Academic writing and scientific data collection

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Why?

- Purpose:

Why?

- Purpose:
  - What are the essentials of academic writing, and what should be avoided?
  - Practical guidelines for effective writing

Purpose of writing

- Convince the audience of your conclusions and prototype's validity using **clear, evidence-based reasoning**
- Focus on **what you did and why it matters**, not how hard you worked.

Purpose of writing

- Why this work matters and what problem it addresses? (Introduction, motivation)?
- What have others done in this area (State of the art)?
- How the project was conducted and the approach taken (Methods)?
- How well does the system perform (Results)?
- How does the result align with the project objectives, and what is the value of your project (Discussion, Conclusion)?

Structure

- Abstract
- Introduction
- Engineering specifications
- Method
- Results
- Discussion / Conclusion

Introduction

- **Why** this work matters and **what problem** it addresses?
- Capture the reader's **interest** and show the **importance** of the work

- Provide **background** to help the reader understand the context
- Clearly state the **focus of your project**
- Identify what has **already been done** and what **gaps** still exist
- Explain **your specific approach** to address the problem

Introduction - Motivation

- Provide background to help the reader understand the context
  - Begin with general statement about the broader field
  - Explain the current state of the technology or problem domain
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Soft robot need variable stiffness

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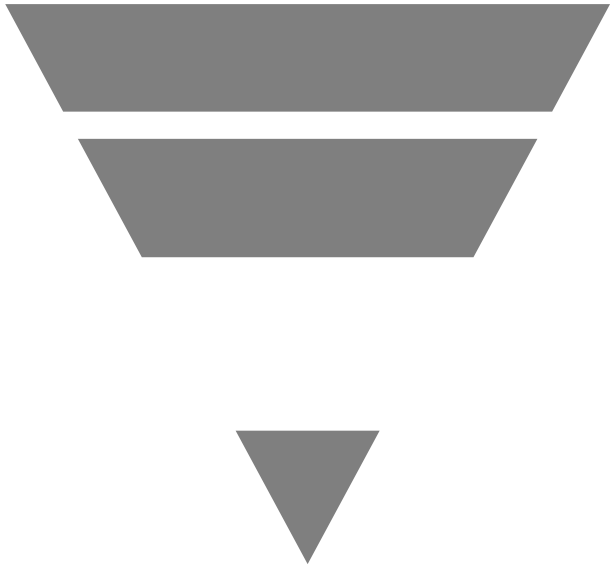
Soft robot is ~~

Soft robot is good for ~~~.
They have gained significant attention in ~~~

Soft robot need variable stiffness



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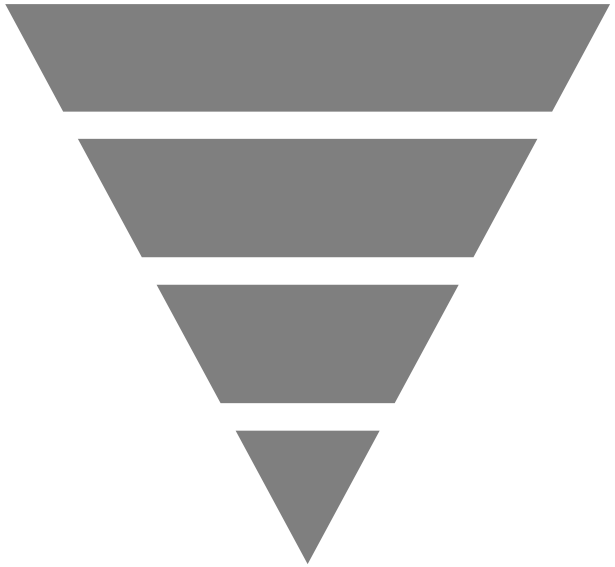
But capability of soft robot is still limited because ~~~

Soft robot need variable stiffness



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Soft robot will have a high value in ~~~ with variable stiffness ability

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- Identify what has already been done and what gaps still exist
  - Mention briefly what others have attempted
  - Highlight the limitations or gaps in existing solutions

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Soft robots have demonstrated the ability to achieve variable stiffness through ~~~

However, still ~~~~ challenges exist.

Introduction – Project introduction

- Explain your specific approach to address the problem
  - What is the exact goal of your project?
  - What makes your project unique or necessary?
  - Describe the general method or system you propose.
  - Keep it brief—details come later in the methodology section.

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In this research, we suggest ~~~

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- Missing logical flow

Engineering specification

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- Clearly, quantitatively, and verifiably

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  - Functional requirements: what the system must do
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  - Environmental condition: where and how the system will operate

Engineering specification

- Be specific: avoid terms like fast, small, or better
- Use measurable values (quantitative)
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Detection accuracy	>= 95%
Response time	<= 0.2 seconds from detect to actuation
Max. dimension	20 cm * 15cm * 10cm
Speed	0.3 to 0.5 m/s average speed

Method

- A recipe of your project
- Readers to assess the validity and feasibility of the approach

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- Briefly mention alternative methods you considered
- Focus on the one you selected and explain your reasoning

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- Selection and source
  - Hardware: Materials, sensors, microcontrollers, mechanical parts etc.
  - Software: Libraries, platforms etc.

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- Selection and source
  - Hardware: Materials, sensors, microcontrollers, mechanical parts etc.
  - Software: Libraries, platforms etc.
- Your design and approach
  - System architecture
  - Flowcharts or block diagrams
  - Circuit diagram
  - Mechanical assembly
  - Code structure or algorithm (pseudo code)

Method

- Experiment setup
  - How did you test the system?
  - Describe conditions, setups, inputs etc.

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  - Describe conditions, setups, inputs etc.
- Assumptions
  - Mention any assumptions made during development

Method

- Be specific and measurable
- Always explain the reasoning behind your choices

Abstract

- Suggest to write last
- Accurate reflection of the manuscript
- *Why did you start? What did you do…? What did you find? What do your findings mean?*

  -Maeve O'Connor-

O'Connor, M. 1991. *Writing successfully in science,* London, Routledge.

Abstract

- So, you will need to consider the following:
  - Use short sentences
  - Use simple, specific words
  - Edit out 'waste' words

Abstract

- Common errors
  - Background too long
  - Question omitted or vague
  - Answer not stated
  - A result summarized (‘X was more effective than X’) without numerical data to support it (60% vs. 20% … statistics)
  - Too many results – just the main ones because you can’t get all results in the abstract
  - ‘Conclusion creep’ – the abstract conclusion contains something different from or in addition to the main manuscript conclusion.

General writing rules

- All figures should be mentioned in the text
- Cite all sources properly
- Use clear, precise and concise sentences
  - Avoid vague terms like “better”, “fast”, or “good”
- Ensure logical structure and flow
- Define all acronyms and technical terms
  - First appearing one
- Include units and labels on all measurements and figures
  - Match the range of value of graphs if comparison between is important
- Avoid plagiarism