

Secondary Publication



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Date of secondary publication: 04.04.2023

Version of Record (Published Version), Workingpaper

Persistent identifier: urn:nbn:de:bvb:473-irb-589507

Primary publication

Jungherr, Andreas: Using ChatGPT and Other Large Language Model (LLM) Applications for Academic Paper Assignments. In: SocArXiv, 2023. DOI: 10.31235/osf.io/d84q6

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Using ChatGPT and Other Large Language Model (LLM) Applications for Academic Paper Assignments

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March 24, 2023

Abstract: Large language models (LLMs), like ChatGPT, GitHub Copilot, and Microsoft Copilot, present challenges in university education, particularly for paper assignments. These AI-driven tools enable students to (semi)automatically complete tasks that were previously considered evidence of skill acquisition, potentially affecting grading and skill development. However, the use of these tools is not legally considered plagiarism and is becoming increasingly integrated into various software solutions.

University education in the social sciences aims to develop students' abilities to make sense of the world, connect their observations with abstract structures, measure phenomena of interest, systematically test expectations, and present findings in structured accounts. These practices are learned through repeated performance of tasks, such as writing research papers. LLM applications like ChatGPT create conflicting incentives for students, who might rely on them to produce parts of their papers instead of engaging in the learning process.

While LLMs can be helpful tools for knowledge discovery, writing assistance, and coding assistance, using them effectively and safely requires an understanding of their underlying mechanisms, potential weaknesses, and enough domain knowledge to identify mistakes. This makes LLMs particularly challenging for students in the early stages of acquiring scientific skills and domain knowledge.

Educators must enable and train students to responsibly use these new tools, reflecting on the underlying tensions and their strengths and weaknesses for academic writing tasks. This working paper aims to provide guidelines on responsible LLM use in academic contexts, specifically for students at the Chair for the Governance of Complex

and Innovative Technological Systems at the University of Bamberg. The paper discusses the function of written paper assignments, the tasks necessary to complete them, and evaluates ChatGPT's performance in assisting with these tasks. It concludes with observations and advice for students to maximize the benefits of LLMs while mitigating potential risks in academic contexts, focusing on enabling learning.

Keywords: teaching, research paper, writing, artificial intelligence, AI, large language models, LLMs, ChatGPT, political science

1 Tensions in the use of ChatGPT and other large language model (LLM) applications for academic paper assignments

The increasing accessibility of large language model (LLM) applications, such as ChatGPT,¹ GitHub Copilot,² and Microsoft Copilot,³ raises significant concerns for academic paper assignments in university education. LLMs can create a tension between traditional academic objectives and the capabilities offered by these AI-driven tools, as they may enable students to bypass essential tasks that demonstrate their acquired skills and competencies.

By using tools like ChatGPT to complete assignments, students can semi-automatically accomplish tasks that previously demonstrated their achievement of essential writing skills and competencies aligned with course objectives. In the past, the paper itself served as evidence of such achievements, as students, barring plagiarism or cheating, had to engage in a series of tasks to complete the assignment. However, with applications like ChatGPT, students can now bypass these tasks, relying on LLMs to generate components of their written assignments. The output produced by current iterations of these models may not result in grades within the top percentiles. Nevertheless, the output might be sufficient to earn a passing grade. This presents challenges not only from a grading standpoint, where alternative testing methods could restrict LLM access (Basbøll, 2023b), but more crucially from the perspective of students' skill development.

In the social sciences, university education aims at allowing students to develop higher skills in making sense of the world, connecting their own observations about phenomena and mechanisms to larger more abstract structures and thereby understanding their connection with a deeper underlying order, the empirical measurement of phenomena of interests and the systematic test of expectations, and to be able to present their findings in a structured intersubjective account. These are not abstract skills, these are practices (Gooblar, 2019; Lang, 2021). Learning these skills requires repeated practice, typically through written assignments. However, LLM applications like ChatGPT can challenge this learning process, as students may be tempted to use AI tools to complete their assignments, thus missing out on valuable hands-on experience.

¹<https://openai.com/blog/chatgpt>

²<https://github.com/features/copilot/>

³<https://blogs.microsoft.com/blog/2023/03/16/introducing-microsoft-365-copilot-your-copilot-for-work/>

The availability of applications like ChatGPT presents students with conflicting incentives. Confronted with time constraints, competing interests, or the allure of experimenting with technology, students may be tempted to bypass the often tedious tasks involved in creating an academic paper, opting instead to use an LLM to generate portions of their work. This challenge complicates the traditional learning process and may hinder the development of essential academic skills.

Although LLMs can be beneficial for knowledge discovery, writing assistance, and coding support (Cowen & Tabarrock, 2023; Korinek, 2023; Mollick & Mollick, 2023; Peng et al., 2023), their effective and safe use requires users to have a solid understanding of underlying mechanisms and domain knowledge. This presents a challenge for students in the early stages of learning scientific practices and subject matter.

Teachers cannot simply ban the use of ChatGPT and similar tools, as their use does not currently qualify as plagiarism (Salden & Leschke, 2023) and they are becoming an integral part of various industries.⁴ Educators must therefore teach responsible usage of these tools, while being aware of the inherent tensions, strengths, and weaknesses in relation to research paper assignments.

This working paper addresses the challenges of using ChatGPT for academic writing assignments, specifically for students at the Chair for the Governance of Complex and Innovative Technological Systems at the University of Bamberg.⁵ These notes offer guidelines for responsibly utilizing AI tools while highlighting potential risks and tensions. While the insights may be valuable for a wider audience, the primary aim is to support students taking classes at this Chair.

The paper begins with an overview of LLMs and related applications, followed by a discussion on the role of written assignments in university education. The paper then explores the use of ChatGPT for various tasks involved in academic writing, focusing on the types of papers assigned at the Chair for the Governance of Complex and Innovative Technological Systems at the University of Bamberg. This analysis allows for a detailed understanding of the strengths and weaknesses of ChatGPT in supporting academic writing. Based on these observations, the paper concludes with recommendations for students on responsibly using tools like ChatGPT in their coursework at the Chair, with a focus on promoting learning and skill development.

2 Large language models (LLMs)

Large language models (LLMs) are designed to predict probable language outputs in response to specific prompts, such as predicting the most likely word following a sequence of words or generating sentences or paragraphs as plausible responses to a given textual prompt. For instance, a LLM might output “dogs” in response to the prompt “it’s raining cats and.” LLMs consist of neural networks trained on extensive text corpora to identify probable word and language patterns, which are then stored as weights within the neural network (Brown et al., 2020; Vaswani et al., 2017).⁶ While LLMs can be trained for specific tasks and domains, their recent prevalence is due to the success of proprietary pretrained models like LaMDA (Thoppilan et al., 2022) and GPT (OpenAI, 2023). These models have been trained on vast datasets by companies, who then provide users with access through APIs, web interfaces, or software applications. Examples include

⁴<https://www.youtube.com/watch?v=Bf-dbS9CcRU>

⁵<https://www.uni-bamberg.de/en/complexsys/>

⁶For a non-technical introduction to ChatGPT and similar models see Wolfram, 2023.

the ChatGPT API,⁷ web interface,⁸ GitHub Copilot,⁹ and Microsoft Copilot¹⁰ in the Microsoft 365 software suite.¹¹ These applications facilitate access to LLM outputs but risk obscuring the underlying mechanisms, dependencies, or error sources. The recent ease of use of LLM-enabled services underscores the importance of understanding their workings, particularly in scientific contexts or training.

Metaphors are often used to describe LLMs, attributing human features such as “thinking,” “knowing,” “saying,” or “feeling” to machines. While engaging, this anthropomorphism can be misleading by hiding LLMs’ inner workings and complicating discussions about their appropriate use and potential risks. Instead of resorting to human metaphors, it may be more productive to consider LLMs as a new type of “understanding” distinct from human cognition (Mitchell & Krakauer, 2023). Critical discussions of LLMs have also employed metaphors like “stochastic parrots” (Bender et al., 2021) or “a blurry JPEG of the web” (Chiang, 2023). While imaginative, these metaphors may obscure more than they reveal. To better comprehend LLMs and their uses, it is essential to examine their workings, training data, outputs, and user practices.

Significant critiques of LLMs have been raised, including concerns about bias and fairness, misinformation, opaqueness due to a lack of interpretability and explainability, and environmental impact (Bender et al., 2021; Gebru et al., 2021; Strubell et al., 2019). This paper focuses on concerns specifically related to academic paper assignments, in addition to some of these broader issues.

One significant challenge lies in the general issue of **interpretability and explainability** of AI systems. Students using applications like ChatGPT may quickly receive plausible responses to their prompts, but the mechanisms producing these responses remain hidden. Does the model generate meaningful predictions based on patterns identified in relevant texts, simply repeat previously encountered patterns, or produce plausible yet ultimately meaningless or false responses? The latter is sometimes referred to as “hallucination.” These concerns, including accidental plagiarism or the invention of academic sources, cannot be entirely resolved by users employing applications like ChatGPT for academic paper writing. Nevertheless, users must remain vigilant when interpreting and critically evaluating model outputs.

Another concern is the effect of **phrasing and order of prompts**. Numerous opinions on the impact of prompt design can be found online. Varying tone, level of detail, and prompt order can influence the results obtained. While this can be entertaining,¹² it is troubling when using ChatGPT to obtain an objective overview of a phenomenon or research field. This challenge is particularly significant for students beginning their academic journey, as they may be less capable of identifying biased or misleading accounts than experienced researchers. Current limitations raise concerns about the replicability of model outputs and place heavy demands on users contributing to the writing process.

The **training data** underlying the model also poses questions. While the corpus of models like ChatGPT is vast, it is unclear whether it forms an appropriate basis for predicting text in academic contexts. Academic papers often focus on specific topics and subfields

⁷<https://openai.com/blog/introducing-chatgpt-and-whisper-apis>

⁸<https://openai.com/blog/chatgpt>

⁹<https://github.com/features/copilot/>

¹⁰<https://blogs.microsoft.com/blog/2023/03/16/introducing-microsoft-365-copilot-your-copilot-for-work/>

¹¹For the development of these and similar models see Cao et al., 2023.

¹²Just ask the model to explain the reasons for Brexit in the voice of William Shakespeare or Basil Fawlty.

not well documented in sources such as Wikipedia, the open web, social media, media coverage, or open access publications. In these cases, LLM returns may not be able to calculate specific probabilities and instead rely on those derived from the available text corpus. At the risk of presenting a caricature: think for example of trying to predict specific paragraphs for a paper comparing the political power structures and government bureaucracies of Ancient Sumer and Babylon based on language patterns learned on Reddit. Again, with the total lack of transparency of current LLM applications, there currently is no obvious fix for this. Current LLM applications lack transparency, making it difficult to address this issue.

The **temporal coverage** of the training data is equally important. For instance, GPT-4 is trained on a corpus with coverage ending in September 2021. For questions beyond this time, the underlying model may be unsuitable, as patterns represented in its weights may no longer apply. While ChatGPT alerts users to its temporal limitation, other models may be less transparent while still similarly limited.

Another critical question involves **adjustments made to the learning process**. While it is sensible to introduce constraints on LLMs intended for widespread use, unobserved interferences in the learning process are problematic for researchers. For example, an adjusted LLM for broad consumption would not be useful for studying interaction patterns and speech within hate groups. While this is an extreme example, other subtle adjustments may occur without public documentation, posing challenges for research and academic paper writing.

Privacy and intellectual property concerns also arise regarding input prompts. It is largely unclear how companies providing LLMs treat user prompts. Are they deleted or saved for future use? How do companies handle the transmission of sensitive or protected data in prompts? Who else may access this data, intentionally or otherwise, once it is reused by the company running the model (e.g., as training data for future iterations)? Users must be made aware of these potential issues early on to avoid establishing unsafe usage patterns.

