

PAT 514 (Winter 2025)

Contemporary Software Techniques in Performing Arts Technology

How to write a paper?

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Discussion

- What's the **most struggling part** when you last wrote a paper?
- **How much writing** does it involve as a researcher?
- **Why do we need to write?**
 - Publications? Fellowship? Funding? Impact? Career? Show-off?
 - Improving the quality of writing actually **improves the quality of thought.**

The Science of Scientific Writing (Gopen & Swan)

- It does not matter how pleased an author might be to have converted all the right data into sentences and paragraphs; it matters only **whether a large majority of the reading audience accurately perceives what the author had in mind.**
- Therefore, in order to understand how best to improve writing, we would do well to **understand better how readers go about reading.**

Writing with the **Reader** in Mind: Expectation & Context

Writing with the **Reader** in Mind

- **Readers do not simply read; they interpret.** Any piece of prose, no matter how short, may "mean" in 10 (or more) different ways to 10 different readers.

t(time)=15', T(temperature)=32°, t=0', T=25°; t=6', T=29°; t=3', T=27°; t=12', T=32°; t=9'; T=31°

Context

time (min)	temperature(°C)
0	25
3	27
6	29
9	31
12	32
15	32

Expectation

temperature(°C)	time (min)
25	0
27	3
29	6
31	9
32	12
32	15

Expectation & Context

- Since we read from left to right, we **prefer the context on the left**, where we can more effectively familiarize the reader.
- We **prefer the new, important information on the right**, since its job is to intrigue the reader.

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0	25
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---	----

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15	32
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Writing with the **Reader** in Mind

- Information is interpreted more easily and more uniformly if **it is placed where most readers expect to find it.**
- A research article, for example, is generally divided into recognizable sections, sometimes labeled Introduction, Experimental Methods, Results and Discussion.
- If these structural expectations are continually violated, readers are forced to **divert energy from understanding the content of a passage to unraveling its structure.**

Discussion

- **How do you read a paper?**
 - Take a moment to reflect the next time you read a paper
- What's the difference between the **Results** and **Discussion** sections?
- When writing a paper, have you thought about **how one might read and interpret your writing?**

Reader Expectations for the Structure of Prose

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The smallest of the URF's (URFA6L), a 207-nucleotide (nt) reading frame overlapping out of phase the NH₂-terminal portion of the adenosinetriphosphatase (ATPase) subunit 6 gene has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene. The functional significance of the other URF's has been, on the contrary, elusive. Recently, however, immunoprecipitation experiments with antibodies to purified, rotenone-sensitive NADH-ubiquinone oxidoreductase [hereafter referred to as respiratory chain NADH dehydrogenase or complex I] from bovine heart, as well as enzyme fractionation studies, have indicated that six human URF's (that is, URF1, URF2, URF3, URF4, URF4L, and URF5, hereafter referred to as ND1, ND2, ND3, ND4, ND4L, and ND5) encode subunits of complex I. This is a large complex that also contains many subunits synthesized in the cytoplasm.*

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Reader Expectations for the Structure of Prose

The smallest of the URF's (URFA6L), a [A] [redacted]
[redacted]
[redacted] has been identified as
the [B] [redacted] subunit
8 gene. The functional significance of the other URF's has been, on the
contrary, elusive. Recently, however, [C] [redacted] experiments
[redacted]
[redacted]
[redacted], as well as [D] [redacted]
[redacted] studies, have indicated that six human URF's ([E] [redacted]
[redacted]
[redacted]) encode subunits of complex I. This is a large
complex that also contains many subunits synthesized in the cytoplasm.*

Subject-Verb Separation

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The smallest of the URF's (URFA6L), a 207-nucleotide (nt) reading frame overlapping out of phase the NH₂ terminal portion of the adenosinetriphosphatase (ATPase) subunit 6 gene has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene. The functional significance of the other URF's has been, on the contrary, elusive. Recently, however, immunoprecipitation experiments with antibodies to purified, rotenone-sensitive NADH-ubiquinone oxidoreductase [hereafter referred to as respiratory chain NADH dehydrogenase or complex I] from bovine heart, as well as enzyme fractionation studies, have indicated that six human URF's (that is, URF1, URF2, URF3, URF4, URF4L, and URF5, hereafter referred to as ND1, ND2, ND3, ND4, ND4L, and ND5) encode subunits of complex I. This is a large complex that also contains many subunits synthesized in the cytoplasm.*

Breaking Sentences?

