BILL'S QUICK GUIDE TO PAPER OPTICS

I prefer to use the word "optics" as a catch-all category rather than separating "formatting" and "style." The impression that your writing makes on your reader depends on many things at once, and I think it's important to treat your ideas, your words, and your page with equal care.

Marginalia
Everything you turn in should have your name, a title ("Research Paper" is *not* a title), the date (at least the month and year), and page numbers. Except for senior essays, master's theses, and doctoral dissertations, title pages are unnecessary.

File Format and Filesize
If you're turning in your paper electronically, send it as a PDF. This is the only way to make sure that I see exactly what you think I should see. Your file should be no more than a few megabytes; if it's more, you should change your PDF export settings or re-embed copies of your images with reduced resolution.

Page Layout and Formatting
I recommend 1.25-inch margins left and right, a 12-point serifed[1] font (Garamond is nice; Baskerville, Palatino, Cambria, and the Yale fonts[2] are also fine), 1.5 line spacing, and left-justified text. This avoids having too many words on any one line (which is hard to read easily), but it also avoids having too few words on a page (which makes the flow of the prose hard to follow). I find double-spaced Times New Roman to be clunky.

You should indent the first line of each paragraph (I recommend 0.25-inch indents[3]), but do not indent the first paragraph of the paper or the first paragraph after a subheading. Do not insert space between each paragraph. You should also use "Widow and Orphan Control"; this prevents the first or last line of a paragraph from appearing alone – widowed or orphaned – on a page by itself.

See the last two pages for an example of what I recommend.

Images
You should embed images throughout your paper rather than collecting them all at the end. (This can be a pain in Word or LibreOffice, so I recommend keeping text and images in separate files until the very last step.) All images should have engaging analytic captions, but be sure to provide a full citation for the image in the caption as well. You should always make your images as large as possible without breaking your margins; enlarged details may also be necessary. (The reader shouldn't have to zoom in to the PDF to read your images.) All images should be referenced specifically in the text: "see figure 2," "As shown in figure 5," etc. If in doubt, err on the side of using more images rather than fewer.

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1   Serifs are the small flourishes added to the ends of letterform strokes. This font has no serifs.
2   http://www.yale.edu/printer/typeface
3   As a rule of thumb, indents should be same as the line spacing. Since there are 72 points to an inch, 18-point spacing (12-point font × 1.5 line spacing) translates to 0.25-inch indents.

Headings
Breaking up a long paper using headings is always a good idea. You don't need a heading for your introduction, and try to avoid a bland heading like "Conclusion" alone. Ideally, your headings will do analytic work and announce not just the topic of the section, but the major themes or arguments as well.

Footnotes and Citations
Historians use footnotes, not parenthetical citations. There's no point in going crazy about citation style, but other scholars should be able to track down your sources if need be. Using *The Chicago Manual of Style* is a good default choice; their citation guide is on the web for free, and the full text is available through Orbis. I recommend giving full citations in your footnotes; this means you won't need a separate bibliography or list of works cited.

Keep in mind that footnotes can be more than just bare citations; you can also provide context, additional details, or explain how you combined information from multiple sources. You can also cite more than one source in the same footnote, and footnotes do not need to come immediately after a quotation as long as the connection between quote and source is still clear. Many students use too many footnotes, each with only one citation, inserted somewhat haphazardly throughout the text. Instead, treat a footnote as a kind of punctuation mark; it slows the reader down slightly, and you can be intentional about where you insert them. (And don't use more than one footnote at a time; this example[23, 24] is wrong.)

Footnotes always go *last* after punctuation and quotation marks. Here are examples of correct placement: Marcy likes peas.[1] Marcy said, "I like peas."[2] Marcy's question – "Do you like peas?"[3] – was great.

Direct Quotations
The source of every quotation should be obvious from its context, and the reader shouldn't have to go to the footnotes to figure out what's going on. This can be quite simple: "As the *New York Times* put it in 1943…," "One historian has even described this as…," or "According to McLuhan…." And the first time you quote someone, use both their first and last names and give a brief description of who they are. For example, "the famous geologist Charles Lyell," "the marine-biologist-turned activist Rachel Carson," or "David Harvey, who was born in England but spent most of his career in the US."

And don't directly quote other scholars (that is, secondary sources) unless you want to critique or engage with the specifics of their vocabulary. Instead, you should use your own words and provide a citation. For example, there's no need for something like this: "According to the historian Mary Burton, 'There were five such museums on the island, and they attracted a large and enthusiastic audience.'" Instead you could simply say that all five museums were very popular, with a citation to Burton in a footnote. But there might be a reason to say something like this: "I disagree with Burton's claim that the audience was, in her words, 'large and enthusiastic.'"

In American usage, commas and periods always go *inside* quotation marks. Other punctuation goes outside, unless it's part of the quote. Also, in American usage all quotation marks should be double, even scare quotes. The *only* use of single quotes is for quotations inside of other quotations.

