Lab Report Writing

Experimental Procedures

- ✓ Features of Experimental Procedure Sections
- ✓ Moves in Procedure Sections
- ✓ Procedure Section Analysis
- ✓ Subordinating Conjunctions in Complex Sentences
- ✓ Dangling Modifiers
- ✓ Editing Worksheet

Features of Experimental Procedure Sections

Moves

1. **Statement of location of experiment (optional)**

2. **Apparatus/Experimental Setup (obligatory)**

3. **Procedure - step by step organization (obligatory)**

Organizational Issues

Paragraph unity
Informative headings

Language Issues

Past tense
Passive voice and impersonal subjects
Complex sentences: Dependent clauses
Dangling modifiers

Moves in Experimental Procedures Sections

Move 1. Statement of location of experiment (optional)
Name of laboratory, department and university

Move 2. Apparatus/Experimental Setup (obligatory)

- apparatus name
- model numbers (serial numbers not necessary)
- clearly-labeled diagrams
- relevant measurements of items related to apparatus
- table of experimental equipment used (refer to this in procedure, but place table in appendix),
- UCSD-made equipment receives a descriptive name, and its origin (UCSD) is mentioned. (dept. requirement).

Move 3. Procedure - step by step organization (obligatory)
Procedure should be explained in enough detail to allow another researcher to duplicate your experiment.

- Calibrations used
- Methods used to obtain data

Analysis of a Procedure Section

Read the following excerpt from a procedure section from a journal article and answer the questions on the following page.

Experimental Methods

All experiments were carried out at the University of Illinois Subsonic Aerodynamics Laboratory using the low-speed, low-turbulence wind tunnel. The general experimental arrangement is shown in Fig. 1. The 12-in (30.48 cm) chord wind-tunnel models spanned the test section vertically, a distance of 33.63 in. (85.42 cm). The width of the test section was 48 in. (122 cm) so that this model orientation minimized the blockage and facilitated flow visualization because photographs were taken from the side. All data were acquired at a Reynolds number of 3×10^5 because this corresponded to previous measurements.[6] A traversable hot-film probe was used to measure the wake velocity at 15 spanwise stations: one at midspan and seven stations above and below midspan. The probe location in the wake also corresponded to the location used for the conditionally averaged LDV measurements.[6,7] The use of the terms "above" and "below" are convenient to use given the vertical orientation of the model but should not be taken literally because this model orientation is arbitrary. Several pieces of information were gleaned from the wake-velocity data. The power spectra were obtained using a dynamic signal analyzer, and the Strouhal numbers were computed. The mean and rms of the fluctuating velocity voltage were also computed.

A rigorous uncertainty analysis was carried out using the methods of Kline and McClintock[11] and Coleman and Steele[12] for 20:1 odds. The wake hot-film probe was not calibrated to output velocity, and so only the voltages are reported here. These voltages were acquired using a 16-bit analog-to-digital conversion board that had a rated accuracy of ±0.76μV. Because the wake voltages were on the order of unity, the relative uncertainty was nearly 0%. The quantization error was 0.153 mV; however, the mean and rms voltage were sufficiently resolved through the acquisition of 30,000 samples. The Strouhal number was computed from the frequency spectrum, the angle of attack, the airfoil chord, and the freestream velocity. The absolute uncertainty in angle of attack was ±0.05 deg. This and the uncertainties in the other quantities (f, $U\infty$) led to a relative uncertainty in the Strouhal number of ±2.5%. More details regarding the uncertainty analysis can be found in Broeren.

In addition to the wake-velocity measurements, flow visualization was performed using fluorescent mini-tufts.[14] The mini-tufts consisted of 0.002-in (0.05-m)-diam monofilament nylon that were dyed fluorescent. This caused the tufts to fluoresce under UV illumination. The small size of the tufts limited their effect on the boundary-layer flow and provided excellent frequency response for the unsteady cases. The tufts were able to capture the key features of the unsteady flowfields over stalled airfoils. Although detailed boundary-layer information was not obtainable, general patterns of separation and reattachment were recognizable. The tufts were applied to the entire model surface so that spanwise variations in these features could also be ascertained. The mini-tuft flow visualization data were processed in a rather unique way to yield information about the spanwise variation of the flowfield near the surface of the airfoil. The hot-film sensor, positioned at midspan, was used a synchronization signal for the acquisition of mini-tuft photography.....