The smallest of the URF's (URFA6L), a 207-nucleotide (nt) reading frame overlapping out of phase the NH₂-terminal portion of the adenosinetriphosphatase (ATPase) subunit 6 gene has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene.

The smallest of the URF's is URFA6L, a 207-nucleotide (nt) reading frame overlapping out of phase the NH₂-terminal portion of the adenosinetriphosphatase (ATPase) subunit 6 gene; it has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene.

Are the Details Actually Important?

The smallest of the URF's (URFA6L), a 207-nucleotide (nt) reading frame overlapping out of phase the NH₂-terminal portion of the adenosinetriphosphatase (ATPase) subunit 6 gene has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene.

The smallest of the URF's (URFA6L) has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene.

Which one is Better?

- **Only the author could tell us** which of these revisions **more accurately reflects his/her intentions.**

The smallest of the URF's is URFA6L, a 207-nucleotide (nt) reading frame overlapping out of phase the NH₂-terminal portion of the adenosinetriphosphatase (ATPase) subunit 6 gene; it has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene.

The smallest of the URF's (URFA6L) has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene.

Stress Position

Stress Position

- It is a linguistic commonplace that readers naturally **emphasize the material that arrives at the end of a sentence.**
- We tend to take something like a "**mental breath**" as we begin to read each new sentence, thereby summoning the tension with which we pay attention to the unfolding of the syntax. As we recognize that the sentence is drawing toward its conclusion, we begin to exhale that mental breath. The exhalation produces a sense of emphasis.

Putting emphatic material **NOT** at the stress position?

- First, the reader might find the stress position occupied by material that clearly is not worthy of emphasis. In this case, **the reader must discern**, without any additional structural clue, **what else in the sentence may be the most likely candidate for emphasis**.
- The reader may find the stress position occupied by something that does appear capable of receiving emphasis, **even though the writer did not intend to give it any stress**.

Stress Position

- The stress position can change in size from sentence to sentence. Sometimes it consists of a single word; sometimes it extends to several lines. The definitive factor is this: **The stress position coincides with the moment of syntactic closure.**

Example

Subject

The smallest of the URF's (URFA6L), a 207-nucleotide (nt) reading frame overlapping out of phase the NH₂-terminal portion of the adenosinetriphosphatase (ATPase) subunit 6 gene

Verb

has been identified

Stress position

as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene.

Subject

Verb

The smallest of the URF's is URFA6L, a 207-nucleotide (nt) reading frame overlapping out of phase the NH₂-terminal portion of the

Verb

Stress position

adenosinetriphosphatase (ATPase) subunit 6 gene

it has been identified

Stress position

as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene.

Why should we Care?

- Had the author placed all stress-worthy material in stress positions, we as a reading community would have been far more likely to interpret these sentences uniformly.
- **We cannot succeed in making even a single sentence mean one and only one thing; we can only increase the odds that a large majority of readers will tend to interpret our discourse according to our intentions.**

Another Example

Subject

Recently, however, immunoprecipitation experiments with antibodies to purified, rotenone sensitive NADH ubiquinone oxido reductase [hereafter referred to as respiratory chain NADH dehydrogenase or complex I] from bovine heart, as well as enzyme fractionation studies have indicated that six human URF's (that is, URF1, URF2, URF3, URF4, URF4L, and URF5, hereafter referred to as ND1, ND2, ND3, ND4, ND4L and ND5) encode subunits of complex I.

Verb

Stress
position

Before the Revision

Subject

The smallest of the URF's (URFA6L), a 207-nucleotide (nt) reading frame overlapping out of phase the NH₂-terminal portion of the **Verb** adenosinetriphosphatase (ATPase) subunit 6 gene has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene. The functional significance of the other URF's has been, on the contrary, elusive. Recently, however, immunoprecipitation experiments with antibodies to purified, rotenone-sensitive NADH-ubiquinone oxidoreductase [hereafter referred to as respiratory chain NADH dehydrogenase or complex I] from bovine heart, as well as enzyme fractionation studies have indicated that six human URF's (that is, URF1, URF2, URF3, URF4, URF4L, and URF5, hereafter referred to as ND1, ND2, ND3, ND4, ND4L, and ND5) encode subunits of complex I. This is a large complex that also contains many subunits synthesized in the cytoplasm.*

After the Revision

Subject

Verb

The smallest of the URF's, URFA6L, has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene; but the functional significance of other URF's has been more elusive. Recently, however, several human URF's have been shown to encode subunits of rotenone-sensitive NADH-ubiquinone oxido-reductase. This is a large complex that also contains many subunits synthesized in the cytoplasm; it will be referred to hereafter as respiratory chain NADH dehydrogenase or complex I. Six subunits of Complex I were shown by enzyme fractionation studies and immunoprecipitation experiments to be encoded by six human URF's (URF1, URF2, URF3, URF4, URF4L, and URF5); these URF's will be referred to subsequently as ND1, ND2, ND3, ND4, ND4L and ND5.