First-Person Voice
In high school most of us learn to avoid the first-person voice in formal writing. This is wrong. Prominent and accomplished writers commonly use the first-person voice to explain their goals and argument in clear terms. Don't go overboard, but phrases like "My goal in this essay is…," "My main argument is…," or "I want to make it clear, however, that…" can be very helpful.

It's likewise fine to use "we" or "our," but use them carefully. Don't use them as rhetorical synonyms for "I" or "you the reader," in phrases like "we will begin by analyzing…," or "our main question is…." This comes off as stilted. Instead, "we" or "our" should only be used to refer to the group of people that includes you, me, and other interested readers (that is, as synonymous with "historians" or "the interested public"), in phrases like "how should we understand these documents?" or "the ubiquity of GPS in our daily lives."

Referring To Your Own Writing
When describing the content of your own paper, use the literary present tense, not the future tense. So you'd say "This paper explores" (not "This paper will explore") or "The second section describes" (not "will describe").

And don't foreshadow future analysis with phrases like "as will be discussed below" or "as I describe later." These mostly just direct the reader's attention away from the immediate point; they're also a bit stuffy. These phrases can almost always be omitted; if not, it's a sign that your logical flow isn't quite right. The same is true for reminders ("as discussed above"). Usually you can just briefly repeat the same information with no problem, perhaps using "again" as a simple acknowledgment: "Their goal, again, was total world domination."

Common Over-Correction Errors
Through the unrelenting tyranny of grammarians drunk on the prescriptivism of Strunk and White's *Elements of Style*, entire generations of students have been contorting their prose to avoid things like the passive voice and split infinitives at all costs. This is nonsense, and great writers (from Shakespeare to Dickens to Pynchon) use these constructions whenever they're needed. Often they're not the best choice, but sometimes they are.

For more, see http://en.wikipedia.org/wiki/Common_English_usage_misconceptions

Common Typographic Errors
If in doubt, see the *Chicago Manual of Style,* or just pick up any history book and see how it's done there. These are just a few of the most common slip-ups I see in student papers:

1, Be mindful of when to use numerals and when to spell out numbers; most students use too many numerals. This is unfriendly: "There are 5 such maps from the 19th century; each is about 11.5" square." This is nicer: "There are five such maps from the nineteenth century; each is about 11.5 inches square."

2, Use one space between sentences, not two.

3, Remind yourself of the rules for hyphenating compound adjectives and other compounds (*Chicago Manual of Style,* sections 7.77 through 7.85).

4, Be mindful of the difference between a hyphen, which is short (-), and a dash, which is longer (either – or —). Ranges of numbers (either dates or page numbers) are linked by dashes, not hyphens. For more detail than you need, see http://en.wikipedia.org/wiki/Dash

5, Always use four-digit dates, don't use apostrophes after dates, and don't use a dash between numerals in prose. Again, this is unfriendly: "Life was easy in the 1960's and '70s, since she earned $100–200 per day." This is nicer: "Life was easy in the 1960s and 1970s, since she earned between $100 and $200 per day."

Elegant Sentences and Punchy Prose
My favorite rule of thumb for writing engaging and pleasant prose is *variation*. Vary the length of your sentences, and vary the size of your paragraphs. If all of your sentences are four lines long, your prose will read like molasses. After several substantial paragraphs, a short paragraph that zooms out and highlights your main point can be really powerful. Inserting questions (with question marks!) can also be a nice way to add some punch.

History prose isn't casual, but you should leave the *really* formal writing to lawyers. Have some fun with your writing; err on the side of the conversational without becoming colloquial. Can you read your prose out loud without getting tongue-tied and running out of breath? Elegant prose is simple and clear, not complex and clever.

The Geography of Radionavigation and the Politics of Intangible Artifacts
William Rankin

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On the cloudy night of October 30, 1944, a British bomber leaves England on its way to Germany. On board, the navigator is primarily occupied with two objects—or possibly three. The first is a black box with knobs and an oscilloscope display, as in figure 1. The navigator spends most of his time fiddling with these knobs trying to make two wavy signals align on the screen; doing this results in two numbers—something like 49.1 and 4.8. At least one of these numbers is constantly changing and the navigator's box requires ongoing attention. The second object is a simple map known as a lattice chart that shows a dense network of colored hyberbolas, as in figure 2. Each of these curves corresponds to one of the numbers from the machine; finding the intersection of the lines labeled 49.1 and 4.8 puts the bomber just north of Leeds. From here, it will head east over the North Sea to join in formation with more than nine hundred other aircraft, all carrying similar equipment, before turning south for yet another bombing raid on German civilians—this time, in the suburbs of Cologne. Hidden by the clouds, not a single plane will be lost.

