

Meaning and Boundaries: How Grammarly and QuillBot Preserve or Interpret Ambiguity in Native English

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ABSTRACT: Many people use Grammarly and QuillBot, including their paraphrasing tools. They are excellent at their job, but they still face difficulties when they are presented with ambiguous phrases and sentences. This study is crucial because ambiguity in communication is harmful, and people tend to rely on AI too much, so identifying patterns that could misconstrue a person's writing will be beneficial for understanding between English speakers. While Grammarly tends to preserve pronoun ambiguity when it is very unclear which potential meaning is correct, QuillBot assigns the ambiguous pronoun to the subject of the sentence, even if there is no suggestion that it would be more likely. The researcher created ambiguous sentences to represent native English that focused on four types of ambiguity, and they were tested using the paraphrasing tools for Grammarly and QuillBot. The results found that both applications showed a pattern of selecting a disambiguation if one interpretation was found more often than another one. With these findings, it can encourage future research in specific types of ambiguity and disambiguation in AI paraphrasing, helping to locate and mitigate bias in communication.

KEYWORDS: Robotics and Intelligent Machines, Machine Learning, Grammarly, QuillBot, Ambiguity.

■ Introduction

AI grammar and writing tools like Grammarly and QuillBot are used by many people from various professions and backgrounds because of their skills in enhancing written communication. They can improve the quality of writing and help users save time on small issues.¹ While these tools are found to be very advanced, with capabilities of decreasing ambiguity and vagueness, they are not always as accurate with these variables compared to simple grammar checking.² While there is current research being done in the field of computational linguistics, specifically focusing on AI grammar tools such as Grammarly and QuillBot, there are areas that have not been thoroughly studied or discussed yet.

One of the main areas of study is investigating the impact of AI grammar and writing tools on students in academic settings who do not speak English as a first language. A study of undergraduate students with English as a foreign language found that Grammarly gave students useful feedback on their work, and QuillBot was a great tool to practice paraphrasing.³ A different study involving undergraduate students found that the English learners preferred QuillBot over Grammarly because its paraphrasing tool was more useful for them than Grammarly's grammar correction tool, even though both were considered helpful.⁴ While these insights are important to add to the current body of knowledge, they do not look at native English speakers, who are one of the main groups that use these tools.

Many studies on Grammarly and QuillBot and their functions do not explicitly focus on ambiguity, and if mentioned, it is often as a small part of a larger observation. A paper that discusses the drawbacks of QuillBot and paraphrasing tools in general identifies an instance of an ambiguous prepositional phrase, but it is not the focus of the study because the re-

search looks at many different factors.⁵ A study interested in how Grammarly interacts with academic literature in English found that the tool could indicate instances of ambiguity, but the paper does not test paraphrasing or go into more depth about ambiguity.⁶ This creates a gap in research that this study aims to fill.

While the study conducted does not have a large enough dataset to make definitive statements, it is an important pilot for further research, as it has a different focus from many existing studies. Most literature that considers AI grammar tools like Grammarly or QuillBot investigates their impact on writers in an academic setting or non-native English learners.^{3,7} However, this study focuses on native and conversational English by constructing sentences with an informal tone and common words. There are very few academic papers that directly compare Grammarly and QuillBot for native English speakers, and the most common articles are blog reviews that look more at personal and overall experience than specific variables.⁸ Meanwhile, this study was performed with high standards to test specific, isolated variables, and with a detailed explanation of the testing process to ensure reproducibility. In addition, many studies do not focus on ambiguity or ambiguity preservation when conducting research on paraphrasing tools, and most existing work is only theoretical.⁹ This study specifically measures ambiguity preservation and the meaning preserved when applicable, adding a different angle of study in an established field.

Ambiguity is known to confuse the people receiving information. This can lead to misunderstandings that might be small or very large. Therefore, it hinders effective communication and makes the spread of ideas more difficult.¹⁰ Users of AI tools are likely to become overreliant and accept suggestions without thinking for themselves, which damages growth in

critical thinking, individual style, creativity, and writing skills.¹¹ This combination can be dangerous for people trying to understand each other in a time when AI usage is only increasing. People may not verify what an AI tool wrote, so if they had an ambiguous sentence that was disambiguated in a different way than what the original user had in mind, it could cause communication gaps and inefficiencies.