Discussion

- **Who are the readers** of your paper?
- **Why are they reading** your paper?
- What should the readers **take away from your writing**?

Topic Position

Stress Position vs Topic Position

- **Stress position**

- **Save the best for last!**

- In the stress position the reader **needs and expects closure and fulfillment**

- **Topic position**

- **First things first!**

- In the topic position the reader **needs and expects perspective and context**

Active vs Passive Voice

- **“Bees disperse pollen.”** → something about bees
- **“Pollen is dispersed by bees.”** → something about pollen

Linkage & Context

- Readers also expect the material occupying the topic position to provide them with **linkage (looking backward)** and **context (looking forward)**

Topic Position

Topic position

Large earthquakes along a given fault segment do not occur at random intervals because it takes time to accumulate the strain energy for the rupture. The rates at which tectonic plates move and accumulate strain at their boundaries are approximately uniform. Therefore, in first approximation, one may expect that large ruptures of the same fault segment will occur at approximately constant time intervals. If subsequent main shocks have different amounts of slip across the fault, then the recurrence time may vary, and the basic idea of periodic mainshocks must be modified. For great plate boundary ruptures the length and slip often vary by a factor of 2. Along the southern segment of the San Andreas fault the recurrence interval is 145 years with variations of several decades. The smaller the standard deviation of the average recurrence interval, the more specific could be the long term prediction of a future mainshock.

How to **Fix** it?

- The **backward-linking old information** appears in the **topic position**.
- The **person, thing or concept whose story it is** appears in the **topic position**.
- The **new, emphasis-worthy information** appears in the **stress position**.

To Flip or Not to Flip?

Large earthquakes along a given fault segment do not occur at random intervals because it takes time to accumulate the strain energy for the rupture. The rates at which tectonic plates move and accumulate strain at their boundaries are approximately uniform. Therefore, in first approximation, one may expect that large ruptures of the same fault segment will occur at approximately constant time intervals. If subsequent main shocks have different amounts of slip across the fault then the recurrence time may vary, and the basic idea of periodic mainshocks must be modified. For great plate boundary ruptures the length and slip often vary by a factor of 2. Along the southern segment of the San Andreas fault the recurrence interval is 145 years with variations of several decades. The smaller the standard deviation of the average recurrence interval, the more specific could be the long term prediction of a future mainshock.

After Revision

Topic position

Large earthquakes along a given fault segment do not occur at random intervals because it takes time to accumulate the strain energy for the rupture. The rates at which tectonic plates move and accumulate strain at their boundaries are roughly uniform. Therefore, nearly constant time intervals (at first approximation) would be expected between large ruptures of the same fault segment. [However?], the recurrence time may vary; the basic idea of periodic mainshocks may need to be modified if subsequent mainshocks have different amounts of slip across the fault. [Indeed?], the length and slip of great plate boundary ruptures often vary by a factor of 2. [For example?], the recurrence intervals along the southern segment of the San Andreas fault is 145 years with variations of several decades. The smaller the standard deviation of the average recurrence interval, the more specific could be the long term prediction of a future mainshock.

Why is it Hard?

- Most writers produce prose linearly (from left to right) and through time.
- As they begin to formulate a sentence, often **their primary anxiety is to capture the important new thought before it escapes.**
- Quite naturally **they rush to record that new information on paper, after which they can produce at their leisure contextualizing material that links back to the previous discourse.**

Rule of Thumb

- Put in the topic position the old information that links backward; put in the stress position the new information you want the reader to emphasize.

Discussion

- How to choose a proper **subject**?
- Why do we need **topic sentences**? What are their purpose?

Perceiving Logical Gaps

Example

Subject

New
info

The enthalpy of hydrogen bond formation between the nucleoside bases 2'deoxyguanosine (dG) and 2'deoxycytidine (dC) has been determined by direct measurement. dG and dC were derivatized at the 5' and 3'

Verb

Potential
stress
positions

hydroxyls with triisopropylsilyl groups to obtain solubility of the nucleosides in non-aqueous solvents and to prevent the ribose hydroxyls from forming hydrogen bonds. From isoperibolic titration measurements, the enthalpy of dC:dG base pair formation is -6.65 ± 0.32 kcal/mol.