There are also significant concerns related to reliance on LLMs provided by **commercial companies**. These companies control the workings of their models, raising issues for scientific use. Decisions about training data, learning process adjustments, transparency, data privacy, and model maintenance are driven by commercial motives. Already at this early stage of LLM development and deployment, there are examples for the depreciation of earlier models leaving developers and users stranded. Integrating commercially maintained LLMs into research processes or workflows under such conditions is less than ideal.

Running LLMs locally may offer a solution to some of these issues. While initial LLM training is resource-intensive, increasingly there are options for running them locally once trained. This approach could address some of the concerns mentioned above but is more resource and skill-dependent than using a web interface. The rights situation regarding running commercially developed models locally is also unclear at the moment. However, over time, alternatives to centrally hosted models will emerge. Whether the use of these models will resolve the other issues raised above remains an open question.

In summary, while LLMs like ChatGPT offer potential benefits for academic paper writing, numerous challenges need to be addressed. These include interpretability and explainability, prompt design and order, training data limitations, temporal coverage, learning process adjustments, privacy and intellectual property concerns, and reliance on commercial companies. As the field of AI and LLMs progresses, researchers and educators must remain cautious and attentive to these issues, continuously evaluating the

appropriateness of LLMs for academic writing tasks.

3 The function of research paper assignments in teaching and learning

The assignment of research papers in higher education currently faces a tension between learning objectives and students' use of large language models (LLMs) through applications such as ChatGPT during the writing process. To address this tension, it is essential to clarify the teaching goals behind assigning research papers and explore the impact of students' use of these LLM applications on achieving those goals.

In university settings, instructors assign graded papers with multiple objectives, some more apparent than others. Three primary goals of graded assignments include:

- Encouraging students to engage in specific tasks that are crucial for skill development, which they can only acquire through their repeated *doing*;
- Enabling students to monitor their progress and achievement of learning goals throughout their academic journey relative to their cohort;
- Signaling students' relative strengths and skill levels to future employers by allowing a comparison between them and their peers.

The focus of this discussion is on the first function. For insights on the first two functions, other resources are likely of greater help.

Considering the use of applications based on LLM, such as ChatGPT, how do they affect our ability to encourage students to engage in specific tasks related to the production of academic papers?

We first must recognize that university education helps students develop a set of skills through repeated practice of specific tasks (Gooblar, 2019; Lang, 2021). This is evident in programs and courses focused on acquiring a particular method or practice – such as statistics, computer-assisted data analysis, or research projects. It is also crucial in courses aimed at understanding a subject area, a group of middle-range theories, or a topic. Typically, these courses require students to submit a final academic paper. But what skills are expected to be practiced in the process of writing an academic paper?

Students often perceive the primary challenge of an academic paper as producing a lengthy, coherent piece of text. However, it is beneficial for both students and instructors to view the academic paper as a culmination of interconnected and cumulative tasks performed throughout the writing process. As such, the paper serves as an artifact that documents the successful completion of these tasks and can be graded accordingly. For learning and skill acquisition, the critical aspect is not the grade but the actual performance of the tasks that contribute to the final paper. These essential tasks include:

- Investigating a given phenomenon, mechanism, or literature;
- Linking a specific case, phenomenon, or mechanism to a broader category understood by the academic field;
- Generating theory-driven hypotheses based on expected patterns for the larger category;

- Formulating a research question that explores general patterns within a specific case;
- Operationalizing expectations by making them measurable and testable;
- Conducting empirical analysis and producing evidence that supports or refutes the hypotheses;
- Structuring and documenting the results in a series of well-organized paragraphs to create the written paper.

Each task involves a set of practices that students can hone over time through their academic education, provided they repeatedly perform them (Basbøll, 2023a; Becker, 1998, 2020; King, 2000; Silvia, 2018).

However, applications like ChatGPT present a challenge. In the past, papers were graded based on the assumption that students had completed the tasks themselves, with plagiarism being the primary concern. Today, services like ChatGPT enable (semi)automated paper production, bypassing the need for students to complete the tasks themselves. By solely examining the paper as an artifact, it is no longer possible to confidently determine whether a student has engaged in the tasks required for skill development. The use of tools like ChatGPT in completing assignments allows students to (semi)automatically achieve tasks that would otherwise serve as evidence of their learning and gradable efforts.

Students must consciously balance this tension between their potentially conflicting interests – quick, effortless assignment completion versus skill acquisition. The outcomes produced by services like ChatGPT are not guaranteed to align with students’ desired results. In fact, relying on them uncritically for paper assignments may result in unsatisfactory grades or the failing of courses. To understand better how applications like ChatGPT can either aid or impede students in developing essential academic skills, it is helpful to examine their contributions to the specific tasks required for creating assigned papers.

4 Large language model (LLM) applications in support of writing tasks for research paper assignments

To better understand the opportunities and limitations of ChatGPT and other LLM applications in research paper assignments, we will examine the associated tasks using a specific example. For the sake of convenience, I have chosen a topic at the forefront of academic and public debate: the dangers of digital misinformation.

In the following sections, we will explore the necessary tasks involved in the research paper writing process. For each task, I will provide a set of sample prompts and the responses generated by OpenAI’s ChatGPT using the GPT-4 model. Keep in mind that entering prompts in a single thread through the ChatGPT web interface creates path dependency in prompts and answers. Responses are not deterministic and can vary over time or based on the sequence in which you call or refine prompts. As a result, do not expect the responses reported here to exactly replicate if you run them yourself.

4.1 Investigating a given phenomenon, mechanism, or literature

One of the first tasks in working on a writing assignment is the investigation of a phenomenon, mechanism, or a literature of interest. Here, LLMs can provide a first overview. Let's give it a try:

Prompt 4.1:

Provide an overview of the current state of academic debate about the dangers of digital misinformation.

Response 4.1:

As of my knowledge cutoff in September 2021, the academic debate surrounding the dangers of digital misinformation remains a pressing concern. While the landscape may have evolved since then, I can provide you with a general overview of the key themes and issues that were prevalent in the academic debate at that time.

1. **Definition and types of misinformation:** Scholars have been attempting to better define and categorize digital misinformation. They distinguish between misinformation (false or misleading information shared unintentionally) and disinformation (false or misleading information shared with malicious intent). This distinction is important because it helps inform the development of strategies to counter different types of false information.
2. **Psychological and cognitive factors:** Researchers have been studying the psychological and cognitive factors that make people susceptible to misinformation. Topics of interest include cognitive biases, the role of emotions in belief formation, and the influence of social identity and group dynamics on information consumption and sharing behavior.
3. **Spread and amplification:** The mechanisms through which digital misinformation spreads and becomes amplified are a key concern in academic debates. Researchers have been examining the roles of social media algorithms, echo chambers, filter bubbles, and the impact of bots and trolls in the dissemination of false information.
4. **Consequences and societal impact:** Scholars are increasingly concerned about the potential harmful effects of digital misinformation on democracy, public health, and social cohesion. Research is focused on understanding the impact of misinformation on political polarization, vaccine hesitancy, and the erosion of trust in institutions.
5. **Detection and mitigation strategies:** As the dangers of digital misinformation become more apparent, academics have been exploring ways to detect and mitigate its spread. This includes the development of AI-based tools for fact-checking, the promotion of media literacy, and the exploration of policy and regulatory approaches to hold platforms accountable.
6. **Platform responsibility and regulation:** Academics are debating the role of social media platforms and other internet intermediaries in the spread of digital misinformation. This includes discussions on the responsibilities of these

platforms, self-regulation versus government regulation, and the potential implications of regulation for free speech and privacy.

7. Ethical considerations: The academic debate also encompasses ethical considerations related to digital misinformation, such as the balance between freedom of speech and the need to limit the spread of false information, as well as the potential consequences of using AI for detecting and countering misinformation.

Overall, the current state of academic debate on the dangers of digital misinformation is multifaceted, with researchers seeking to understand its causes, consequences, and potential solutions. Collaboration between academia, industry, and policymakers is essential to address this complex issue effectively.

This overview is quite helpful as a starting point. Notice how the model first provides information about its knowledge cutoff in September 2021, indicating that it has no information available on subsequent developments in the field. However, be cautious, as outputs from other models might not be as transparent about the temporal limits of their data.

Examining the content of the response is also informative. We see a canonical definition of mis- and disinformation followed by a fairly comprehensive list of topics discussed in the context of digital misinformation. Each topic sketch remains somewhat general but can offer a broad sense of which topic you could pursue further based on your interests or experiences.

However, while the results on the dangers of misinformation provide a helpful general overview, this may not be the case for all topics. For example, if a topic has undergone significant developments not represented in the model's available data, the overview could be less useful or even misleading. Additionally, digital misinformation is a widely-discussed topic with a substantial data footprint, while other topics may be more niche. In these cases, large language models may rely more on general patterns in text rather than those specific to the topic at hand, resulting in outputs that are more general and less relevant to your topic of interest. In such instances, the results may be less helpful.

Now it's time to get more specific. You are satisfied with the list of potential research topics returned by the model, but you need to decide on one to pursue in your paper. Let's assume you are interested in the fourth topic: consequences and societal impact. Let's dig deeper:

Prompt 4.2:

Provide a detailed discussion of the current state of academic debate about the consequences and societal impact of digital misinformation. Include academic sources.

Response 4.2:

As of my knowledge cutoff in September 2021, the consequences and societal impact of digital misinformation have been a topic of great concern in academic debates. This discussion is multifaceted, with researchers examining the impact of digital misinformation on various aspects of society, including democracy, public health,

and social cohesion. Here are some key areas of focus:

1. **Political polarization:** Digital misinformation has been found to contribute to political polarization, as it often reinforces existing beliefs and biases. Researchers argue that the spread of false information can deepen existing divisions and create an environment where it becomes difficult to engage in constructive political dialogue (Allcott & Gentzkow, 2017; Bail et al., 2018).
2. **Electoral integrity:** Misinformation has been shown to influence voters' decisions and undermine the integrity of democratic processes. Studies have found that exposure to false information can shape people's attitudes, beliefs, and voting behavior (Grinberg et al., 2019; Pennycook & Rand, 2018).
3. **Public health:** The spread of misinformation related to public health, particularly during the COVID-19 pandemic, has led to vaccine hesitancy and the adoption of harmful practices. Researchers have highlighted the negative consequences of health misinformation, including undermining trust in medical institutions and compromising efforts to control the pandemic (Roozenbeek et al., 2020; Wilson & Starbird, 2020).
4. **Social cohesion:** Misinformation can lead to the erosion of social cohesion by fueling fear, hatred, and divisions among different groups. For example, the spread of false information about minority groups can contribute to discrimination, stigmatization, and even violence (Wardle & Derakhshan, 2017; Marwick & Lewis, 2017).
5. **Trust in institutions:** The proliferation of digital misinformation can lead to a general decline in trust in institutions, such as the media, government, and scientific establishments. This erosion of trust can have serious implications for the functioning of democratic societies (Lewandowsky et al., 2017; Friggeri et al., 2014).
6. **Economic consequences:** Misinformation can also have negative economic impacts, such as influencing financial markets based on false rumors or causing panic-buying and hoarding during crises (Bordino et al., 2012; Vosoughi et al., 2018).

Academic sources:

- Allcott, H., & Gentzkow, M. (2017). Social media and fake news in the 2016 election. *Journal of Economic Perspectives*, 31(2), 211-236.
- Bail, C. A., Argyle, L. P., Brown, T. W., Bumpus, J. P., Chen, H., Hunzaker, M. B. F., ... & Volfovsky, A. (2018). Exposure to opposing views on social media can increase political polarization. *Proceedings of the National Academy of Sciences*, 115(37), 9216-9221.
- Grinberg, N., Joseph, K., Friedland, L., Swire-Thompson, B., & Lazer, D. (2019). Fake news on Twitter during the 2016 US presidential election. *Science*, 363(6425), 374-378.

