Scientific Writing: Structure and Flow

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Inspiration

"clear thinking can emerge from clear writing" – Scott Montgomery

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Internal Structure

- OCAR defines the overall structure
  - Opening - grabs attention with characters and setting
  - Challenge - creates uncertainty and curiosity
  - Action - provides info and develops story
  - Resolution - rewards the reader and relieves the tension
- This creates an overall story arc

Development: action

Build tension

Relieve tension
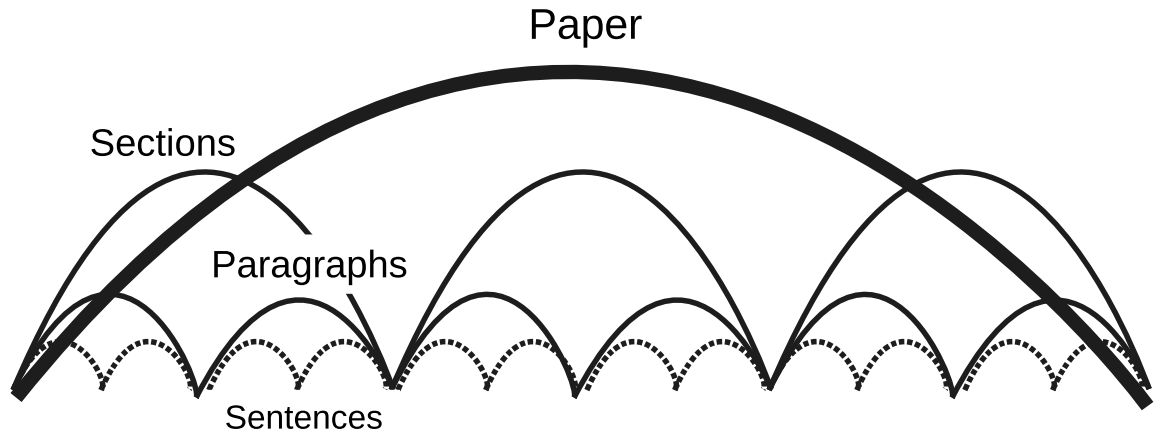
Opening

Resolution

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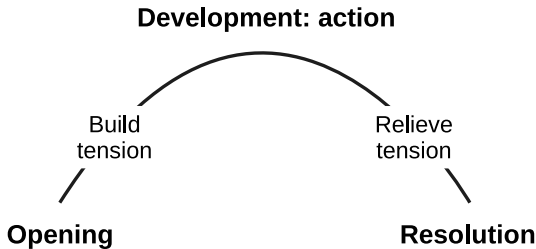
Internal Structure

- A story has a spiral structure
  - moving forward and returning to where it started at the end

- Successful writing creates that flow and that arc

- A paper's structure is:
  - sections, composed of
  - subsections, composed of …
  - … paragraphs, composed of
  - sentences

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Internal Structure

Internal Structure

- Creating arcs compartmentalizes your thoughts and makes them manageable
- For each new point we build a structure and form a small story arc
- These arcs are then linked together

Complete, linked arcs

- This structure works on the premise that the beginning and endings are power positions
  - These positions help guide the reader
- Try to root out extraneous thoughts that break the serial nature

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Effective Arcs

- The prior concepts told us how to build arcs
- We also can understand that these same principles apply at all levels of organization

- Evaluating Internal Structure
  - Does each unit make a single, clear point?
  - When several paragraphs together form a section, are the linkages among them clear?
  - Has every extraneous thought that breaks the serial arc structure been removed?
  - When you introduce a topic, do you resolve the discussion before introducing a new topic?
  - Is every major unit of the work defined by either a subhead or clear opening text
- A "No" to any question indicates you still need to work on the structure.