Excerpt of procedure section taken from: Broeren, A. P. and Bragg, M.B. (2001). Spanwise Variation in the Unsteady Stalling Flowfields of Two-Dimensional Airfoil Models. *AIAA Journal*, 39 (9), 1641-1651.

Experimental Procedure Section: Analysis
Procedure section from "Spanwise Variation"

Please answer the following questions about the "Spanwise Variation" experimental procedure section from the article by Broeren and Bragg.

Moves

1. Label the moves. Are all of the moves discussed in lecture present in this procedure section?

2. There are no informative headings in this procedure section. Where might some headings be placed and how would you word each heading?

Language

1. Underline the verbs in the first paragraph of this section. Does the writer always use passive voice? What reason can you give for those cases where passive voice is not used?

2. In line 7, why does the author use the phrase "data **were**..."?

3. What verb tense are the verbs in this section written in for the most part? Find an example where the verb tense used is **not** past tense. Why do you think the author switched tenses?

Subordinating Conjunctions in Complex Sentences

A complex sentence is a sentence composed of an independent clause and a dependent clause joined by a subordinating conjunction. The clause which begins with the subordinating conjunction is the dependent clause.

From an article on airfoils…..

Because the wake voltages were on the order of unity, the relative uncertainty was nearly 0%.

The relative uncertainty was nearly 0% because the wake voltages were on the order of unity.

In each sentence, the subordinating conjunction is boxed, and the dependent clause is underlined. What is the rule for comma use with dependent and independent clauses?

Chart of Subordinating Conjunctions

Time	Cause/ Result	Condition	Opposition	Manner	Comparison
after since before by the time when whenever while now that until once as soon as as/so long as as	because since so (that) whereas in order that	if even if unless only if once in case (that) whether or not in the event (that) provided (that)	although while though whereas even though	as though as if	than as

Dangling Modifiers

Dangling modifiers occur when the implied subject of a reduced clause does not match the subject of the main clause to which it is attached. Consider the following example:

Running up the first long hill, my nose began to drip.[1]

This sentence contains a dangling modifier ("walking up the hill") and is considered grammatically incorrect. In such sentences, the subject of the main clause ("**my nose**") is assumed to be the subject of the reduced clause ("walking up the hill"). Therefore, according to this sentence, "my nose" is walking up the hill -- not me.

The following sentences were taken from real engineering lab reports. Some of them contain dangling modifiers. Decide whether or not the sentence contains a dangling modifier. If it does, change the structure of the sentence so that the subjects of the two clauses are the same.

Hint: In procedure sections, it is generally expected that the passive voice will be used. Keep that in mind as you revise these sentences. It may help to change both clauses to passive voice.

1. After obtaining the plots for each mass, we used the voltage-position relationship...to convert the data.

2. While acquiring a new data set through a 12 bit A/D converter, the signal conditioning and updating of the statistics of the previous set took place.

3. After plotting the data in Microsoft Excel, an equation was derived to calculate the motor frequency as a function of the velocity.

[1] Example taken from Heffernan, J.A., and Lincoln, J. E. (1986). Writing: A college handbook, 2nd ed. p. 266. New York: W.W Norton and Co.

Editing

Procedure peer editing worksheet

Area	Question	Y/N	Comments
Content	1. Does the writer state the location of the experiment? 2. Does the writer describe the apparatus or experimental setup? 3. Is the procedure described in enough detail, without adding irrelevant information?		
Organization	1. Are there enough informative headings? 2. Does the section have clear paragraphs covering one topic?		
Language	1. Does the writer avoid the use of "we" and use the passive voice? 2. Does the writer avoid mechanical and grammatical errors (e.g., dangling modifiers)?		