- Pennycook, G., & Rand, D. G. (2018). The Implied Truth Effect: Attaching Warnings to a Subset of Fake News Stories Increases Perceived Accuracy of Stories Without Warnings. *Management Science*, 66(11), 4944-4957.
- Roozenbeek, J., Schneider, C. R., Dryhurst, S., Kerr, J., Freeman, A. L., Recchia, G., van der Bles, A. M., van der Linden, S., & Nyhan, B. (2020). Susceptibility to misinformation about COVID-19 around the world. *Royal Society Open Science*, 7(10), 201199.
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- Friggeri, A., Adamic, L. A., Eckles, D., & Cheng, J. (2014). Rumor Cascades. *Proceedings of the Eighth International Conference on Weblogs and Social Media, ICWSM 2014*, 101-110.
- Bordino, I., Battiston, S., Caldarelli, G., Cristelli, M., Ukkonen, A., & Weber, I. (2012). Web search queries can predict stock market volumes. *PloS One*, 7(7), e40014.
- Vosoughi, S., Roy, D., & Aral, S. (2018). The spread of true and false news online. *Science*, 359(6380), 1146-1151.

To summarize, the academic debate on the consequences and societal impact of digital misinformation remains a crucial area of research. The key areas of focus include political polarization, electoral integrity, public health, social cohesion, trust in institutions, and economic consequences. The findings from these studies highlight the significance of understanding and addressing digital misinformation to safeguard the well-being of societies around the world. However, it is essential to keep in mind that the landscape of digital misinformation and its consequences is continuously evolving, and ongoing research is necessary to better understand and respond to emerging challenges.

Once again, this overview is helpful while also alerting you to the fact that this topic alone is too broad for your paper. So, it seems reasonable to explore one of the subtopics in more depth. But before we do so, let's examine the references provided by the model.

First, we need to verify whether the provided references actually exist. This may be a surprising step, but since LLMs focus on plausibility, they can sometimes return plausible yet nonexistent sources. So, do not take them at face value.

In this case, we are fortunate – all the sources exist. But do they actually support the points for which they are cited?

It turns out that this is not the case. Take, for example, Bordino et al. (2012) and Vosoughi et al. (2018). Both are cited in support of the economic consequences of misinformation – an interesting question, indeed. However, neither source covers this specific issue. While potentially informative, the sources listed by the LLM cannot be trusted at face value. To find access points to the relevant literature, you would be better served by reading a handbook chapter or review article on the topic.

Now, let's return to our exploration. But first, let's ensure that there are no additional subtopics to consider:

Prompt 4.3:

Are these all aspects of the current debate about the consequences and societal impact of digital misinformation?

Response 4.3:

While the aspects mentioned in the previous responses provide a comprehensive overview of the main themes and concerns in the academic debate about the consequences and societal impact of digital misinformation, there could be other related aspects and emerging topics that contribute to the discussion. Here are a few more potential areas of interest:

1. **Emotional manipulation:** Researchers are examining the role of emotions in the spread and impact of digital misinformation. Misinformation that triggers strong emotional reactions, such as fear, anger, or surprise, is more likely to be shared and engaged with, which can have consequences for societal discourse and decision-making (Brady et al., 2017).
2. **Conspiracy theories:** The proliferation of conspiracy theories online is another aspect of digital misinformation with societal consequences. The spread of such theories can contribute to a distrust of established institutions, scientific consensus, and mainstream media, undermining social cohesion and rational public discourse (Douglas et al., 2019).
3. **Impact on marginalized communities:** Misinformation can disproportionately affect marginalized communities, such as ethnic and religious minorities, LGBTQ+ individuals, or people with disabilities. False information targeting these groups can perpetuate stereotypes, stigmatization, and discrimination (Starbird, 2019).
4. **Algorithmic amplification:** The role of algorithms and platform design in the spread of digital misinformation is another area of interest. Researchers are exploring how social media algorithms can amplify misinformation by prioritizing content that generates engagement, even if it is false or misleading (Vosoughi et al., 2018).
5. **Impact of deepfakes:** Advances in technology have led to the rise of deepfakes, which are manipulated audio and video content that can be difficult

to distinguish from authentic material. This emerging form of digital misinformation raises concerns about its potential implications for disinformation campaigns, privacy violations, and the erosion of trust in audiovisual content (Chesney & Citron, 2019).

These additional aspects, along with the ones previously discussed, contribute to the current academic debate on the consequences and societal impact of digital misinformation. However, as the landscape of digital misinformation and technology is continuously evolving, new issues and concerns may emerge, requiring ongoing research and analysis.

This example demonstrates that it is always important not to simply accept the results of a model at face value, but instead to examine them further. In fact, we could continue to investigate, although the usefulness of doing so might vary depending on the topic in question.

Now that you have an extensive list of potential societal impacts of digital misinformation, you need to settle on a topic specific enough to write a paper about. Let's focus on one topic: electoral integrity.

Prompt 4.4:

Provide an account of how academics think digital misinformation do or do not impact electoral integrity.

Response 4.4:

Academics have been investigating the potential impact of digital misinformation on electoral integrity, with some studies suggesting that misinformation can have a considerable influence on voters' decisions and the democratic process as a whole. Here are some key findings and perspectives on how digital misinformation may or may not impact electoral integrity:

1. Influence on voting behavior: Research indicates that exposure to misinformation can affect people's attitudes, beliefs, and ultimately, their voting behavior. For instance, a study by Pennycook and Rand (2018) demonstrated that attaching warnings to a subset of fake news stories can increase the perceived accuracy of stories without warnings, indirectly influencing voters' decisions. Another study by Grinberg et al. (2019) found that fake news played a significant role in shaping public opinion during the 2016 US presidential election.
2. The role of echo chambers and filter bubbles: Researchers argue that echo chambers and filter bubbles, where individuals are exposed primarily to information that aligns with their existing beliefs, can contribute to the spread of misinformation and further polarize voters (Bail et al., 2018). As a result, these phenomena may compromise the integrity of elections by fostering an environment where misinformation thrives and significantly influences voters' choices.
3. Misinformation campaigns and foreign interference: Academics have docu-

mented cases of coordinated misinformation campaigns, often backed by foreign adversaries, that aim to undermine electoral processes and public trust in democratic institutions (Marwick & Lewis, 2017; Wardle & Derakhshan, 2017). These campaigns can spread misinformation to manipulate public opinion, discredit candidates, and even suppress voter turnout.

4. Limited impact on voter behavior: On the other hand, some studies suggest that the impact of misinformation on electoral integrity may be limited. A study by Guess et al. (2018) found that the exposure to fake news during the 2016 US presidential election was heavily concentrated among a small group of people, and the overall impact on voting behavior was relatively minor. Additionally, Nyhan and Reifler (2010) found that corrective information can sometimes be ineffective in changing people's beliefs, suggesting that the effects of misinformation may be difficult to counteract, even when debunked.

In conclusion, while the academic literature provides evidence that digital misinformation can impact electoral integrity by influencing voter behavior, creating echo chambers, and facilitating foreign interference, some studies suggest that the overall impact on elections might be limited. More research is needed to understand the complex interplay between digital misinformation and electoral integrity, as well as to develop strategies to mitigate the potential negative effects of misinformation on democratic processes.

This remains promising. We began with a general list of various potential ways digital misinformation might impact societies. Through a series of further prompts, we refined that list, focusing on political dangers and ultimately settling on one. For that topic, the model provided different perspectives and key readings. While the discussion of each topic remained rather superficial and brief, the results present us with a wide array of potential topics we could delve deeper into and begin reading up on outside the model. As a discovery and structuring tool for this specific question, ChatGPT proved helpful.

More generally, the examples above demonstrate that LLM applications can indeed assist students in gaining an initial understanding of academic debates and their topical substructures. However, the quality of responses depends on the nature of the topic and the richness of its representation in the data available to the model. Additionally, students should not rely on the specifics of the results being correct. There is no guarantee that listed references exist, are accurate, or speak to the point they are supposed to reference. Simply relying on these outputs will likely lead to unsatisfactory or even failing grades.

Furthermore, while LLM might provide students with a list of topics or subtopics, this does not replace the balanced discussion of specific academic subfields and topics found in academic handbooks or survey articles. In these resources, students can discover valuable overviews documenting dominant theories, prominent methods, important findings, and historical developments for specific scientific areas. These overviews are far more suited to provide actual understanding of a field, as opposed to a list of bullet points with high-level summaries.

Now, let's move on and see if we can apply this approach to a specific case.

4.2 Linking a specific case, phenomenon, or mechanism to a broader category understood by the academic field

Now that we have a general idea of how academics think digital misinformation might impact elections, let's see if we can apply this to a specific case:

Prompt 4.5:

Provide a list of the different ways digital misinformation might have impacted the German Federal Election 2021.

Response 4.5:

Although specific instances of digital misinformation impacting the 2021 German Federal Election might not be available due to my knowledge cutoff in September 2021, it is possible to outline different ways in which digital misinformation could have potentially affected the election, based on general patterns and trends observed in other elections:

1. **Influence on voter behavior:** Digital misinformation, including fake news and disinformation, can sway public opinion by spreading false or misleading information about political parties, candidates, or policies. This may lead to voters making decisions based on incorrect or manipulated information.
2. **Polarization and echo chambers:** Misinformation can contribute to the creation of echo chambers and filter bubbles, where individuals are primarily exposed to information that aligns with their existing beliefs. This can result in increased political polarization and less constructive political discourse.
3. **Foreign interference:** Foreign actors may use digital misinformation campaigns to interfere in the election process. By spreading false information or engaging in coordinated disinformation efforts, they can attempt to undermine public trust in democratic institutions, discredit candidates, or manipulate public opinion in favor of a particular political agenda.
4. **Erosion of trust in mainstream media and institutions:** The spread of digital misinformation can lead to an erosion of trust in mainstream media, political institutions, and the democratic process. This may result in greater cynicism and apathy among the electorate, potentially impacting voter turnout or the perceived legitimacy of the election outcome.
5. **Amplification through social media:** Social media platforms can inadvertently amplify the spread of misinformation due to their algorithms, which prioritize content based on engagement. As misinformation often generates strong emotional reactions, it can be more likely to be shared and engaged with, potentially increasing its reach and impact on the election.
6. **Impact on marginalized communities:** Misinformation targeting specific ethnic, religious, or other marginalized communities can exacerbate existing social tensions and contribute to the further marginalization and stigmatization of these groups. This can have implications for social cohesion, as well as for the electoral process.

7. Challenges for journalism and fact-checking: The proliferation of digital misinformation poses challenges for journalists and fact-checkers, who must contend with the rapid spread of false information and the erosion of trust in their profession. This can make it more difficult to provide accurate, unbiased reporting and analysis during the election period.

While these potential impacts are based on general trends observed in other elections, they can serve as a starting point for understanding how digital misinformation might have influenced the 2021 German Federal Election. Further research and analysis would be necessary to determine the specific instances and extent of digital misinformation's impact on the election.

Unfortunately, this is less helpful. Each of the issues raised by the model could be relevant for the impact of misinformation on electoral integrity, but they are not specific to misinformation. In fact, they would all be true for any type of informational campaign, whether misinformative or not. However, perhaps we can obtain better results by asking about one specific impact:

Prompt 4.6:

How could we know if digital misinformation impacted marginalized communities in Germany as to influence the German Federal Election 2021?

