

PERSPECTIVES / FROM BENCH TO BOT

From bench to bot: How to use AI to structure your writing

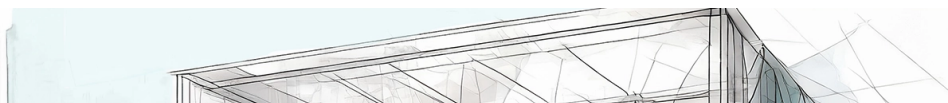
When given specific examples, ChatGPT can generate templates to help guide different types of documents.

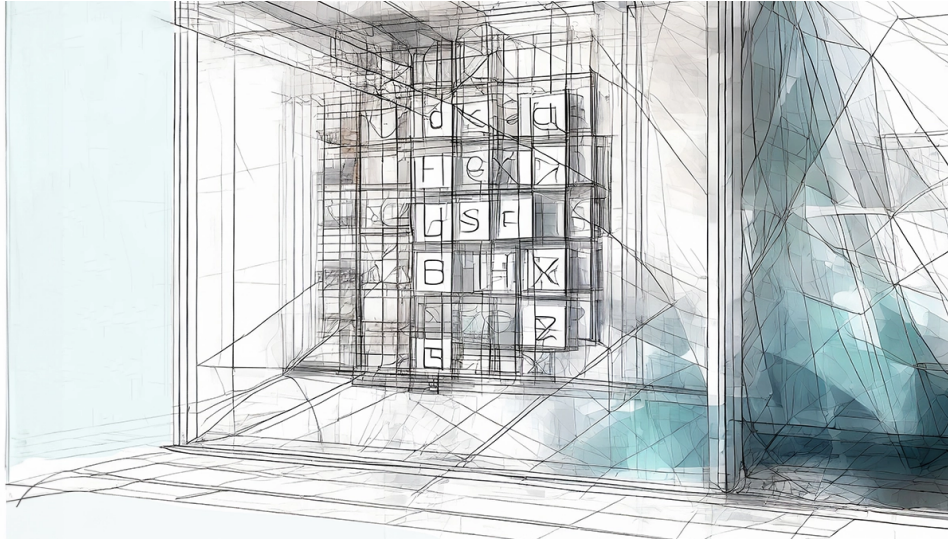
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Reverse engineering: Artificial intelligence can analyze texts' structures and provide paragraph- or sentence-level breakdowns of their key components.

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In the “From
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“Blank page syndrome” may not be an official medical condition, but it certainly can feel like one for writers on deadline. Many advice columns about how to overcome blank page syndrome — or writer’s block of any kind — embrace so-called “free writing.” That is, just put words on the page and worry about the rest later.

Although forcing yourself to “just write” may serve you well at some stages in the process or for some types of writing, I’ve found that it can be more trouble than it’s worth. A blank page is

intimidating, for sure, but equally intimidating is a mess of unstructured writing that readers struggle to understand. And who hasn't spent hours perfecting a paragraph that you ultimately decide to cut the next day because it isn't relevant to the argument?

I've found that it's generally more efficient and less painful to give careful thought to structure first. For me and my students, this means using a template. The power of templates is that they can turn almost any piece of writing into a really long "fill in the blank."

How to construct a *Nature* summary paragraph

Annotated example taken from *Nature* 455, 114–118 (5 May 2005).