This combination of a black box and a map was known as the "interpretation system" for a radionavigation system codenamed Gee that first came online in March 1942. This system was an urgent necessity, since the British had realized that most of their nighttime bombers weren't able to navigate anywhere near their intended targets, let alone bomb accurately once they arrived. Gee stood for "grid"; in the words of Robert Watson-Watt, leader of the British radar project, the goal was to "unfold [an] electronic grid over Germany."[1] Following Watson-Watt's logic, the third object in the cockpit—one which I'll argue should be seen as no less a part of the material culture of technology than the other two—is the network of Gee radio signals that had been "unfolded" over the Western Front.

Although the distinction may seem subtle, understanding how radio waves can sometimes act more like a stable physical artifact than a fleeting communications signal

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1   For RAF sorties, see campaign diaries (published 2002) at http://webarchive.nationalarchives.gov.uk/ 20070706011932/http://www.raf.mod.uk/bombercommand/oct44.html. For an overview of Gee, see R. J. Dippy, "Gee." On interpretation systems, see "Minutes of a Meeting Held in Air Ministry, Abbey House on Thursday, 25th May, 1944 to Agree Action Required to Provide Interpretation Systems for Use with Stations Type 7000 on the Continent," in NARA, RG 331, entry 268, box 75, folder "Lattice Charts Production—Policy." For Robert Watson-Watt, see his *The Pulse of Radar*, 338. For G meaning Grid, see Robert I. Colin, "Robert J. Dippy," 476.

Figure 1: Mock-up of the black boxes used for radionavigation in an Avro Lancaster, one of the principal heavy bombers of the British Royal Air Force during the second half of World War II. The large circle on the left is an oscilloscope display that would show two wavy lines; using the knobs below to adjust the position of the wavy peaks would result in a pair of numbers. Photo from Peter Zijlstra, http://home.versatel.nl/gmwzijlstra-prummel/lancaster.htm.
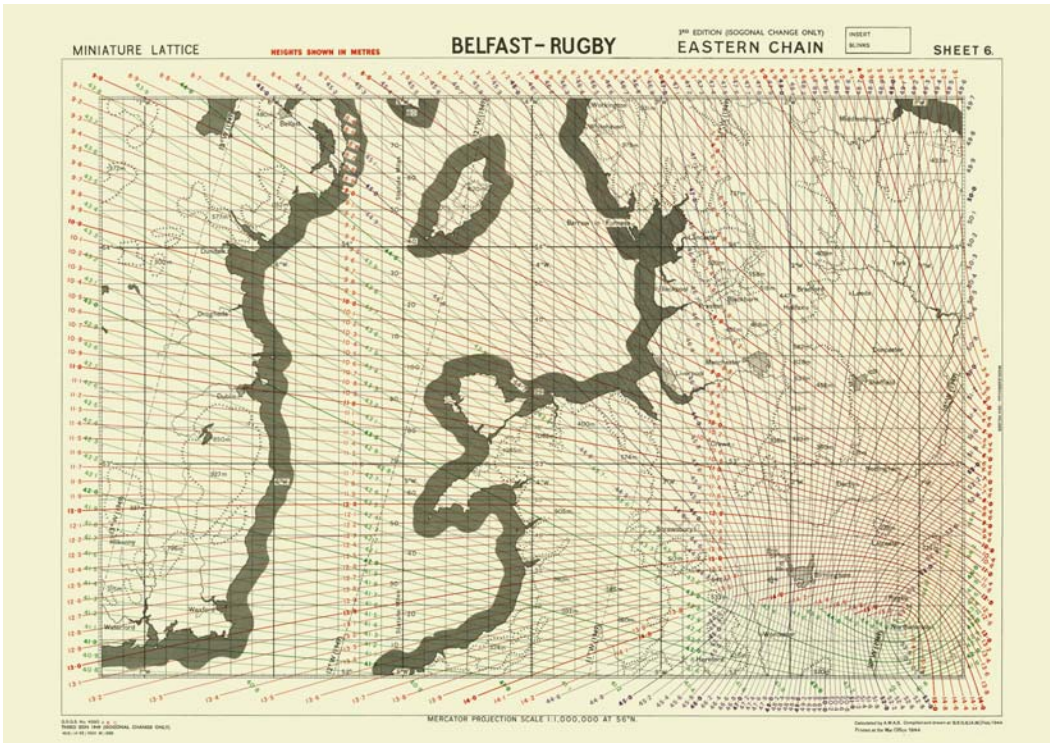

Figure 2: Lattice chart showing central Great Britain and eastern Ireland. The two numbers from the black box in figure 1 correspond to two of the (colored) hyperbolic lines crisscrossing the map. The intersection of 49.1 (purple) and 4.8 (red) is in the upper right, just north of Leeds. This postwar reprint of a British map is dated February 1944, from NARA Cartographic Records, RG 77, box 54 of 215, folder "907.2: Raydist, Decca."