Paragraphs

Paragraphs are the "unit of composition"

- Three forms:
  - TS-D - Topic Sentence-Development (point-first)
  - LD - Lead/Development (point-first)
  - LDR - Lead/Development (point-last)
- Bad Paragraphs
  - fail to tell stories
  - lack coherent structure

- Fixing Paragraphs
  ❶ Determine the real story
  ❷ Pick either a point-first or point-last structure
  ❸ Pull apart story threads to clarify relationships
- Shorter tends to be better than long

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Sentences

- A sentence has components: Subject, Verb, Object
- These map to story units that carry out the OCAR functions:
  - O – Opening: who is the story about? = Subject
  - C/A – Challenge/Action: what happened = Verb
  - R – Resolution: what was its outcome? = Object

Topic and Stress

- **Topic**: critical opening position
- **Stress**: critical resolution position

- A sentence should focus on a single character, the topic.
  - Readers interpret the beginning of the sentence as the topic
- The last words of a sentence carry the greatest weight
  - put the stress of the sentence here
- If you change this ordering, you change the meaning.

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Managing Sentences

- Connect the Subject and Verb
  - The verb should immediately follow the subject
  - Otherwise it is hard to follow
- Managing complex sentences, boils down to uncluttering the Topic, Action, Stress structure.
- **Unburying the Stress**
  1. Fix the topic
     - should be short and clear
     - main verb should immediately follow
  2. Fix the Stress
     - this is where the key message should be
  3. Finish
     - package everything else in the middle

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Flow

2 Approaches for Creating Flow

❶ Write paragraphs where all sentences are on the same team
  – Coherent theme
  – Working together for a common goal

❷ Write sentences so the team forms a relay
  – Each passes a baton at the transition
  – Allowing an idea to flow cleanly from start to finish

• Paragraph opening sets the theme
  – If all sentences have a topic that fits the theme they will hang together
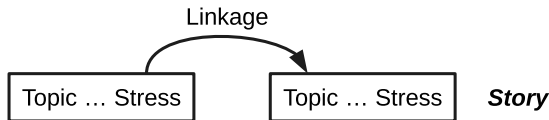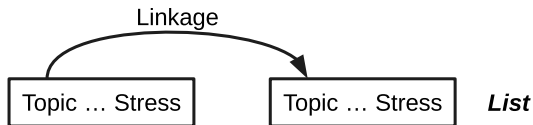
Flow

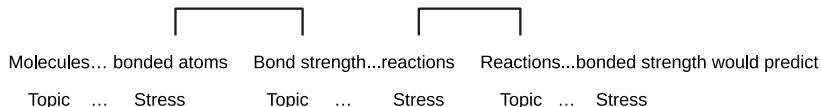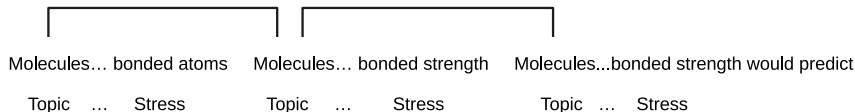Challenge: Ensuring readers do not derail at the transition

- Help them follow you through your arguments and between story arcs
- Sentences need to link seamlessly to each other
- Each sentence must tell a coherent story, while functioning to advance the larger story
- You must tie together stress and top, weaving old and new information in an unbroken chain
- Paragraphs are linked similarly

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Flow

Molecules… bonded atoms

Topic … Stress

Molecules… bonded strength

Topic … Stress

Molecules...bonded strength would predict

Topic … Stress

Molecules… bonded atoms

Topic … Stress

Bond strength...reactions

Topic … Stress

Reactions...bonded strength would predict

Topic … Stress

Linkage

Topic … Stress → Topic … Stress *List*

Linkage

Topic … Stress → Topic … Stress *Story*

- Avoid list structure if possible
- Short lists can be okay
- Long lists confuse readers

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Energizing Writing

- Good stories are driven by action
  - "Show, don't tell"

- Action is the job of verbs, use them well
  - Otherwise your writing is overburdened

Overburdening your Writing

❶ Passive Voice

❷ Fuzzy Verbs

❸ Nominalizations

Passive vs. Active Voice

Active Voice

```
John        called       Jane
Actor       Action       Acted-on
Subject     Verb         Object
```

Passive Voice

```
Jane        was called   by John
Acted-on    Action       Actor
Subject     Verb         Object
```

Example:

- Active: Soil porosity influences water retention.
- Passive: Water retention in soil is influenced by porosity.