One or two sentences providing a basic introduction to the field, comprehensible to a scientist in any discipline.	During cell division, mitotic spindles are assembled by microtubule-based motor proteins ^{1,2} . The bipolar organization of spindles is essential for proper segregation of chromosomes, and requires plus-end-directed homodimeric motor proteins of the widely conserved kinesin-5 (Kif2C) family ³ . Hypotheses for bipolar spindle formation include the 'push-pull mitotic muscle' model, in which kinesin-5 and opposing motor proteins act between overlapping microtubules ^{4,5} .
Two to three sentences of more detailed background , comprehensible to scientists in related disciplines.	However, the precise roles of kinesin-5 during this process are unknown. Here we show that the vertebrate kinesin-5 Kif5 drives the sliding of microtubules depending on their relative orientation. We found in controlled <i>in vitro</i> assays that Kif5 has the remarkable capability of simultaneously moving at ~20 nm s ⁻¹ towards the plus-ends of each of the two microtubules it crosslinks. For anti-parallel microtubules, this results in relative sliding at ~40 nm s ⁻¹ , comparable to spindle pole separation rates <i>in vivo</i> ⁶ . Furthermore, we found that Kif5 can tether microtubule plus ends, suggesting an additional microtubule-binding mode for Kif5. Our results demonstrate
One sentence clearly stating the general problem being addressed by this particular study.	
One sentence summarizing the main result (with the words 'here we show' or their equivalent).	
Two or three sentences explaining what the main result reveals in direct comparison to what was thought to be the case previously, or how the main result adds to previous knowledge.	

One or two sentences to put the results into a more general context .	how members of the kinesin-5 family are likely to function in mitosis, pushing apart interpolar microtubules as well as recruiting microtubules into bundles that are subsequently polarized by relative sliding. We anticipate our assay to be a starting point for more sophisticated <i>in vivo</i> models of mitotic spindles. For example, the individual and combined action of multiple mitotic motors could be tested, including minus-end-directed motors opposing fts's motility. Furthermore, Egfr inhibition is a major target of anti-cancer drug development, and a well-defined and quantitative assay for motor function will be relevant for such developments.
Two or three sentences to provide a broad perspective , readily comprehensible to a scientist in any discipline, may be included in the first paragraph if the editor considers that the accessibility of the paper is significantly enhanced by their inclusion. Under these circumstances, the length of the paragraph can be up to 300 words. (This example is 190 words without the final sentence, and 250 words with it).	

Courtesy of *Nature*

Take *Nature's* [annotated abstract](#), one of the most helpful teaching documents I use. In the document, the abstract is on the right and a *Nature* editor has annotated the function of each sentence on the left. The specific content here isn't relevant. The magic occurs in the annotations, which provide a sentence-by-sentence blueprint for an abstract on any subject:

1. One or two sentences providing a basic introduction to the field, comprehensible to a scientist in any discipline.
2. Two to three sentences of more detailed background, comprehensible to

comprehensible to

scientists in related
disciplines.

3. One sentence clearly stating the general problem being addressed by this particular study.
4. One sentence summarizing the main result (with the words “here we show” or their equivalent).
5. Two or three sentences explaining what the main result reveals in direct comparison with what was thought to be the case previously, or how the main result adds to previous knowledge.
6. One or two sentences to put the results into a more general context.
7. Two or three sentences to provide a broader perspective, readily comprehensible to a

scientist in any discipline, may be included in the first paragraph if the editor considers that the accessibility of the paper is significantly enhanced by their inclusion.

As a writer, I find responding to these seven prompts with my own sentences to be less psychologically perilous than staring at a blank page for hours and admonishing myself to “just write an abstract.”

Of course, finding the perfect template for your task at hand can be difficult. Excellent templates exist for highly structured documents such as [specific aims pages](#). But when I search for other types of templates online, they are often overly

vague or overly specific.

What if you are working on a document so niche that no one has posted a template on it? Or you want to mimic the structure of a particular piece of writing that you really like? It's possible to generate your own template through careful analysis of several examples of the genre, but that is a time-consuming process.

This is where artificial-intelligence tools such as ChatGPT can be of immense help. You can provide the AI an example or two of the kind of document you'd like to write and specify the level of detail you'd like in a template. Let's use the personal statement from a National Institutes of Health (NIH) biosketch of a fictional

postdoctoral fellow as an example. Though there are many pointers on how to write an effective personal statement for a biosketch, there's also a lot of flexibility in the form, and people's personal circumstances and career trajectories vary widely. Perhaps there's a biosketch whose structure you like, and you want to create a template based on that. For this exercise, I've adapted a sample biosketch provided on NIH's website.