With this study as the starting point for future research, people could be more aware and educated about the tendencies and biases of AI grammar tools when paraphrasing, encouraging critical thinking when using them. Identifying the patterns that AI models are trained on can help in creating clear distinctions between what the tool thinks a person is trying to say and what they actually mean. It can also help anyone developing their own model by demonstrating things to take into account that can improve technology and innovation in the field of AI grammar tools.

■ Methods

The objective of this study is to determine trends of Grammarly and QuillBot when preserving or removing certain types of ambiguity from ambiguous sentences with a conversational tone. This paper describes a small-scale in-field study using online tools. This includes Google Sheets to keep track of the data, the Grammarly website to test sentences, and the QuillBot website for the same purpose as Grammarly.

The researcher formed forty sentences to test four different types of ambiguity with ten sentences each: lexical ambiguity, structural ambiguity, pronoun ambiguity, and punctuation ambiguity. The sentences were created to have a conversational tone to mimic the style of native English. The sentences were copied one at a time into the free versions of Grammarly's paraphrasing tool and QuillBot's paraphrasing tool that do not require an account, and the result was recorded verbatim. Grammarly did not present customization for its free, no sign-up required tool, but QuillBot was configured to standard mode using American English with fewer synonym changes. This was to try to decrease anything that could affect the results of the sentences besides the training of the models. After the results were recorded, the data were analyzed by first considering whether the original ambiguity of the sentence was preserved. If ambiguity was not preserved, the meaning that the model tended toward was recorded based on the two disambiguation options that were considered before testing. Punctuation ambiguity was tested using two different forms of each of the ten sentences, only changing the punctuation, meaning twenty sentences were tested for punctuation ambiguity in total. However, each sentence pair was considered one data point in graphs, with specific differences being noted later in the results section.

This study was conducted using online tools only, so no physical tools or research instruments were utilized. Ethical considerations that should be observed include following the terms of use for both Grammarly and QuillBot by not automating the collection of data or testing in bulk. All sentences used for testing were created by the researcher for this study and do not contain private information. Testing was performed

on the same day to ensure no disparities between potential updates, and the specific version of each tool was documented. Results were evaluated from a linguistic standpoint, and the results were not attributed to the inherent intelligence of an AI application; instead, the focus was on model behavior. Grammarly and QuillBot are third-party services, so it is possible for output to differ from the results of this study in the case of future updates.

Common AI Grammar Tools:

AI tools for writing were not always at the high level that they are today. While they initially only checked for basic grammar and spelling mistakes, they have improved greatly. AI tools use machine learning and natural language processing (NLP) to evaluate complex tone, style, and varying situations.¹² QuillBot is very good at paraphrasing, a skill that can even help native speakers who need to improve. It helps the user understand what they need to do, like changing sentence structure and using synonyms while still keeping the intent of the original passage.¹³ Grammarly is most helpful in error correction. It helps the user avoid mistakes in grammar and punctuation while also looking more widely at sentence structure.¹⁴

Table 1: Comparison of common AI grammar tools, specifically Grammarly and QuillBot, highlights QuillBot's specialized focus on paraphrasing capabilities.

Feature	Grammarly	QuillBot
Grammar Checking	Strong	Good
Paraphrasing	Okay	Strong
Plagiarism Detection	Good	Good
AI Generation	Good	Okay
Integration	Strong	Good

Grammarly and QuillBot offer many similar functions, but they each have different strengths. Comparative research finds that Grammarly specializes in grammar accuracy and mechanics, while QuillBot focuses on the readability of sentences.¹⁵ Along with the baseline feature comparison in Table 1 that QuillBot is slightly less accurate than Grammarly in grammar checking and that Grammarly does not have a paraphrasing model as high-quality as QuillBot, there are other tools that the platforms possess, even if they are not as well-known. Both tools have mostly error-free plagiarism detection tools. However, Grammarly is able to perform better when generating written content using AI with a very specific prompt, and it has better integration across many other services.

It is also important to consider that there are some features that the applications do not share, especially those specific to their target audience. Grammarly can provide specific suggestions based on the tone or style that someone is aiming for, including style guides and a brand tone for businesses that want to keep communication consistent. QuillBot can summarize long text to highlight the main points of a message without having to read it all. It can also be used in over 45 languages,¹⁶ making it accessible to non-English or multilingual speakers in different places around the world.

