Options for Lit Reviews

Debate

- Emphasizes opposing positions in field, especially longstanding controversies

Language Patterns

- There have been two (three, four, etc.) distinct approaches to this problem
- The first approach posits…
- The second approach argues that the first approach is wrong for three reasons. Instead, the second approach claims…

Some Organizational Options for Lit Reviews

Seminal Study

- Starts topic or section with extended description of an extremely important study that shaped field

Language Patterns

- The most important research on this topic was the study by X in (date)…
- Following X's study, research fell into two camps… extended X's work by building upon…

1.1 Cosmological Evidence

The most widely accepted theory for the origin and evolution of the Universe is the Big Bang model. According to this model, the Universe began approximately 10^{10} years ago from a hot dense state in thermodynamic equilibrium from which it has subsequently expanded. The Big Bang model is supported by several key pieces of observational evidence: the homogeneity and isotropy of the Universe on large scales, the redshift of distant galaxies, and the existence of the cosmic microwave background (CMB). During the last decade, cosmological data of increasing sensitivity and precisions have led to the development of more quantitative cosmological theories that are built on the Big Bang framework. The current most widely accepted theory is the cosmological concordance model known as ΛCDM

In the ΛCDM model the current energy density of the Universe is divided among three main components baryonic matter, cold dark matter (CDM), and dark energy. Baryonic matter consisting primarily of the constituents of normal atoms (protons, neutrons, and electrons) comprises only 5% of the total energy density while DM and dark energy comprise 23% and 72% respectively. To the precision of current measurements, the properties of dark energy are consistent with a *cosmological constant*, Λ, with an equation of state corresponding to a vacuum energy density, while the DM component is best modeled as a cold collisionless fluid. In the following sections the theoretical framework of the ΛCDM

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Chronology

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Signposting for dissertation intro

Follow-up Activities

- If you have a draft, analyze your introduction or literature review/background for these structural elements and use them to strengthen your narrative
- Look at an example introduction or lit review for a thesis in your field. Analyze the organization of the example and how the research is positioned.
- Work on a rough outline for your introduction or background chapter/lit review keeping these structural elements in mind.

General Methods Chapters

- Although less common, it could be useful if your chapters have the same or similar methods
- Easier to do if you wrote a dissertation proposal for your committee with all of the methods in one section (and not many changes are needed at this point)
- Findings chapters are basically the manuscript structure without methods (traditional complex structure)
- General methods could be before or after the findings chapters (probably more common before)

General Conclusions

- Two primary features of global dissertation conclusions:
  1. Summary of findings
  2. Future directions

- Structure by aim or by article/study

- Length and structure also depend on how interconnected your articles/studies are

Conclusion - Future Directions and Implications

Few studies have examined the role of the cerebellum in cognitive development. Study 2 employed a verbal WM task to investigate cerebellar contributions to cognitive development, because studies in adults have shown that cerebellar activation is robust during performance within this cognitive domain. Previous studies investigating developmental changes in visual-spatial (Scherf et al., 2006) and object (Ciesielski et al., 2006) WM reported decreasing cerebellar activity with age. Study 2 demonstrated that cerebellar activation increased with age during linear-load dependent WM. This finding is consistent with known age-related improvements in processes that the cerebellum is postulated to contribute to, namely phonological storage and covert speech (Desmond & Fiez, 1998). These changes may be functionally distinct from developmental changes in cerebellar involvement in other types of WM and suggest a conceptualization of the rote of the cerebellum in *verbal* WM development. Future studies will be needed to compare cerebellar contributions to verbal and visual spatial WM development within the same group of individuals.

Conclusion - Future Directions and Implications

Language at the beginning of this paragraph is very similar to General Intro

What was novel and what other studies are required

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Follow-up Activity

- If you do not have a global conclusion yet, how might you incorporate:
  (1) summary of findings?
  (2) future directions?
  (3) limitations?

  What information would you include?
  How would you organize the info?

- If you have a draft conclusion, update or edit your draft based on what we have discussed so far

Revision: How do you edit and integrate your articles into thesis chapters?

- Give yourself enough time for revision
- Revising and editing for organization and structure:
  - “Flow” handout
- Work on an outline of your whole document
- When appropriate, remove redundancies, but don’t worry too much about them.