Response 4.6:

To determine if digital misinformation impacted marginalized communities in Germany during the 2021 German Federal Election, researchers would need to conduct thorough investigations and analyses. Here are some approaches that could be employed:

1. Content analysis: Analyze social media posts, articles, and other digital content targeting marginalized communities in Germany during the election period. Look for instances of misinformation or disinformation that may have affected the communities' perception of political parties, candidates, or issues.
2. Surveys and interviews: Conduct surveys and interviews with members of marginalized communities to gauge their exposure to misinformation during the election and its perceived impact on their political beliefs, opinions, and voting behavior.
3. Social media data analysis: Examine social media data to identify patterns of misinformation spread within and across marginalized communities. This can help in understanding how misinformation may have infiltrated these communities and influenced their political views or actions.
4. Case studies: Carry out in-depth case studies of specific instances where misinformation may have targeted marginalized communities during the election. Investigate the sources and motivations behind these misinformation campaigns, as well as their potential impact on the targeted communities.

5. Collaborate with local organizations: Work with organizations and NGOs that support marginalized communities in Germany to gather insights about the communities' experiences with digital misinformation during the election.
6. Assess the impact on voter turnout: Examine voter turnout data for areas with higher concentrations of marginalized communities. Analyze if there were noticeable changes in voter turnout that might be attributable to the influence of misinformation.
7. Compare with previous elections: Analyze the prevalence and impact of misinformation in previous German Federal Elections to determine if there were significant differences in the 2021 election that could suggest a particular impact on marginalized communities.

These approaches can provide valuable insights into the potential impact of digital misinformation on marginalized communities during the 2021 German Federal Election. However, it is essential to recognize that determining the causal relationship between misinformation and electoral outcomes is complex and may involve multiple factors. Thus, researchers should employ multiple methods and triangulate their findings to arrive at a more comprehensive understanding of the issue.

This is well-written, but so general that it could be true for any study examining persuasion in political campaigns for any subgroup or population. As we have seen above, the more specific the task demanded of the LLM, the more general and unspecific the responses become.

Let's take a step back and see if the model is better at identifying mechanisms underlying suspected effects of digital misinformation:

Prompt 4.7:

Provide a detailed mechanism of how digital misinformation might have influenced voting behavior during the German Federal Election 2021. Be specific as possible to the conditions of German elections.

Response 4.7:

While specific instances of digital misinformation impacting the 2021 German Federal Election might not be available due to my knowledge cutoff in September 2021, a hypothetical mechanism detailing how digital misinformation could have influenced voting behavior during the election can be outlined:

1. Creation and dissemination of misinformation: Misinformation could be created by various actors, including individuals, groups with vested interests, or foreign adversaries. This misinformation, in the form of misleading articles, memes, or videos, may target specific political parties, candidates, or policies, and could be spread through social media platforms, messaging apps, or other digital channels.
2. Amplification through social media and algorithms: The algorithms employed by social media platforms may inadvertently amplify the spread of

misinformation by prioritizing content that generates high engagement. Misinformation often evokes strong emotional reactions, making it more likely to be shared, commented on, or liked, increasing its visibility and reach.

3. Exposure and consumption: German voters may come across this misinformation on their social media feeds, messaging apps, or other digital channels. Voters might be more susceptible to misinformation that aligns with their existing beliefs or political inclinations, making them more likely to accept and engage with it.
4. Echo chambers and filter bubbles: As people share and engage with misinformation, social media algorithms may create echo chambers and filter bubbles, further reinforcing voters' existing beliefs and polarizing their opinions. These phenomena could lead to a more distorted perception of political reality, making it difficult for voters to make informed decisions.
5. Impact on political beliefs and opinions: Exposure to misinformation can influence voters' beliefs and opinions about political parties, candidates, or policies. This could potentially result in misinformed policy preferences or support for candidates based on incorrect or misleading information.
6. Influence on voter turnout: Misinformation may affect voter turnout by creating apathy or distrust in the electoral process, discouraging some voters from participating in the election. Alternatively, misinformation could mobilize certain groups of voters by appealing to their emotions or exploiting existing divisions.
7. Voting decisions: Ultimately, the exposure to and influence of digital misinformation could impact the way voters cast their ballots during the 2021 German Federal Election, potentially altering the election results.

It is important to note that this mechanism is a hypothetical illustration of how digital misinformation might have influenced voting behavior during the German Federal Election in 2021. Determining the actual impact of misinformation on the election would require a thorough investigation and analysis of specific instances of misinformation and their effects on voters. Additionally, the relationship between misinformation and electoral outcomes is complex, and numerous other factors may also contribute to voting behavior.

Once again, we find ourselves in the wonderland of generalities. Note how nothing in the results points to the specifics of German elections. Also, the model does not present mechanisms in the sense of causally linked variables and outcomes. Instead, it lists general phenomena connected to misinformation.

Let's give it another try. This time, we specify that we are looking for a causal model and focus on the election of 2017 – an election that should be within the scope of textual representation available to the model.

Prompt 4.8:

Provide a set of five causal mechanism of how exposure of digital misinformation might have influenced voting behavior during the German Federal Election 2017. Be specific as possible to the conditions of German elections and the empirically known usages patterns of digital media in the German population.

Response 4.8:

While my knowledge is limited to information up to September 2021 and specific instances of digital misinformation impacting the 2017 German Federal Election may not be available, I can provide a set of hypothetical causal mechanisms detailing how exposure to digital misinformation could have influenced voting behavior during the election:

1. Exploiting existing social divisions: Misinformation creators could have crafted content that played on existing social divisions, such as concerns about immigration or the perceived effects of globalization. By exploiting these divisions, digital misinformation might have reinforced or exacerbated pre-existing beliefs and fears among the German population, swaying voter preferences towards political parties or candidates that promised to address these issues.
2. Undermining trust in political figures and institutions: Digital misinformation might have spread false claims or rumors about political parties, candidates, or government institutions, eroding public trust in the democratic process. This erosion of trust could have led to increased support for alternative parties or candidates perceived to be more transparent or trustworthy, or, conversely, voter apathy and reduced voter turnout.
3. Shaping policy preferences: Misinformation might have misrepresented or exaggerated the potential consequences of certain policies, leading voters to support or oppose policies based on false or misleading information. For instance, misinformation could have spread misleading statistics about the economic impact of certain policies, pushing voters to make decisions based on inaccurate perceptions of potential outcomes.
4. Manipulation through emotional appeal: Digital misinformation often uses emotional appeal to gain attention and engagement. By evoking strong emotions such as fear, anger, or sympathy, misinformation creators could have manipulated voter opinions, pushing them towards political parties or candidates who appeared to address these emotional concerns.
5. Peer influence and social media networks: In the context of the German population's usage patterns of digital media, peer influence could play a significant role in shaping voting behavior. As misinformation spreads through social media networks and messaging apps, people might be more likely to trust and engage with content shared by their friends, family, or acquaintances. This social validation could reinforce the impact of digital misinformation on political beliefs and, ultimately, voting behavior.

It is essential to understand that these causal mechanisms are hypothetical and based on general trends and patterns observed in other elections. Determining the actual impact of digital misinformation on the 2017 German Federal Election would require thorough investigation and analysis of specific instances of misinformation and their effects on voters. Additionally, the relationship between misinformation and electoral outcomes is complex, and numerous other factors may also contribute to voting behavior.

Examining the response, specifying that we are looking for causal mechanisms helped in formulating potential mechanisms. That said, the results are not at all specific to German elections, the context of 2017, or the use of digital media by the German population.

In summary, ChatGPT was much less successful in connecting the academic debate about digital misinformation to the specific case of German elections. This was true for both the federal election of 2021 and that of 2017, on which the model should have been able to draw information. At least in its current iteration, the model provides much less meaningful results the more specific a request becomes. Additionally, it is not able to translate general expectations (like the expected impact of misinformation on elections) to a specific context (their impact in the context of German elections). As paper assignments focus on specific questions and cases, this limits the usefulness of these models for students in this regard.

4.3 Generating theory-driven hypotheses based on expected patterns for the larger category

Let's focus on the next task in preparing a research paper assignment: formulating theory-driven hypotheses. This is an area that students regularly struggle with, especially during their first semesters. The difficulty of this task lies in translating one's own interests and knowledge of a case into a specific structure. Theories (here and subsequently, I only refer to mid-range theories when using the term) are a symbolic representation of the way scientists believe a specific part of the world works. Now, I only have to figure out which theory contains expectations about the workings of that part of the world I am interested in – in our case, voting behavior and the persuasive appeal of information or misinformation. Once I have done so, I can develop hypotheses based on scientific expectations about the world – theories – for how my specific case – the role of misinformation for voting behavior during the Federal election 2017 in Germany – should work.

A large part of academic training focuses on training students to translate their interests into this structure and familiarize them with relevant theories and practices of empirical evidence generation and interrogation.

Interestingly, the structured representation of theories and associated hypotheses in texts makes LLMs potentially more suited to this specific task than the previous one, where they had to form expectations about a specific case. So let's see how the LLM performs:

Prompt 4.9:

Provide a set of five testable theory-driven hypotheses on how digital misinformation might have impacted voting behavior during the German Federal Election 2017. Consider the specifics of the German electoral context.

Response 4.9:

Here are five testable, theory-driven hypotheses on how digital misinformation might have impacted voting behavior during the 2017 German Federal Election, considering the specifics of the German electoral context:

1. Hypothesis 1 (Impact on Support for Political Parties): Exposure to digital misinformation that portrayed mainstream parties in a negative light or emphasized the alleged benefits of alternative parties led to an increase in support for smaller or populist parties during the 2017 German Federal Election.
2. Hypothesis 2 (Trust in Democratic Institutions): Exposure to digital misinformation that cast doubt on the integrity of democratic institutions or questioned the transparency and honesty of political figures resulted in a decrease in trust in democratic institutions and processes among German voters, subsequently affecting their voting behavior.
3. Hypothesis 3 (Polarization and Issue Salience): Exposure to digital misinformation that amplified polarizing issues, such as immigration or economic policies, increased the salience of these issues in voters' minds and led them to vote for parties that took more extreme positions on these matters.
4. Hypothesis 4 (Voter Turnout): Exposure to digital misinformation that fostered cynicism, apathy, or distrust in the electoral process contributed to a decrease in voter turnout during the 2017 German Federal Election, particularly among specific demographic groups.
5. Hypothesis 5 (Regional Variation): The impact of digital misinformation on voting behavior in the 2017 German Federal Election varied by region, with areas that experienced higher levels of exposure to misinformation showing different voting patterns compared to areas with lower exposure levels.

These hypotheses can be tested using a combination of quantitative and qualitative research methods, including analyzing voter behavior data, conducting surveys, and analyzing social media data. Comparing the results of these investigations to previous elections or other electoral contexts can further strengthen the validity of the findings. It is important to remember that causal relationships between digital misinformation and voting behavior are complex, and other factors may also contribute to observed voting patterns.

At first glance, this appears rather promising. We receive a set of clearly defined hypotheses that focus on different potential effects of misinformation on voting behavior. But again, we encounter the model's tendency toward the general. The hypotheses could apply to virtually any election or type of information. Now, one could argue that this is the point, as we treat the German federal election 2017 as a case for elections in general. So general hypotheses are in order. However, a deeper reflection on what makes German elections or the context of 2017 unique would have been nice and would probably be expected in a written paper along the lines suggested.

But, and I think this should be emphasized, the model returns helpful examples for topically related hypotheses. As stated above, one of the central challenges for students in preparing their research papers is translating their interests into the structure of theory-

driven hypotheses. By using LLMs, they can generate and experiment with many examples that are related to their interests and do not have to rely on the few and topically limited examples provided by textbooks or lectures. This makes this a potentially very helpful feature in teaching.

There is another wrinkle in the results. While the hypotheses are plausible, their connection to underlying theories remains implicit. Let's see if we can mitigate this:

Prompt 4.10:

Be specific: What theories of voter behavior ground these hypotheses?