Prompt:

Analyze the provided example personal statement from an NIH biosketch for a postdoctoral fellowship

application and construct a general template for writing your own biosketch. The template should include the necessary sections and highlight the key components that should be included in each section. Specify a number range of sentences for each key component, and specify where any paragraph breaks should occur.

Here is the statement:

“““My long-term research interests involve the development of a comprehensive understanding of key neurodevelopmental pathways and how alterations in gene expression contribute to

neurological disorders.

My academic training and research experience have provided me with an excellent background in multiple biological disciplines, including molecular neuroscience, neurobiology, biochemistry and genetics. As an undergraduate, I conducted research with Dr. Xavier Factor on the neurobiological mechanisms of action of novel neuroprotective agents. As a predoctoral student with Dr. Tanti Auguri, my research focused on the regulation of gene expression in neural cells, and I gained expertise in the isolation and biochemical characterization of

neural transcription complexes. I developed a novel protocol for the purification of components of large neural transcription complexes. I was the first author of the initial description of the Most Novel Complex in neural systems. A subsequent first author publication challenged a key paradigm of gene regulation in neuronal development and was a featured article in a major neuroscience journal. During my undergraduate and graduate careers, I received several academic and teaching awards in neuroscience. For my postdoctoral training, I will continue

to build on my previous training in transcriptional controls by moving into a mammalian neural system that will allow me to address additional questions regarding the regulation of neurodifferentiation and development. My sponsor, Dr. I.M. Creative, is an internationally recognized leader in the field of neural transcription/chromatin and has an extensive record for training postdoctoral fellows in neuroscience. The proposed research will provide me with new conceptual and technical training in developmental

neurobiology and whole-genome analysis. In addition, the proposed training plan outlines a set of career-development activities and workshops — e.g., grant writing, public speaking, lab management and mentoring students — designed to enhance my ability to be an independent investigator in neurodevelopmental disease research. My choice of sponsor, research project and training will give me a solid foundation to reach my goal of studying developmental neurological diseases in humans. During my second postdoctoral year in Dr. Creative's lab, my

father had a severe stroke that eventually ended his life. I was out of the lab for six months dealing with my father's incapacitating illness and end-of-life issues. This hiatus in training reduced my scientific productivity.”””

(Putting text in triple quotes ensures that chatGPT differentiates the text to be acted on from the instructions.)

ChatGPT output:

To create a general template for an NIH biosketch personal statement, especially for a postdoctoral

fellowship application, we can analyze the provided example and extract the key components. The template should be structured to clearly present your research interests, academic and professional achievements, and future goals. Here's a breakdown of the template with the necessary sections and key components:

Personal statement template

1. Research interests (one to two sentences)

- **Key component:**
Briefly state your long-term research interests, focusing on

the specific field or
problem you are
passionate about.

- **Paragraph**
break: None.

2. Academic and research
background (three to five
sentences)

- **Key component:**
Summarize your
academic journey,
emphasizing relevant
disciplines studied.
- **Key component:**
Highlight significant
research experiences,
mentioning key
mentors or
collaborators.
- **Paragraph break:**
After discussing
academic
background, before
moving to research
experiences.

3. Notable achievements and publications (three to six sentences)

- **Key component:**
Describe any notable research findings or methodologies you developed.
- **Key component:**
Mention important publications, particularly where you were the first author.
- **Key component:**
Include any academic, research or teaching awards received.
- **Paragraph break:**
After discussing publications, before mentioning awards.

4. Postdoctoral training and future goals (three to five

sentences)

- **Key component:**
Outline your plans for postdoctoral training, including specific areas you intend to explore.
- **Key component:**
Mention the mentor under whom you will be training and their credentials.
- **Key component:**
Briefly discuss how this training aligns with your long-term career goals.
- **Paragraph break:**
After detailing postdoctoral training plans, before transitioning to future goals.