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Copyright and Obtaining Permissions

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- Reprints typically require more work to insert into the thesis (formatting and pagination)
- Word version of published paper is easier
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- You also need permission from your co-authors

Formatting

General Tips

- Table of contents is very time consuming
  - Do front matter in separate pages and then compile
- Tables and figures:
  - Probably should not repeat across chapters
  - While revising, keep them at the end of each chapter rather than embedded in text; embed in text only at the very end
  - Captions should be on the same page
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The Dissertation Abstract

- Should be written last
- Often published separately—more people will read your abstract than any other portion of your dissertation
- Can be short form (half a page) or longer (1.5 pages), double-spaced (200-500 words, depending on field and committee—look at previous dissertations chaired by your advisor)

Adapted from W. L. Belcher's *Writing Your Journal Article in 12 Weeks: A Guide to Academic Publishing Success.*

Writing the Dissertation Abstract

- Should include:
  - Rationale (gap in field, research question, main problem to be solved, why it is significant)
  - What your project addressed—in a dissertation, this is often broken down by chapter
  - Methodology (not in detail, but general methods)
  - Results
  - Conclusions/implications
  - A statement that the dissertation will address applications and/or future directions

Adapted from W. L. Belcher's *Writing Your Journal Article in 12 Weeks: A Guide to Academic Publishing Success.*

Writing the Dissertation Abstract

- Should not include:
  - Quotes
  - Citations
  - Extraneous wording like “we hope to…” or “this dissertation seeks to…”
  - Unexplained acronyms or terminology
  - Anything that your reader would need the whole dissertation to understand
  - Anything that does not tell the story of your dissertation

Adapted from W. L. Belcher’s *Writing Your Journal Article in 12 Weeks: A Guide to Academic Publishing Success.*

Neural Spike Sorting in Hardware:
From Theory to Practice

Short Form Abstract

Brain-machine interfaces require real-time, wireless signal acquisition systems. However, wireless transmission of raw data is impossible for high-channel-count systems given the power constraints. Data rates could be reduced, thereby enabling wireless data transmission, by performing spike sorting—mapping each recorded action potential to the neuron that generated it—on a DSP at the recording site and transmitting only the sorting results. Our first objective was to design such a DSP. We first developed a standardized dataset and methodology in order to perform an extensive, unbiased comparison of published spike-sorting algorithms to determine which would be most appropriate for hardware implementation. We then considered various implementation issues, such as whether analog or digital spike detection is more efficient and how best to quantize neural signals. This work led to two low-power digital spike-sorting chips.

Our second objective was to provide an offline solution for the research setting that would accelerate the processing of data that has already been recorded using conventional data-acquisition systems. Here, we present an FPGA-based spike-sorting platform that can increase the speed of offline spike sorting by at least 25 times, effectively reducing the time required to sort data from long experiments from several hours to just a few minutes. We attempted to preserve the flexibility of software by implementing several different algorithms in the design, and by providing user control over parameters such as spike detection thresholds.

Portion of Long Form Abstract

The four studies comprising this dissertation combine structural and functional brain imaging methodologies in the study of cerebro-cerebellar networks and verbal WM development Structural and functional development is examined in typically developing individuals, and those with prenatal alcohol exposure, a group known to have neuroanatomical and cognitive abnormalities relevant to cerebro-cerebellar verbal WM networks. Study 1 examines relationships between cortical thickness and WM-related functional activation in typically developing children and adolescents. Findings demonstrate that more mature cortical morphologies are associated with mature patterns of functional activation in frontal and parietal regions thought to be Important for verbal WM. Study 2 was designed to fully characterize the nature of mature functional activation patterns for verbal WM by examining age related changes in functional activation across childhood, adolescence, and adulthood. Results indicated that increases in parietal and cerebellar activation are a critical component of verbal WM development. Study 3 further explored this idea by evaluating the neural basis of verbal WM functioning in individuals with prenatal alcohol exposure. Findings suggested that that frontal-parietal processing during verbal WM is less efficient in alcohol exposed Individuals, consistent with known patterns of brain structural abnormalities in this population. Study 4 examined cerebellar vermal morphology in individuals with prenatal alcohol exposure in an effort to link cerebellar anatomy with cognition.

Good Practices

Review Models

- Review examples of prior dissertations from your lab/advisor/department/field
- ProQuest is very easy to navigate, and full dissertations are available for download
- In ProQuest you can easily search by advisor or committee member, as well as school and field
- eScholarship also provides full dissertations if you know enough info (but not searchable by advisor)

Dissertation Support

- UCLA GWC writing appointments
  (50 minutes, consultants available from many fields)

- UCLA CAPS Dissertation Writer's (Support) Group:
  Contact The Counseling Center for latest info

- Writing groups (GWC sometimes organizes writing groups, especially in spring/summer)