Response 4.10:

The five hypotheses presented earlier draw upon various theories of voter behavior. Here, I will outline the theories that underpin each hypothesis:

1. Hypothesis 1 (Impact on Support for Political Parties): This hypothesis is based on the theory of issue voting, which posits that voters choose parties or candidates based on their stance on specific issues that are most important to the voter. In the context of misinformation, false or misleading information about parties or candidates can alter voters' perceptions of their issue stances, thereby affecting their voting choices.
2. Hypothesis 2 (Trust in Democratic Institutions): This hypothesis is grounded in the theory of political trust, which suggests that trust in political institutions influences how citizens engage with the political system. Misinformation that erodes trust in democratic institutions can discourage political participation, leading to changes in voting behavior.
3. Hypothesis 3 (Polarization and Issue Salience): The theory of agenda-setting and issue salience informs this hypothesis. Agenda-setting theory posits that the media's focus on specific issues influences the importance that voters assign to these issues. Misinformation that amplifies polarizing issues can heighten their salience, leading voters to prioritize these issues and support parties or candidates that take more extreme positions on them.
4. Hypothesis 4 (Voter Turnout): This hypothesis is informed by the theory of political efficacy, which refers to the belief that an individual's political actions can make a difference. When misinformation breeds cynicism or distrust in the electoral process, it can diminish voters' sense of political efficacy, resulting in lower voter turnout.
5. Hypothesis 5 (Regional Variation): The contextual or ecological theory of voting behavior underlies this hypothesis. According to this theory, contextual factors, such as regional variations in exposure to misinformation, can influence voting behavior. In this case, areas with higher exposure to misinformation might exhibit different voting patterns compared to areas with lower exposure levels.

These theories provide a foundation for understanding how digital misinformation might have impacted voting behavior during the 2017 German Federal Election.

By testing these hypotheses and examining their relationships with the theories, researchers can gain valuable insights into the role of digital misinformation in shaping electoral outcomes.

Now, this is very helpful. The model returns for each hypothesis an appropriate theory of voting behavior that underlies the proposed expectations. While each item remains brief and by itself is not enough for a written paper, this set of prompts helps students in two of their most challenging tasks in preparing a written paper: formulating theory-driven hypotheses and surveying a set of potentially relevant theories. While I would argue that the results by themselves are not sufficient for a respective discussion in a written paper, this can serve as a structuring and surfacing device for students. It allows them, through repetition and variation, to gain a firmer grasp on the structure of scientific argument and the set of prominent theories within a given subject area, which they can then further explore through traditional means of exploration and literature research.

That said, the model again shows its limitations. Notice how the model does not propose theories specific to misinformation or the German case, but voting behavior in general. This again demonstrates its strengths for data-rich and general topics and its relative weaknesses for specific conditions with relative data scarcity. As many of your interests will share these characteristics, remain aware of these limitations and avoid the pull toward the general and unspecific.

From the lecturer's perspective, this pull toward the general of LLMs can prove helpful. True, general assignments along the lines of "What are the five most influential theories on voting behavior?" might face challenges given the capabilities of LLMs. But specifying assignments to specific cases or specific types of effects might limit – at least for now – the use of LLMs to substitute tasks in the research, drafting, and writing process of a research report sufficiently as to force students back to engage with the topic instead of relying fully or predominantly on model outputs.

4.4 Formulating a research question that explores general patterns within a specific case

Another challenge students face is formulating and committing to a research question to pursue in their written assignments. This task involves translating individual interests and insights into a recognized structure of academic argument. LLMs can potentially provide helpful assistance in this area.

Prompt 4.11:

What are possible research questions examining these hypotheses?

Response 4.11:

To examine the hypotheses presented earlier, researchers can formulate specific research questions that help guide their investigations. Here are some possible research questions for each hypothesis:

1. Hypothesis 1 (Impact on Support for Political Parties):
 - To what extent did exposure to digital misinformation about main-

stream parties or alternative parties influence voters' support for these parties during the 2017 German Federal Election?

- Did digital misinformation change voters' perceptions of political parties' stances on key issues, and if so, how did this affect their voting choices?

2. Hypothesis 2 (Trust in Democratic Institutions):

- How did exposure to digital misinformation that cast doubt on the integrity of democratic institutions or political figures affect German voters' trust in these institutions during the 2017 German Federal Election?
- Did changes in trust levels correlate with changes in voting behavior, such as increased support for alternative parties or candidates?

3. Hypothesis 3 (Polarization and Issue Salience):

- Did exposure to digital misinformation that amplified polarizing issues lead to increased issue salience among German voters during the 2017 German Federal Election?
- How did the heightened salience of these issues influence voters' preferences for parties or candidates with more extreme positions on these matters?

4. Hypothesis 4 (Voter Turnout):

- Did exposure to digital misinformation that fostered cynicism, apathy, or distrust in the electoral process contribute to a decrease in voter turnout during the 2017 German Federal Election?
- Were specific demographic groups more affected by this decrease in voter turnout, and if so, which groups?

5. Hypothesis 5 (Regional Variation):

- How did regional variations in exposure to digital misinformation affect voting behavior during the 2017 German Federal Election?
- Were there specific regions in Germany that showed significant differences in voting patterns due to higher exposure to misinformation compared to areas with lower exposure levels?

These research questions can be addressed using a combination of quantitative and qualitative methods, such as analyzing voter behavior data, conducting surveys, and analyzing social media data. By examining these research questions, researchers can gain a better understanding of the role of digital misinformation in shaping voting behavior during the 2017 German Federal Election.

As expected, the LLM output effectively surfaces potential research questions connected with the previously defined hypotheses. Although these questions may be too vague to serve as actual assignment questions, they help students understand the structure needed to translate their interests and insights. Similar to the construction of theory-driven hypotheses, generating a large set of potential research questions can aid students in grasping the structure of argument expected in research papers.

We have observed that the model output has been helpful in presenting various potential hypotheses and research questions that, from a perspective of argument structure, are sensible and promising. However, the model was less successful in accounting for the conditions of specific cases. This limitation might result from having insufficient information available for specific cases, which could potentially be resolved by inputting more data, or it might be due to an underlying pull toward generalization. For now, this restricts the applicability of the models for research questions examining specific cases in written assignments.¹³

4.5 Operationalizing expectations by making them measurable and testable

The next step after settling on a research question and developing hypotheses involves operationalizing the associated expectations. This process makes them measurable and, in turn, testable. We can anticipate mixed results from LLMs in this area. Operationalization requires applying a theoretical expectation to a specific variable, connecting features from general representations of mechanisms specified in theory with specific variables documenting particular features of individual cases. The former should be a strength of LLMs, while the latter may not be.

Prompt 4.12:

Provide three examples of how to operationalize and measure hypothesis 1

Response 4.12:

Hypothesis 1 states that exposure to digital misinformation that portrayed mainstream parties in a negative light or emphasized the alleged benefits of alternative parties led to an increase in support for smaller or populist parties during the 2017 German Federal Election. To operationalize and measure this hypothesis, researchers can use various methods:

1. Example 1: Content analysis of digital misinformation
 - Collect and analyze a sample of digital misinformation from social media, websites, and other online platforms during the 2017 German Federal Election campaign period.
 - Code and categorize the misinformation based on the targeted political parties (mainstream vs. alternative) and the nature of the content (negative portrayal of mainstream parties or promotion of alternative parties).
 - Quantify the prevalence of misinformation targeting different parties and identify key themes or narratives that emerged.
2. Example 2: Surveys on exposure to misinformation and party support
 - Conduct surveys among a representative sample of German voters.

¹³It's worth noting that the prompts used here are relatively straightforward. There might be alternative prompt sequences – for example, starting with case descriptions and then moving to theory – that could yield more promising results.

- Include questions about respondents' exposure to specific instances of digital misinformation targeting mainstream or alternative parties, as well as their level of agreement with the misinformation.
- Assess respondents' support for various political parties and compare support levels between those who were exposed to misinformation and those who were not.
- Use statistical analysis to determine if there is a significant relationship between exposure to digital misinformation and increased support for smaller or populist parties.

3. Example 3: Panel data analysis

- Use panel data that tracks a group of individuals over time, preferably before, during, and after the 2017 German Federal Election campaign period.
- Measure respondents' exposure to digital misinformation and their support for different political parties at various points in time.
- Employ panel data analysis techniques, such as fixed effects or random effects models, to estimate the impact of exposure to digital misinformation on changes in support for mainstream and alternative parties over time.
- Control for potential confounding factors, such as demographic characteristics, political beliefs, and media consumption habits.

These examples illustrate different approaches to operationalizing and measuring the impact of digital misinformation on support for political parties during the 2017 German Federal Election. By using a combination of methods and triangulating findings, researchers can obtain a more robust understanding of the relationship between exposure to digital misinformation and changes in voting behavior.

As expected, the model provides helpful, albeit rather general, approaches to measure the impact of digital misinformation on the German federal election in 2017. The suggestions are all sensible but could have been posed identically for any other election or any other type of informational phenomenon. So again, LLMs are helpful in providing a general high-level overview of potential empirical approaches but remain too abstract to replace human effort.

The LLM has suggested specific empirical approaches, but no empirical approach is perfect. Let's see if the model recognizes this:

Prompt 4.13:

What are known issues in the measurement of exposure to digital misinformation and their effects?

Response 4.13:

Measuring exposure to digital misinformation and its effects presents several challenges for researchers. Some known issues include:

1. **Selection bias:** People may self-select the type of information they consume, often seeking content that aligns with their existing beliefs or opinions. This makes it difficult to disentangle the effect of misinformation exposure from individuals' predispositions, as those who are exposed to misinformation might already hold certain opinions or beliefs that make them more susceptible to it.
2. **Social desirability bias:** In surveys and interviews, respondents might underreport their exposure to digital misinformation or overreport their resistance to it due to social desirability bias. This can lead to an underestimation of the prevalence and impact of misinformation.
3. **Recall bias:** When measuring exposure to digital misinformation through surveys, respondents might have difficulty accurately recalling specific instances of misinformation they encountered, particularly if they were exposed to a large volume of information during a given period. This can result in inaccurate estimates of exposure levels and effects.
4. **Endogeneity and reverse causality:** The relationship between exposure to digital misinformation and its effects on beliefs or behaviors may be endogenous, meaning that an unobserved factor influences both exposure and outcomes. Alternatively, reverse causality might be at play, with individuals' pre-existing beliefs or behaviors affecting their exposure to misinformation. Both of these issues complicate the identification of causal relationships.
5. **Establishing causality:** Demonstrating a causal link between exposure to digital misinformation and specific outcomes, such as voting behavior or policy preferences, can be challenging due to the complex interplay of various factors that influence these outcomes. It can be difficult to isolate the effect of misinformation exposure from other factors, such as media environment, personal beliefs, and social context.
6. **Privacy and ethical concerns:** Analyzing digital misinformation often involves collecting and analyzing data from social media platforms and other online sources, which can raise privacy and ethical concerns. Researchers must navigate issues related to data privacy, informed consent, and the potential for harm resulting from the disclosure of personal information.
7. **Dynamic nature of digital misinformation:** The rapid pace at which digital misinformation evolves and spreads makes it challenging to measure exposure and track its effects over time. Content may be deleted, altered, or replaced, making it difficult to assess the reach and impact of specific instances of misinformation.

Despite these challenges, researchers continue to develop innovative methods and approaches for measuring exposure to digital misinformation and its effects, using

a combination of data sources, research designs, and analytical techniques to overcome these obstacles and advance our understanding of the role of misinformation in shaping public opinion and behavior.

We see the same pattern as before. The model returns very reasonable and valid concerns, but these concerns could apply to any effect identification of communicative interventions, without necessarily being specific to the effects of misinformation.

