

## CHAPTER

## 0

## Appendix A: Wheeler's Rules of Writing

*If you haven't found something strange during the day, it hasn't been much of a day.*

—John Archibald Wheeler

### Wheeler's rules of writing

(These rules were assembled over several years by Edwin F. Taylor, one of many collaborators with John Archibald Wheeler (JAW). JAW has read these and generally approved them, but he has not edited them.)

**Motivate! Motivate! Motivate!** The text should read like a detective story, keeping the reader on the edge of her chair, gasping for the next handout. Every sentence quotable! Book design must contribute to the rich, headlong plunge.

**Simplify! Simplify! Simplify!** JAW: "Everything important is, at bottom, utterly simple." Einstein: "I want to know His [God's] thoughts, the rest are details."

**The power and generality of the singular, the specific, the committed:** Avoid plurals. "those designing Earth satellites" becomes "anyone designing an earth satellite." Use *the* rather than *a*: "Center of the black hole," not "center of a black hole." No "if," no "suppose;" instead, use "when."

**The power of the present:** Avoid past tense unless talking about history. Avoid unnecessary future tense.

**The power of the active:** Avoid passives.

**The dullness of simply being:** Suppress the use of the verb "to be."

JAW: "Whenever I have an 'is' in a sentence, I know there is something wrong with that sentence."

"...is not an harmonic oscillator" becomes "...does not rate as an harmonic oscillator."

"He is happy" becomes "He beams happiness."

"Schwarzschild spacetime geometry is distinguished from all other conceivable geometries..." becomes "Schwarzschild spacetime geometry distinguishes itself from all other conceivable geometries..."

**Avoid the subjunctive** ("We would like to express the metric as...") except in cases in which you are presenting something with which you do not agree ("Some would conclude incorrectly that...").

**Avoid "ing" words.** "before escaping or plunging" be-

comes "before it escapes or plunges"; "The Earth is rotating" becomes "The Earth rotates."

**Put the key word first** or early in the sentence or at the end of the sentence, not in the middle.

**Rhetorical rule of threes.** Use three descriptions to establish a triangle that spans the idea being presented: "proper time, interval, wristwatch time" or "Schwarzschild radial coordinate,  $r$ , reduced circumference." It is also a reminder of the different descriptors of the same thing.

Use "**we**" to include the student, rather than "you," which is not so friendly: "As we plunge into a black hole..."

However...

**Use infinitive construction:** "To find", "to learn", "to determine" rather than "we do so and so" or "let us do so and so," which is condescending because the author is going to do it anyway.

"We use the Principle of Relativity to derive the invariance of the interval." or "Let us use the Principle of Relativity to derive the invariance of the interval." or "Use the Principle of Relativity to derive the invariance of the interval." all become "To derive the invariance of the interval, use the Principle of Relativity."

**Use commands to stir the blood—but sparingly.**

"Find..."

"Determine..."

"Reckon..." (rather than "compute" or "calculate," which seem technical)

"Plunge..."

But not so much as to seem bossy.

**Appeal to experiment or logic**—not to the professions. Do not invoke "scientists" to enforce a point.

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(#WheelerRulesOnly)

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5 John Archibald *Wheeler's Rules of Writing* influence every page of this book.  
6 We struggle to follow his commands "Motivate!" "Simplify!" "Use infinitives"  
7 and the rest. Sometimes we find it awkward or impossible to do so. Other  
8 times we intentionally ignore him: For example, Wheeler's word "reckon"  
9 seems to us old-fashioned.

10 Wheeler did not include in his published Rules of Writing some central  
11 hallmarks of his composition. Chief among these is **self-descriptive**  
12 **terminology**; the most important of these is the name **black hole**. Wheeler  
13 did not create the term *black hole*, but adopted it immediately when someone  
14 (now unknown) used it in a question at one of Wheeler's lectures (initial quote,  
15 Chapter 3). Similarly, we call a reading on your wristwatch *wristwatch time*.  
16 The standard term is *proper time*, but that is not self-descriptive. (What could  
17 *improper time* possibly mean?) *Wristwatch time* is our effort to duplicate the  
18 gorgeous German noun "die Eigenzeit," literally "one's own time."

19 The self-descriptive term *shell* refers to an imaginary spherical latticework  
20 concentric to a black hole and a local inertial frame at rest on that shell  
21 (Sections 5.7 and 7.4). *Rain* describes a stone or local inertial frame that falls  
22 from initial rest at a great distance (Section 7.6); *hail* a stone or local inertial  
23 frame flung radially inward from a great distance; and *drip* a stone or local  
24 inertial frame dropped from rest off a shell (all summarized in Section 9.7).

25 Wheeler uses the same unit for distance and time measured in a local  
26 inertial frame (Section 1.2), either: (1) meters of distance and meters of  
27 light-travel time, or (2) years of time and light-years of distance. He measures  
28 energy and momentum in the common unit mass, so that  $E/m$  and  $\mathbf{p}/m$  have  
29 no units (Section 1.10).

30 Other rules of writing we developed ourselves: We use no abbreviations  
31 whatsoever in this book, except in subscripts and in an occasional equation  
32 label. We always spell out the words *second* and *meter* because abbreviations  
33 are ambiguous. (Does  $m$  mean mass or meters? Does  $s$  refer to seconds or  
34 distance?) Our goal is to eliminate what we call *hiccups*: moments when the  
35 reader must pause to recall the meaning of a term.

36 We have developed notation rules of our own: *Be consistent and avoid*  
37 *redundant notation!* Always write subscripts in the order (component, frame,  
38 particle); for example,  $E_{\text{ring},b}$  as the ring-frame energy of particle  $b$ , or  $p_{x,\text{ring},b}$ .  
39 Finicky? Absolutely! Avoid hiccups at all cost.

40 Are we similarly limited in everyday conversation with friends and  
41 colleagues? Of course not. Everyday life is full of gorgeous ambiguity. But  
42 ambiguity does not belong in our textbook. We believe that to be slightly  
43 boring is much better than to be unclear!

44 We talk constantly about components but do not use vectors. Most  
45 derivatives are total; only twice in the book do we use partial derivatives. For  
46 this introductory text, we simplify the metric and the resulting analysis by  
47 describing spacetime and motion on a *slice*, a spatial symmetry plane through  
48 the center of a non-spinning black hole (Section 3.6) or in the equatorial plane  
49 of the spinning black hole (Section 17.2).

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50 Wheeler exclaimed, "I *hate* footnotes!" So there are none in this book: Full  
51 reference to every quote is given in the References section at the end of each  
52 chapter.

53 Throughout the book we employ the *radical conservatism* of John  
54 Archibald Wheeler: *Follow what the equations tell us, no matter how strange*  
55 *the results, then develop a new intuition!*

**56 REFERENCE**

57 John Archibald Wheeler, "Wheeler's rules of writing," *American Journal of*  
58 *Physics*, Volume 67, Number 11, November 1999, page 945.

59 Download file name: VAppendixAWheelersRules170511v1.pdf