Different Types of Ambiguity:

Linguistic ambiguity can be found very often in the English language, and it arises whenever a phrase or a sentence can be understood in more than one way. While there are wide varieties, such as pragmatic ambiguity, which focuses on the context surrounding a statement, or vocal ambiguity, which relies on analyzing the way in which a language is spoken verbally,¹⁷ this study only focuses on certain types of ambiguity. They are all concerning written language and do not need to be extrapolated outside of the context of an individual sentence. The following types are lexical ambiguity, structural ambiguity, pronoun ambiguity, and punctuation ambiguity.

Lexical ambiguity is a type of ambiguity when a single word has more than one meaning. While ambiguity can make communication more difficult, it is hard to eliminate from languages because lexical ambiguity is found very frequently, and it is hard to avoid. Examples of lexical ambiguity are also known as homonyms. As there is normally one definition of the word that is used more often, it is called the dominant meaning, and the other, less-used meanings are called subordinate meanings. To understand which definition a person is referring to in a lexically ambiguous phrase or sentence, people consider both the context and how often each meaning is used. An example of this is the sentence, “The bat flew through the air.”¹⁸ If the sentence were used in a conversation about sports, it could be interpreted one way, but if there was not as much context, someone might find it more logical for the animal to be flying instead of the object.

Structural ambiguity occurs not in individual words, but because there are multiple ways to think of the sentence based on how it is worded. For example, the sentence, “I saw the man with the telescope,” can be viewed in multiple ways.¹⁹ One person might think it means that the subject of the sentence saw a man while they themselves were using a telescope, but someone else might think the man was using the telescope and the subject saw that.

Pronoun ambiguity is caused when there is difficulty understanding the antecedent of a pronoun, or the noun that the pronoun is referring to. People often try to interpret pronoun ambiguity by thinking about which noun acting as the pronoun would lead to a more logical cause-and-effect relationship. With the statement, “Albert invited Ron to dinner. He spent hours cleaning the house,” there are two ways an individual could view it. They would either think Albert cleaned the house or Ron did. However, it is more likely that Albert would have to clean the house to prepare for Ron’s arrival as a guest, so that it would be the more common disambiguation.²⁰

Punctuation ambiguity arises when punctuation or the lack thereof can alter or shift the meaning of a sentence. For example, the sentences “John, said Mary, was the nicest boy at the party” and “John said Mary was the nicest boy at the party” can be compared. Only changing the usage of commas, the sentence that originally meant Mary was talking ended up with John being the speaker. This is because commas affect the way people group words to form meaning, also known as syntactic parsing.²¹

Table 2: Summary of lexical, structural, pronoun, and punctuation ambiguity with an explanation of why it causes confusion and an example sentence, highlighting individual differences.

Type of Ambiguity	Reason for Ambiguity	Example Sentence
Lexical	Word with multiple meanings	The bat flew through the air.
Structural	Structure of the sentence	I saw the man with the telescope.
Pronoun	Antecedent, or defining noun, for the pronoun is unclear	Albert invited Ron to dinner. He spent hours cleaning the house.
Punctuation	Punctuation changes the grouping of words, therefore changing the meaning	John, said Mary, was the nicest boy at the party vs. John said Mary was the nicest boy at the party

To summarize the different types of ambiguity discussed in Table 2, all types of ambiguity studied in this research are focused on written English without requiring any outside context. Lexical ambiguity occurs when a single word can have multiple meanings.¹⁸ Structural ambiguity is found when the structure of a sentence does not indicate a single interpretation.¹⁹ Pronoun ambiguity arises when a pronoun in a sentence could refer to one of multiple nouns mentioned before.²⁰ Punctuation ambiguity occurs when the presence or lack of punctuation changes the way words are grouped.²¹

■ Results and Discussion

Ambiguity Preservation:

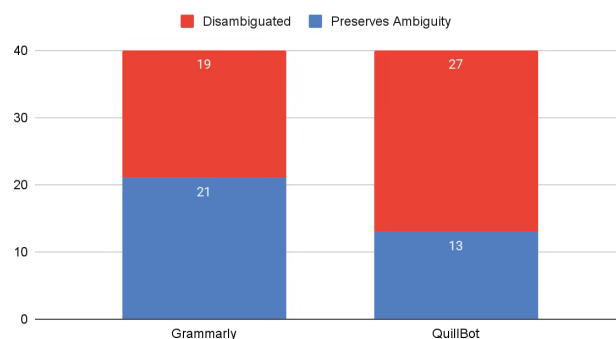


Figure 1: Sentences and sentence pairs vs. tool disambiguation overall. The Y-axis represents the total number of tested sentences, with the stacked bars displaying the relative proportion of instances in which ambiguity was preserved or resolved. This reveals Grammarly’s higher probability of preserving ambiguity in ambiguous sentences. These results signify that Grammarly may be more likely to leave meaning intact, while QuillBot may have a higher chance of defaulting to a single interpretation, possibly changing a user’s intended message.