Example:

- Active: A magnetospheric source produces variable electric fields.
- Passive: Variable electric fields are produced by a magnetospheric source.

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Fuzzy Verbs

- **Fuzzy Verbs**: say that something happened but not what
  - Steal energy by telling and not showing

- **Action Verbs**: powerful, concrete storytelling tools.

Fuzzy Verbs (Weak)			
Occur	Facilitate	Conduct	Implement
Affect	Perform		

Action Verbs (Strong)			
Modify	Increase	React	Accelerate
Accomplish	Decrease	Inhibit	Migrate
Create	Invade	Disrupt	

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Nominalizations

- You can kill the entire action by turning a verb into a noun.

Examples

Verb	Nominalization
Move	Movement
Differ	Difference
Suggest	Suggestion
Interact	Interaction
Analyze	Analysis
Develop	Development

Words

- Choosing words is not easy.
- English has amassed works from many sources
- Academics have a fondness for long, heavy words
  – but this is not necessary to be effective

Jargon vs. Technical Term

- **Jargon:** (A) a term that refers to a schema the reader does not hold. (B) A term for which there is an adequate plain language equivalent

- **Technical term:** (A) a term that refers to a schema the reader **does** hold. (B) A term for which either there is no plain language equivalent or where using it would be confusing.

- Remember to define terms before using them (and at the end of a sentence), and in the right place to ensure flow.

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Condensing

- Condensing keeps your ideas from becoming
  - buried in words, cumbersome sentences, and extraneous info

- Prevents your readers from getting confused and frustrated

- There are two approaches
  - ❶ Tighten up your ideas and language (harder)
  - ❷ Formatting tricks (cheating)

Condensing Strategy

- Identify the following targets for the [Delete] key
  - Redundancies
  - Obvious
  - Modifiers: adjectives and adverbs
  - Metadiscourse
  - Verbosity

Condensing

Redundancies

- Sometimes we use several words where one is all that is needed:
  - Ex: "I will develop, test, and apply a new synthetic approach to produce photovoltaic plastics."
    - Testing is part of developing
    - "synthetic" and "produce" both refer to making things
  - Revision: "I will develop a new approach to produce photovoltaic plastics."

Obvious

- Remove ideas that are well known or implied and so don't need to be said
  - Ex: "There is evidence that X17-production can be associated with enzyme induction (Chu et al. 2008)."
    - If there wasn't evidence for this, you wouldn't have said it (and there wouldn't be a citation)
  - Revision: "X-17 production can be associated with enzyme induction (Chu et

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Condensing

Modifiers: Adjectives and Adverbs

- These are not your friends
- Good words do not need modifiers
- Eliminate unnecessary modifiers to make your writing stronger and tighter

Good Modifiers

- These don't just reinforce but clarify or define their referent
- Some, rather than amplifying, alter the meaning. These are powerful.

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Condensing

Metadiscourse

- Discussing the discussion:
  - We found that…
  - We argue that…
  - Our initial hypothesis was that…
  - These data may indicate…
  - To conclude…
- Avoid unnecessary metadiscourse

Verbosity

- the sum of multiple types of filler
- sentences that ramble on endlessly
- Indication of an author that is
  - insecure
  - afraid to make a definitive statement
  - can't separate their mental processes from the story

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Editing

- **S**tructure: get the structure of the story into shape
- **C**larity: ensure that your ideas are clear and concrete
- **F**low: make the ideas flow, linking one thought to the next
- **L**anguage: make it sound good

- These overlap, and require many iterations

- Final Technique: **Read it out loud**

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Are there any questions?

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Optimal Publications