Let's proceed. We have a set of options for measuring the electoral effects of misinformation and are aware of some limitations. Since we are dealing with a research paper assignment, we probably don't have the means to conduct an original survey. However, the model may have pointers to opportunities for secondary data analysis:

Prompt 4.14:

I do not have the opportunity for data collection. Are their data sets available that I can use in secondary analyses to identify the impact of digital misinformation on voting behavior in the German federal election 2017?

Response 4.14:

While there might not be ready-made datasets specifically designed to study the impact of digital misinformation on voting behavior in the 2017 German Federal Election, you can still utilize existing datasets in combination with supplementary data sources to conduct secondary analyses on this topic. Here are some options to consider:

1. GLES (German Longitudinal Election Study): GLES is a comprehensive, ongoing study of electoral behavior in Germany, which includes data from cross-sectional surveys, panel surveys, and other sources. You can use GLES data to study voting behavior, political attitudes, and media consumption habits of German voters. GLES data is available at <https://www.gesis.org/en/gles/data/>
2. Eurobarometer: The Eurobarometer surveys are conducted periodically across European Union member states, including Germany, and cover a wide range of topics, such as political attitudes, trust in institutions, and media usage. While these surveys may not directly address digital misinformation, you can use the data to explore related issues and voter behavior. Eurobarometer data is available at <https://www.gesis.org/en/services/data-analysis/survey-data/eurobarometer>
3. Social media data: To study the spread and content of digital misinformation during the 2017 German Federal Election, you can collect and analyze social media data from platforms like Twitter, Facebook, or Reddit. Although obtaining such data might require some technical expertise and may be subject to platform-specific limitations, you can use APIs or third-party tools to access historical data and identify instances of misinformation.
4. Digital news archives: Some news websites and online platforms maintain archives of their content, which can serve as a valuable resource for studying

the prevalence of digital misinformation during the 2017 German Federal Election. You can use content analysis or text mining techniques to analyze these archives and identify misinformation trends.

To identify the impact of digital misinformation on voting behavior, you can combine these data sources and employ advanced statistical techniques, such as regression analysis, propensity score matching, or instrumental variable analysis, to estimate causal relationships while controlling for potential confounding factors. Keep in mind that while these data sources can provide valuable insights, there might be limitations regarding the direct measurement of exposure to digital misinformation and its impact on voting behavior. You may need to make assumptions or use proxy variables to explore the relationships between misinformation and voting behavior in the context of the 2017 German Federal Election.

These suggestions are helpful. Both the Eurobarometer and the German Longitudinal Election Study (GLES) are promising data sources for the analysis of voting behavior in Germany. Now, we can move on to the next stage.

4.6 Conducting empirical analysis and producing evidence that supports or refutes the hypotheses

We have settled on a research question, hypotheses, and potential data sets. Now let's see if the model has suggestions for the next task in our research project: data analysis.

Prompt 4.15:

Using data from Eurobarometer: What was the impact of misinformation on voting behavior in the German federal election 2017?

Response 4.15:

As an AI language model, I am unable to directly analyze data or perform statistical analyses myself. However, I can guide you on how to approach the analysis using Eurobarometer data to study the impact of misinformation on voting behavior in the 2017 German Federal Election.

Keep in mind that Eurobarometer data may not include direct measures of exposure to digital misinformation. Nevertheless, you can explore related issues and use proxy variables to study the relationship between misinformation and voting behavior. Here's a suggested approach:

1. Data selection: Identify and download the Eurobarometer datasets that cover the time period surrounding the 2017 German Federal Election. These datasets should ideally include information on political attitudes, trust in institutions, media usage, and other relevant factors.
2. Variable selection: Look for variables in the Eurobarometer data that can serve as proxies for exposure to digital misinformation or its effects. For example, you might consider variables related to trust in media, political polarization, or perceptions of specific political parties or issues.

3. **Voting behavior:** Identify variables that capture voting behavior or party preferences in the German Federal Election. These variables can serve as your dependent variables in your analysis.
4. **Control variables:** Include control variables that account for potential confounding factors, such as age, education, income, political ideology, and media consumption habits.
5. **Data analysis:** Use statistical methods, such as regression analysis or propensity score matching, to estimate the relationship between your proxy variables for misinformation exposure (or its effects) and voting behavior, while controlling for the selected confounding factors.
6. **Interpretation:** Carefully interpret your findings, keeping in mind the limitations of using proxy variables and the potential for omitted variable bias or other issues that may affect the validity of your results.

As the Eurobarometer data may not provide a direct measure of exposure to digital misinformation, your analysis will likely focus on the broader context of media consumption, trust, and political attitudes. Be cautious when drawing conclusions about the specific impact of misinformation on voting behavior, and consider exploring additional data sources to supplement your findings.

This is interesting. The model provides a general high-level account of how we might examine the impact of digital misinformation on voting behavior during the 2017 federal election in Germany. However, this reads like a general account of the impact of any sort of information on voting behavior. We are also unsure if there is any specificity to the suggested data source or if this remains a general account. Let's run the prompt again for a different data source, the German Longitudinal Election Study (GLES):

Prompt 4.16:

Using data from GLES: What was the impact of misinformation on voting behavior in the German federal election 2017?

Response 4.16:

As an AI language model, I am unable to directly analyze data or perform statistical analyses myself. However, I can guide you on how to approach the analysis using GLES (German Longitudinal Election Study) data to study the impact of misinformation on voting behavior in the 2017 German Federal Election.

GLES data may not have direct measures of exposure to digital misinformation, but you can use the available variables to explore related issues and use proxy variables to study the relationship between misinformation and voting behavior. Here's a suggested approach:

1. **Data selection:** Identify and download the GLES datasets that cover the time period surrounding the 2017 German Federal Election. These datasets should ideally include information on voting behavior, political attitudes, trust in institutions, and media usage.

2. Variable selection: Look for variables in the GLES data that can serve as proxies for exposure to digital misinformation or its effects. For example, you might consider variables related to trust in media, political polarization, or perceptions of specific political parties or issues.
3. Voting behavior: Identify variables that capture voting behavior or party preferences in the German Federal Election. These variables can serve as your dependent variables in your analysis.
4. Control variables: Include control variables that account for potential confounding factors, such as age, education, income, political ideology, and media consumption habits.
5. Data analysis: Use statistical methods, such as regression analysis or propensity score matching, to estimate the relationship between your proxy variables for misinformation exposure (or its effects) and voting behavior, while controlling for the selected confounding factors.
6. Interpretation: Carefully interpret your findings, keeping in mind the limitations of using proxy variables and the potential for omitted variable bias or other issues that may affect the validity of your results.

As the GLES data may not provide a direct measure of exposure to digital misinformation, your analysis will likely focus on the broader context of media consumption, trust, and political attitudes. Be cautious when drawing conclusions about the specific impact of misinformation on voting behavior, and consider exploring additional data sources to supplement your findings.

It turns out our original suspicions were correct. While instructive on a very general level, the results are not specific to either data source, and the model doesn't provide insight into which variables we should consider. Important analytical decisions remain unsolved.

Let's see if the model is helpful in providing suggestions to actually run the analysis:¹⁴

Prompt 4.17:

Provide R code to download relevant data from GLES, to identify relevant variables, and run the appropriate regression model.

Response 4.17:

As an AI language model, I cannot directly access data from the internet or perform data analysis tasks in real-time. However, I can guide you through the steps of downloading GLES data, identifying relevant variables, and running a regression model in R.

¹⁴Here, I allowed myself to be lazy and to continue to use GPT-4 through the ChatGPT web interface. A more ambitious approach for more demanding coding projects would of course mean to turn to an applications for AI-supported programming, such as GitHub Copilot. These might offer more functionality and better results.

1. Step 1: Download GLES Data

Visit the GLES website (<https://www.gesis.org/en/gles/data/>) and download the relevant datasets for the 2017 German Federal Election. You may need to create an account and agree to their terms of use. Once you've downloaded the data, save it as a CSV or other compatible format.

2. Step 2: Load Data and Relevant Libraries in R

Install and load the necessary libraries for data manipulation and regression analysis:

```
install.packages("tidyverse")  
install.packages("haven")
```

```
library(tidyverse)  
library(haven)
```

Load the GLES dataset you downloaded:

```
gles_data <- read_csv("path/to/your/gles_data.csv")
```

3. Step 3: Identify Relevant Variables

Based on the GLES codebook, identify the relevant variables for exposure to digital misinformation, voting behavior, and control variables. Replace "var1", "var2", etc., with the appropriate variable names.

```
misinfo_proxy_var <- "var1"  
voting_behavior_var <- "var2"  
control_vars <- c("var3", "var4", "var5")
```

4. Step 4: Run the Regression Model

>Install and load the "lmtest" library for running linear regression models:

```
install.packages("lmtest")  
library(lmtest)
```

>Run a linear regression model with the selected variables:

```
regression_model <- lm(voting_behavior_var ~  
                  misinfo_proxy_var +  
                  var3 +  
                  var4 +  
                  var5,  
                  data = gles_data)
```

5. Step 5: Display Regression Results

```
summary(regression_model)
```

Keep in mind that this is a simplified example, and the actual analysis may require more nuanced data manipulation, variable transformation, or the use of more advanced regression techniques. Additionally, consider the limitations of using proxy variables and the potential for omitted variable bias or other issues that may affect the validity of your results.

As with many of the previous prompts, the model returns a general account of how one might run a typical regression analysis in R. The result is neither very specific nor surprising. Still, it might serve students new to computer-assisted data analysis with a template for structuring their R code and trying out alternative approaches. For example, the model could also offer alternatives to frequentist regression analysis:

Prompt 4.18:

What if I want to run a Bayesian analysis?

Response 4.18:

If you'd like to run a Bayesian analysis, you can use the `brms` package in R, which is an interface to the probabilistic programming language Stan. The package allows you to fit Bayesian regression models using a formula syntax similar to that of the `lm` function.

1. Step 1: Install and Load the Necessary Libraries

```
install.packages("brms")  
library(brms)
```

2. Step 2: Specify Priors

Before fitting the Bayesian model, you need to specify prior distributions for the parameters in the model. The choice of prior distribution depends on your background knowledge or beliefs about the parameters. For this example, let's assume normal priors with a mean of 0 and a standard deviation of 10 for the regression coefficients, and a half-Cauchy prior with a scale of 2 for the residual standard deviation.

```
prior1 <- prior(normal(0, 10), class = "b")  
prior2 <- prior(cauchy(0, 2), class = "sigma")  
priors <- c(prior1, prior2)
```

3. Step 3: Fit the Bayesian Regression Model

Run the Bayesian regression model with the selected variables and specified priors:

```
bayesian_model <- brm(voting_behavior_var ~  
  misinfo_proxy_var +  
  var3 +  
  var4 +  
  var5,
```

```
data = gles_data ,  
family = gaussian() ,  
prior = priors )
```

4. Step 4: Examine the Results

You can examine the results by summarizing the fitted model:

```
summary( bayesian_model )
```

This will provide you with information about the posterior distributions of the parameters, including the mean, standard deviation, and credible intervals.

Keep in mind that this is a simplified example. The actual analysis may require more nuanced data manipulation, variable transformation, or the use of more advanced Bayesian regression techniques. Also, consider the limitations of using proxy variables and the potential for omitted variable bias or other issues that may affect the validity of your results. Additionally, make sure to properly specify your priors based on your domain knowledge, as this will have a direct impact on the posterior estimates.

Looking at these examples of LLM-supported data analysis, the actual opportunities for using LLM in this task might not be in providing a copy-paste substitution for coding. Instead, it might serve more as a quick way to vary approaches or procedures for a problem before settling on one.