After Revision

Subject

Verb

We have directly measured the enthalpy of hydrogen bond formation between the nucleoside bases 2'deoxyguanosine (dG) and 2'deoxycytidine (dC). dG and dC were derivatized at the 5' and 3' hydroxyls with triisopropylsilyl groups; these groups serve both to solubilize the nucleosides in non-aqueous solvents and to prevent the ribose hydroxyls from forming hydrogen bonds. From isoperibolic titration measurements, the enthalpy of dC:dG base pair formation is -6.65 ± 0.32 kcal/mol.

**New
info**

The Logical Gaps

We have directly measured the enthalpy of hydrogen bond formation between the nucleoside bases 2'deoxyguanosine (dG) and 2'deoxycytidine (dC). dG and dC were derivatized at the 5' and 3' hydroxyls with triisopropylsilyl groups; these groups serve both to solubilize the nucleosides in non-aqueous solvents and to prevent the ribose hydroxyls from forming hydrogen bonds. From isoperibolic titration measurements, the enthalpy of dC:dG base pair formation is -6.65 ± 0.32 kcal/mol.

Derivation

Measurement

Fixing The Logical Gaps

We have directly measured the enthalpy of hydrogen bond formation between the nucleoside bases 2'deoxyguanosine (dG) and 2'deoxycytidine (dC). dG and dC were derivatized at the 5' and 3' hydroxyls with triisopropylsilyl groups; these groups serve both to solubilize the nucleosides in non-aqueous solvents and to prevent the ribose hydroxyls from forming hydrogen bonds. Consequently, when the derivatized nucleosides are dissolved in non-aqueous solvents, hydrogen bonds form almost exclusively between the bases. Since the interbase hydrogen bonds are the only bonds to form upon mixing, their enthalpy of formation can be determined directly by measuring the enthalpy of mixing. From our isoperibolic titration measurements, the enthalpy of dG:dC base pair formation is -6.65 ± 0.32 kcal/mol.

Fixing The Logical Gaps

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Locating the Action

Who owns the story?

Transcription of the 5S RNA genes in the egg extract is TFIIIA-dependent. This is surprising, because the concentration of TFIIIA is the same as in the oocyte nuclear extract. The other transcription factors and RNA polymerase III are presumed to be in excess over available TFIIIA because tRNA genes are transcribed in the egg extract. The addition of egg extract to the oocyte nuclear extract has two effects on transcription efficiency. First, there is a general inhibition of transcription that can be alleviated in part by supplementation with high concentrations of RNA polymerase III. Second, egg extract destabilizes transcription complexes formed with oocyte but not somatic 5S RNA genes.

Who owns the story?

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After Revision

In the egg extract, the availability of TFIIIA limits transcription of the 5S RNA genes. This is surprising because the same concentration of TFIIIA does not limit transcription in the oocyte nuclear extract. In the egg extract, transcription is not limited by RNA polymerase or other factors because transcription of tRNA genes indicates that these factors are in excess over available TFIIIA. When added to the nuclear extract, the egg extract affected the efficiency of transcription in two ways. First, it inhibited transcription generally; this inhibition could be alleviated in part by supplementing the mixture with high concentrations of RNA polymerase III. Second, the egg extract destabilized transcription complexes formed by oocyte but not by somatic 5S genes.

Summary

Follow a grammatical subject as soon as possible
with its verb.

Place in the stress position the "new information" you want the reader to emphasize.

Place the person or thing whose "story" a sentence is telling at the beginning of the sentence, in the topic position.

Articulate the action of every clause or sentence in its verb.

In general, provide context for your reader before asking that reader to consider anything new.

In general, try to ensure that the relative emphases of the substance coincide with the relative expectations for emphasis raised by the structure.

The Seven Principles

- Follow a grammatical subject as soon as possible with its verb.
- Place in the stress position the "new information" you want the reader to emphasize.
- Place the person or thing whose "story" a sentence is telling at the beginning of the sentence, in the topic position.
- Place appropriate "old information" (material already stated in the discourse) in the topic position for linkage backward and contextualization forward.
- Articulate the action of every clause or sentence in its verb.
- In general, provide context for your reader before asking that reader to consider anything new.
- In general, try to ensure that the relative emphases of the substance coincide with the relative expectations for emphasis raised by the structure.