5. Additional training and

career-development activities
(two to four sentences)

- **Key component:** List any planned career-development activities (e.g., workshops, courses).
- **Key component:** Explain how these activities will contribute to your growth as an independent investigator.
- **Paragraph break:** None.

6. Personal experience or challenges (optional, two to three sentences)

- **Key component:** If relevant, briefly mention any personal experiences or

challenges that have impacted your career trajectory.

- **Paragraph break:** None.

Formatting tips:

- **Length:** Keep the entire statement within one page.
- **Clarity and focus:** Ensure that each section is concise and directly related to your career in research.
- **Personalization:** While following this template, infuse your statement with personal insights and motivations.

This template serves as a guide and should be adapted to fit your

individual experiences
and career goals.
Remember to tailor your
statement to reflect your
unique path,
achievements and
aspirations in the field of
research.

ChatGPT link:

<https://chat.openai.com/share/a431c815-39d3-49be-acd4-3902f94b7f5b>

Armed with a template, you
can use the [notes-to-draft
workflow](#) outlined in the
previous column to develop a
well-structured rough draft in
a shockingly short amount of
time. If you want, you can
even ask ChatGPT to convert
the template into a series of
Q&A-style prompts —
literally turning your drafting
process into a long fill-in-the-

blank form. I find this technique so powerful that I even created a custom GPT called “[Template Genius](#)” solely for the purpose of providing templates. If you have a ChatGPT Plus subscription, you can upload a few examples of writing and it will generate a sentence-by-sentence template for you. (Be mindful of privacy, though, and don’t submit other people’s nonpublic text to ChatGPT without their permission.)

There are a few things to keep in mind. First, a sentence-by-sentence template may be too granular for you, so feel free to generate templates at a paragraph level (perfect for modeling a section in a long review paper, for example). You can then generate

sentence-by-sentence templates at the paragraph level if you need to. More importantly, remember that the effectiveness of a template generator hinges on the quality of the examples you provide. This selection process requires experience and discernment, which comes from you and not the AI.

My hope is that, by exploring template-driven writing, you'll gain a deeper appreciation for the underlying structure of scientific texts. Pay attention to not just what is written, but how it's written. Identify the techniques that enhance or detract from a piece's effectiveness. If a particular argument's structure captivates you, try to

understand its mechanics. At the very least, preserve such exemplars for future reference. By adopting a writer's perspective in your reading habits, you'll not only be able to provide AI tools with better examples, but you'll develop a deeper understanding of what makes a piece of writing tick, whether you end up relying on ChatGPT or not.

User beware

When exploring the use of AI, it's crucial to be aware that to incorporate it into our writing life is to

navigate a minefield of possible dangers. AI can confidently produce convincing but inaccurate information (often called “hallucinations”), making it untrustworthy for factual queries, which means it is crucial that you have verification checkpoints in your workflow. Even accurate AI-generated content can be biased. It is well documented, for

example, that social biases, such as racism and sexism, are embedded in and exacerbated by AI systems. AI may also recapitulate bias in subtler ways, such as by steering users toward established scientific ideas, which are more likely to be represented in the AI's training data.

Data-privacy concerns arise when using

standard web interfaces, as

user inputs can be adopted to train future AI models, though certain technical workarounds offer more protection. And at least one major journal (*Science*) and the U.S. National Institutes of Health have banned the use of AI for some purposes. Lastly, although generative AI generally does not pose a high risk of detectable plagiarism, that

risk may increase for highly specialized content that is poorly represented in the training data (which might not be much of a concern for the typical user but could be a larger concern for the typical scientist). Some AI systems in development may overcome some of these problems, but none will be perfect. We'll discuss these and other issues

at length as they
arise.



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Get alerts for “AI: From bench to bot” in your inbox.

This column explores
the promises and
pitfalls of artificial-
intelligence tools in
writing—when it can
make writing better,
faster and easier, and
how to navigate the
minefield of possible
dangers.

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