4.7 Structuring and documenting the results in a series of well-organized paragraphs to create the written paper

Now we come to the biggest concern for educators: Will ChatGPT or other applications running on LLMs replace the human author of academic paper assignments?

Spoiler alert: Not yet.

The first step of the actual writing process is settling on a structure. For a research paper, the overall structure is rather strictly predefined.¹⁵ In fact, for empirical papers, it follows a nearly universal pattern. We can even assign these sections their relative share of the paper (Basbøll, 2018).

1. Abstract
2. Introduction (10%)
3. Theory (15%)
4. Data & Methods (15%)
5. Data Analysis (40%)
6. Conclusion (15%)

¹⁵Yes, there are other types of academic papers or academic subfields where this pattern does not apply. But this is the structure, you are most likely to follow in papers for assignments at this Chair. And, while details might vary, the general points raised should hold.

7. References¹⁶

The real surprise lies in what happens within these sections. So, what does the model suggest for our paper?

Prompt 4.19:

Suggest a structure for an empirical paper discussing the impact of misinformation on voting behavior in the German federal election 2017. The paper is an assigned paper for a university course in political science on the advanced Bachelor level. It should be 15 pages long. Do not make up references and cite sources following APA conventions.

Response 4.19:

Title: The Impact of Misinformation on Voting Behavior in the 2017 German Federal Election

1. Abstract: Provide a brief summary of the research question, methods, and key findings of the paper.
2. Introduction
 - a) Present the research question: How did misinformation impact voting behavior in the 2017 German Federal Election?
 - b) Explain the relevance of the research question in the context of political science and elections.
 - c) Provide an overview of the paper's structure.
3. Literature Review
 - a) Discuss existing research on misinformation and its impact on voting behavior.
 - b) Highlight the research gap and justify the need for the current study.
 - c) Explain the theoretical framework guiding the research (e.g., theories of voter behavior).
4. Data and Methodology
 - a) Describe the data source (e.g., GLES) and the variables used in the analysis.
 - b) Explain the methodology used to study the relationship between misinformation and voting behavior (e.g., regression analysis, propensity score matching, or Bayesian analysis).
 - c) Address potential limitations and challenges in the data and methodology.
5. Results
 - a) Present the main findings of the empirical analysis.

¹⁶Yes, this does not add up to 100%, but you will find you need some space for references within the word count.

- b) Discuss the relationship between misinformation and voting behavior, considering the German electoral context.
- c) Highlight any unexpected results or findings.

6. Discussion

- a) Interpret the results in the context of the existing literature and the theoretical framework.
- b) Discuss the implications of the findings for political science, electoral integrity, and democratic processes.
- c) Address potential limitations of the study and suggest avenues for future research.

7. Conclusion

- a) Summarize the main findings of the paper.
- b) Restate the significance of the study in the context of political science and elections.
- c) Offer concluding remarks on the impact of misinformation on voting behavior in the 2017 German Federal Election.

8. References: List all the sources cited in the paper, following APA conventions. Since I cannot make up references, you will need to consult relevant academic sources and cite them accordingly.

Throughout the paper, ensure that you adhere to the page limit (15 pages) and follow APA citation conventions when referencing sources.

Well, this makes sense on a general level. However, as we've observed quite often, the structure is rather general and remains unspecific in many aspects that matter. Maybe things will improve once we replace the section "Literature Review" with an actual theory section.

Prompt 4.20:

Replace the literature section with a theory section. Change subheadings accordingly.

Response 4.20:

Title: The Impact of Misinformation on Voting Behavior in the 2017 German Federal Election

1. Abstract: Provide a brief summary of the research question, methods, and key findings of the paper.
2. Introduction
 - a) Present the research question: How did misinformation impact voting behavior in the 2017 German Federal Election?

- b) Explain the relevance of the research question in the context of political science and elections.
- c) Provide an overview of the paper's structure.

3. Theoretical Framework

- a) Discuss theories of voter behavior relevant to misinformation, such as the cognitive miser theory, motivated reasoning, and the affective intelligence theory.
- b) Explain how these theories help us understand the potential impact of misinformation on voting behavior.
- c) Develop hypotheses derived from the theoretical framework that relate to the impact of misinformation on voting behavior in the German electoral context.

4. Data and Methodology

- a) Describe the data source (e.g., GLES) and the variables used in the analysis.
- b) Explain the methodology used to study the relationship between misinformation and voting behavior (e.g., regression analysis, propensity score matching, or Bayesian analysis).
- c) Address potential limitations and challenges in the data and methodology.

5. Results

- a) Present the main findings of the empirical analysis.
- b) Discuss the relationship between misinformation and voting behavior, considering the German electoral context.
- c) Highlight any unexpected results or findings.

6. Discussion

- a) Interpret the results in the context of the theoretical framework.
- b) Discuss the implications of the findings for political science, electoral integrity, and democratic processes.
- c) Address potential limitations of the study and suggest avenues for future research.

7. Conclusion

- a) Summarize the main findings of the paper.
- b) Restate the significance of the study in the context of political science and elections.
- c) Offer concluding remarks on the impact of misinformation on voting behavior in the 2017 German Federal Election.

8. **References:** List all the sources cited in the paper, following APA conventions. Since I cannot make up references, you will need to consult relevant academic sources and cite them accordingly.

Throughout the paper, ensure that you adhere to the page limit (15 pages) and follow APA citation conventions when referencing sources.

This is a little better, but not by much. Relying on ChatGPT or similar LLM applications illustrates potential general structures for papers. This can greatly help students familiarize themselves with the structure of academic papers, but the results are too general to be much more than a starting point for writing an actual paper.

Now, how does the model perform when asked to write sections of the paper?

Prompt 4.21:

Draft the introduction of the paper following your suggested structure.

Response 4.21:

Title: The Impact of Misinformation on Voting Behavior in the 2017 German Federal Election

Abstract: Provide a brief summary of the research question, methods, and key findings of the paper.

Introduction: In recent years, the rise of digital media has led to a growing concern about the spread of misinformation and its potential impact on democratic processes, including elections. The 2017 German Federal Election serves as an important case study to examine the relationship between misinformation and voting behavior, as it took place in a context of increasing digital media consumption and heightened political polarization. This paper aims to explore the following research question: How did misinformation impact voting behavior in the 2017 German Federal Election?

Understanding the role of misinformation in shaping voting behavior is crucial for preserving the integrity of the democratic process and ensuring that voters make informed decisions based on accurate information. Moreover, studying the impact of misinformation on voting behavior in the context of the German Federal Election may provide valuable insights into the generalizability of findings from other electoral contexts and contribute to a broader understanding of this phenomenon. To address the research question, this paper will first present a theoretical framework that incorporates the cognitive miser theory, among other relevant theories, to explain the potential impact of misinformation on voting behavior. Following this, the paper will describe the data and methodology used to empirically examine the relationship between misinformation and voting behavior in the 2017 German Federal Election. The results of the analysis will then be presented and discussed in the context of the theoretical framework, and the paper will conclude with a summary of the main findings and their implications for political science and electoral integrity.

The structure of the paper is as follows: Section 2 provides a comprehensive theoretical framework that outlines the cognitive miser theory and other relevant theories

of voter behavior, and derives hypotheses based on these theories. Section 3 details the data source and methodology used in the study, as well as any limitations and challenges. Section 4 presents the results of the empirical analysis, while Section 5 discusses the implications of the findings in relation to the theoretical framework, existing literature, and potential avenues for future research. Finally, Section 6 concludes the paper with a summary of the main findings and their significance in the context of political science and elections.

This return follows the general structure of an academic paper and hits the right notes: real-world relevance, proposed relevance of the analyzed case, proposed theory, and the structure of the remaining paper. While this structure fits the demands of an introduction for a research paper, it remains somewhat vague. Although there is nothing inherently wrong, there is also nothing very specific or original in what the model returns. Perhaps the model can be more specific if explicitly prompted:

Prompt 4.22:

Be more specific about the ways that misinformation might have come to matter in Germany in 2017 given the specific electoral context at the time.

Response 4.22:

Title: The Impact of Misinformation on Voting Behavior in the 2017 German Federal Election

Abstract: Provide a brief summary of the research question, methods, and key findings of the paper.

Introduction: In recent years, the rise of digital media has led to a growing concern about the spread of misinformation and its potential impact on democratic processes, including elections. The 2017 German Federal Election serves as an important case study to examine the relationship between misinformation and voting behavior, as it took place in a context of increasing digital media consumption, heightened political polarization, and the emergence of new political actors. This paper aims to explore the following research question: How did misinformation impact voting behavior in the 2017 German Federal Election?

In the specific electoral context of Germany in 2017, misinformation may have come to matter in several ways:

The rise of populist parties, such as the Alternative for Germany (AfD), created a highly polarized political landscape, which may have amplified the spread and impact of misinformation as voters sought information that confirmed their pre-existing beliefs. The influx of refugees and migrants to Germany in the years leading up to the 2017 election fueled public debates on immigration and integration, making these topics susceptible to misinformation and manipulation. The increasing use of social media platforms for political information and communication in Germany provided a fertile ground for the spread of misinformation, with users often sharing and engaging with content that evoked strong emotions or resonated with their existing views. Understanding the role of misinformation in shaping voting behavior is crucial for preserving the integrity of the democratic process and ensuring that voters make informed decisions based on accurate information. Moreover,

studying the impact of misinformation on voting behavior in the context of the German Federal Election may provide valuable insights into the generalizability of findings from other electoral contexts and contribute to a broader understanding of this phenomenon.

To address the research question, this paper will first present a theoretical framework that incorporates the cognitive miser theory, among other relevant theories, to explain the potential impact of misinformation on voting behavior. Following this, the paper will describe the data and methodology used to empirically examine the relationship between misinformation and voting behavior in the 2017 German Federal Election. The results of the analysis will then be presented and discussed in the context of the theoretical framework, and the paper will conclude with a summary of the main findings and their implications for political science and electoral integrity.

The structure of the paper is as follows: Section 2 provides a comprehensive theoretical framework that outlines the cognitive miser theory and other relevant theories of voter behavior, and derives hypotheses based on these theories. Section 3 details the data source and methodology used in the study, as well as any limitations and challenges. Section 4 presents the results of the empirical analysis, while Section 5 discusses the implications of the findings in relation to the theoretical framework, existing literature, and potential avenues for future research. Finally, Section 6 concludes the paper with a summary of the main findings and their significance in the context of political science and elections.

This is somewhat better. The model now connects specifics of the German electoral context (i.e., the right-wing party Alternative für Deutschland (AfD) and heightened concerns about refugee numbers and immigration in general) that might contribute to a potentially fertile ground for misinformation in the 2017 election. Subsequent specification of prompts might improve the model's output, although it still falls short of fully replacing human writing.

Let's see how the model does with a different section:

Prompt 4.23:

Draft the theoretical framework as structures by you. Include references.

Response 4.23:

In this example theoretical framework, I will outline three theories of voter behavior that are relevant to misinformation and explain how they help us understand the potential impact of misinformation on voting behavior. Keep in mind that I cannot make up references; you will need to consult relevant academic sources and cite them accordingly.

Theoretical Framework

1. Cognitive Miser Theory

The cognitive miser theory posits that individuals tend to minimize cognitive effort when processing information, relying on heuristics, and mental shortcuts to make decisions (Fiske & Taylor, 1991). In the context of misin-

formation, this theory suggests that voters may be more likely to accept false information if it aligns with their existing beliefs or if it is easier to process than more complex or nuanced information.

Reference: Fiske, S. T., & Taylor, S. E. (1991). *Social cognition* (2nd ed.). New York: McGraw-Hill.

2. Motivated Reasoning

Motivated reasoning is the idea that individuals process information in a way that confirms their pre-existing beliefs or attitudes, leading to biased information processing (Kunda, 1990). This theory implies that voters may be more susceptible to misinformation that supports their existing political views or preferences, while dismissing or discrediting information that contradicts those views.

Reference: Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, 108(3), 480-498.

3. Affective Intelligence Theory

The affective intelligence theory focuses on the role of emotions in political decision-making, arguing that emotions can shape individuals' cognitive processing and evaluations of political information (Marcus, Neuman, & MacKuen, 2000). This theory suggests that misinformation that evokes strong emotions, such as fear or anger, may have a greater impact on voting behavior than more neutral or dispassionate information.

Reference: Marcus, G. E., Neuman, W. R., & MacKuen, M. (2000). *Affective intelligence and political judgment*. Chicago: University of Chicago Press.

By incorporating these theories into the analysis of misinformation's impact on voting behavior in the 2017 German Federal Election, this paper aims to provide a comprehensive understanding of the underlying psychological mechanisms that may drive the observed effects. Future research should continue to explore these and other relevant theories to gain a deeper understanding of the role misinformation plays in shaping political behavior and decision-making.

The model returns a helpful list of theories illustrating potential ways misinformation might impact elections. The theories are presented concisely with a sample reference. Again, this wouldn't serve as a substitute for a written theory section. For example, it lacks a critical account of the performance of these theories in similar or divergent contexts. But it serves as a helpful device for students to start exploring potential theories and dig deeper.

Finally, let's see if the model can suggest specific hypotheses based on one of the proposed theories:

Prompt 4.24:

Provide hypotheses for the study based on the cognitive miser theory.

Response 4.24:

Based on the cognitive miser theory, the following hypotheses can be derived to investigate the impact of misinformation on voting behavior in the 2017 German Federal Election:

1. H1: Voters who are more likely to rely on cognitive heuristics and shortcuts will be more susceptible to the influence of misinformation on their voting behavior.
2. H2: Misinformation that aligns with voters' pre-existing beliefs and requires less cognitive effort to process will have a greater impact on voting behavior.
3. H3: The influence of misinformation on voting behavior will be stronger for voters with lower levels of political knowledge, as they may be more likely to rely on cognitive shortcuts when processing political information.
4. H4: Misinformation that is simple and easy to comprehend will have a greater impact on voting behavior than more complex or nuanced information.
5. H5: Voters who are exposed to misinformation that reinforces their party preference will be more likely to vote for their preferred party, compared to those who are exposed to information that challenges their party preference.

This output is a helpful complement to the more general hypotheses suggested earlier. We now have a set of very specific hypotheses that define specific outcomes for specific groups, potentially driven by misinformation. If our available data set provides access to these variables, we could test these hypotheses.

Overall, regarding the actual writing tasks for a research paper, model output has limited use for outright substitution of human writing. However, the model can serve as an exploration, surfacing, and variation device, allowing students to explore typical structures and get a better sense of the form of scientific argument and the research paper as a specified genre of text. As this is one of the major challenges in social science university teaching, these promising features of LLMs are not threatening, as long as students remain aware of their limitations and the remaining tasks they need to perform to build on the model output, rather than being limited by it.

5 Lessons learned

ChatGPT can be a valuable tool for assisting with academic research papers, but it's essential to recognize its limitations and treat it as a supplementary resource rather than a replacement for human effort. The AI model demonstrates strengths in generating potential hypotheses, research questions, and providing high-level overviews of empirical approaches. However, it falls short in handling specific cases, operationalization, and offering detailed guidance on data analysis. Specifically:

- ChatGPT can help students translate their interests into structured scientific arguments by proposing potential research questions or hypotheses.

- ChatGPT offers quick and easy opportunities for exploration and variation, which can be useful for surveying a field and learning to apply the structure of scientific arguments to specific cases of student interest.
- ChatGPT's performance diminishes when it comes to executing specifics, making student effort more critical. As an example, think of the difference between the questions: "How does misinformation influence voting behavior in elections?" and "How did misinformation influence voting behavior in the 2017 German federal election?"

Students can leverage ChatGPT to explore the structure of academic papers and familiarize themselves with scientific arguments and the research paper genre. It can help surface relevant theories and references, providing a starting point for research. Nevertheless, the AI-generated content often lacks the specificity and originality required in academic writing.

It's worth noting that the process discussed here followed a predominantly inductive approach, which emphasizes a specific case. In a more deductive approach – starting with a set of theories, developing questions based on theory or gaps within it, and only then settling on cases to illustrate this – LLMs might perform more successfully. The model excels in cases where questions rely predominantly on the representation of the world in text (like theories, hypotheses, or their interconnections and tensions). It struggles with the world itself or specific cases within the world (Smith, 2019). Consequently, research practices focusing on the representation of the world in data are easier to connect with LLMs, while those with a greater interest in the world, specific cases, or their interpretation will be more challenging to engage with.

While large language models like ChatGPT can serve as tools for exploration, surfacing, and variation, enabling students to better understand scientific arguments and research papers as a specific genre of text, it is crucial to recognize their limitations. LLMs can offer promising features for teaching and learning, as long as students are aware of their constraints and the additional tasks they need to perform to build on the model output without being limited by it.

When assessing the impact of ChatGPT on writing and its legitimate contribution to text, it is helpful to consider different types of academic texts. On one end of the spectrum, we have texts with a strong claim to authorship and voice, where the text is viewed as an expression of the author's thoughts and reflection process (Thomas & Turner, 2011). In these cases, using LLMs may be helpful for initial field exploration and final editing but may prove problematic when predicting text, as it might primarily reflect common views and the status quo, ape a known author's voice, or dilute the voice of a specific writer.

On the other end, we have technical reports (Minto, 2021), where texts serve as a representation of information available in other formats, such as data, results of analyses, documentation, meeting minutes, or research reports. In this context, the informed use of LLMs for text generation seems less problematic, as the focus lies on translating information into a coherent paper.

However, considering the student perspective introduces additional challenges. AI-enabled systems work best as support for those who are skilled in the tasks in question and knowledgeable about the area of interest. For them, LLMs can provide valuable assistance, but prior skill and domain knowledge are necessary to recognize when models fail or produce shallow responses.

For those without these skills or knowledge – or those in the process of acquiring them – AI can provide broad overviews of the subject matter. However, without prior skills or

domain knowledge, it can be difficult to identify when AI-assisted systems fall short. This is particularly concerning in educational contexts, as LLMs can produce plausible text that might earn a passing grade, but could mislead students with incorrect information. Moreover, AI might tempt students to avoid exercising tasks and developing skills over time, potentially leading to a de-skilling among those not willing to invest time or effort in acquiring skills or deep domain knowledge.

This presents a significant challenge for teaching, as grading output alone may no longer suffice to incentivize learning. In the past, output could serve as an indicator that tasks were performed and skills developed. Today, AI-supported systems appear capable of enabling students to produce outputs without performing the necessary tasks. Responsible teaching will need to develop alternative approaches to incentivizing and assessing task performance and skill development.

Despite these challenges, prohibiting the use of AI-supported services for students is not the solution. LLMs can benefit students, albeit in ways different from what is currently imagined.

6 Notes to students

By now, you have likely encountered accounts of ChatGPT's potential for assisting you in writing tasks. Perhaps you have even tried it out. This is excellent and highly recommended, as there is every reason to expect that your future life in work or research will involve working with AI-enabled assistants, whether for software development, data analysis, or managing mundane office tasks (Lee & Quifan, 2021). Therefore, familiarizing yourself with these tools and learning about their strengths and weaknesses is crucial. However, as a student, certain uses may be more advisable than others.¹⁷

Before you start using ChatGPT, consider what you might lose by relying on it. We assign research papers to help you practice specific tasks repeatedly throughout your studies, offering you the opportunity to learn and improve your skills. However, this will only happen if you actually *perform* the tasks and *do* the work. Relying on ChatGPT or other models too early in your education may prevent you from acquiring or refining these skills over time. At the same time, we can expect workflows in academia and industry to be shaped by collaboration between humans and AI-enabled systems, such as LLMs, sooner rather than later. Consequently, developing the necessary skills to use these models effectively is also essential.

One approach is to consider the skills or tasks you are expected to learn, perform, or improve with a given paper assignment. Challenge yourself to complete these tasks independently, write down your solutions, and then compare them with the output of your current AI-enabled model of choice or even competing models. By doing this, you can reflect on the accuracy of your work and the model's output, identify areas of improvement, and understand where the model's strengths and weaknesses lie. This process transforms LLMs into a supporting tool rather than a substitute, while also providing valuable insight into your own work.

¹⁷Keep in mind that these notes apply specifically to students at the Chair for the Governance of Complex and Innovative Technological Systems at the University of Bamberg. Other educators in Bamberg or elsewhere may have different perspectives and guidelines for valid reasons. If you are interested in using ChatGPT or similar models to assist with your writing assignments, consult your lecturer and inquire about their rules on these questions rather than assuming these notes hold universally.

For transparency reasons, we ask students at the Chair for the Governance of Complex and Innovative Technological Systems to include a short disclaimer in their papers, indicating if and which AI model they used and for what tasks. Possible tasks include:

1. Exploring a phenomenon, mechanism, or literature;
2. Formulating a research question;
3. Developing theory-driven hypotheses;
4. Analyzing data;
5. Structuring the paper;
6. Writing;
7. Editing.

Additionally, please describe how your work built upon the results provided by the model.

Remember, you are solely responsible for the text you submit. Undocumented use of AI-enabled models, plagiarism, flaws in reasoning or analysis, and fabricated sources may result in significant grade reductions or even failure of the class. It does not matter whether these issues originated from you or the model – as the author, you are accountable for the strengths and weaknesses of your submitted work.

Be aware that when grading papers, we may place greater emphasis on aspects where models perform poorly and discount tasks where models excel.

We are all on a journey to determine how best to use AI-enabled tools, implement them in our work and learning, and capitalize on the opportunities they offer while avoiding their pitfalls. This process may reveal gaps, but it is a necessary journey. It is crucial to approach it with critical reflection and an open mind.

7 Leveraging opportunities of LLMs in academic writing while ensuring skill development

In conclusion, ChatGPT and similar AI tools offer valuable support for students working on academic research papers by generating ideas, familiarizing them with paper structures, and exploring relevant theories. However, these tools should not replace human writing and critical thinking. Students must recognize the limitations of AI-generated content and engage in further research, critical evaluation, and refinement of the material produced by the model. Using ChatGPT as a starting point and building upon its output can help students develop the skills necessary to create well-structured, original, and specific academic research papers.

However, there is a risk that students might rely too heavily on AI assistance, taking shortcuts before they have acquired crucial skills in the development and writing of research papers. Advisors must alert students to the associated risks, including plagiarism, the very real risk of skill decline, relying on false information, repeating common misconceptions, and losing themselves in generalities when specificity is asked for.

Despite these concerns, ChatGPT presents clear opportunities for learning. It can provide quick overviews of fields and generate examples of research questions, hypotheses,

and structures, offering significant assistance to students in understanding the form of these elements in academic writing.

While AI tools are not a replacement for human writing, they hold promise in supporting and enriching the academic writing process. As we continue to explore the potential of AI in education, the focus should be on leveraging these tools to become better teachers and researchers.

8 Disclaimer

The working paper has been edited with ChatGPT¹⁸ using the GPT-4¹⁹ model. The abstract of the paper was produced by ChatGPT with the Introduction serving as input.

All prompts were run through the ChatGPT web interface on March 18 and 19, 2023 using the GPT-4 model.

In drafting these notes, I profited from exchanges with Valeska Gerstung-Jungherr, Johannes Marx, Oliver Posegga, Adrian Rauchfleisch, and Alexander Wuttke.

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¹⁸<https://openai.com/blog/chatgpt>

¹⁹<https://openai.com/product/gpt-4>

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