To evaluate these data points, it is important to acknowledge that Grammarly primarily focuses on grammatical correctness as a mechanics-focused grammar checker, while QuillBot prioritizes readability through paraphrasing suggestions using NLP.¹⁵ Given the exploratory nature of this study, the data set of sentences tested is too small to evaluate apparent trends and percentage differences as generalizations or conclusive findings. Overall, as shown in Figure 1, Grammarly had a higher rate of ambiguity preservation at 52.5%, while the ambiguity preservation rate for QuillBot was only 32.5%. This means that almost half of the time for Grammarly and more than two-thirds of the time for QuillBot, the tool resolved the sentence toward one potential meaning of a sentence over the other. One possible explanation is that QuillBot tended to change the sentence structure instead of only substituting

words for synonyms, more so than Grammarly.¹⁵ This would increase the chance of removing ambiguity and resolving the ambiguity toward a single disambiguation.

The following subsections begin with an analysis of the results by looking at one type of ambiguity from a general perspective, and then investigating specific cases. The order presented is the same as the order tested: lexical ambiguity, structural ambiguity, pronoun ambiguity, and then punctuation ambiguity.

Lexical Ambiguity:

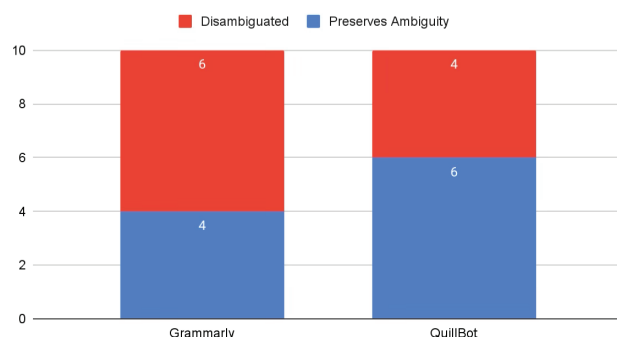


Figure 2: Sentences vs. tool disambiguation in lexical ambiguity. Similar to Figure 1, the Y-axis reflects the total sentence count tested, broken down by the proportion of ambiguous and disambiguation sentences. There was a slightly higher chance of QuillBot preserving ambiguity for a sentence compared to Grammarly. This indicates that, in contrast to the overall findings, QuillBot may be more likely to preserve the intent of a user's message, while Grammarly might select a certain meaning over another at a higher frequency.

According to Figure 2, the rate of ambiguity preservation for Grammarly concerning lexical ambiguity was 40%, while it was 60% for QuillBot. This means the difference between the two is not very large, but it does contradict the overall trend of Grammarly preserving the ambiguity of more sentences. Because lexical ambiguity is dependent on specific words being ambiguous, more words being substituted would likely lead to disambiguation. This occurred with Grammarly inputting a few more unique words than QuillBot, which is interesting because it does not align with current research that finds that QuillBot has a higher lexical diversity when paraphrasing.²² Out of the ten sentences tested, only two of them had ambiguity preserved by both tools, but when both tools disambiguated them, the selection of interpretation was the same, and this happened twice. For example, with the input sentence "I found a pen near the farm," Grammarly paraphrased it as "I discovered a pen close to the farm," while QuillBot wrote, "I discovered a pen close to the property." The word pen is ambiguous because it could be understood as a writing utensil, but it would also be thought of as a holding space for animals, especially when near a farm. However, neither application specified what kind of pen the sentence meant. An example of this not happening for either tool is with the sentence "He offered her a date." A date can be a social appointment, often romantic, or it can be a chewy fruit coming from palm trees. Grammarly very explicitly had a tendency to the first disambiguation option with the output, "He asked her out on a date," while QuillBot wrote, "He proposed a date to her," a more subtle output but still only referring to the first possibility. This implies that both models

believe the first meaning is more common than the second, to the extent that it is acceptable to assume what the person inputting the text meant.

Structural Ambiguity:

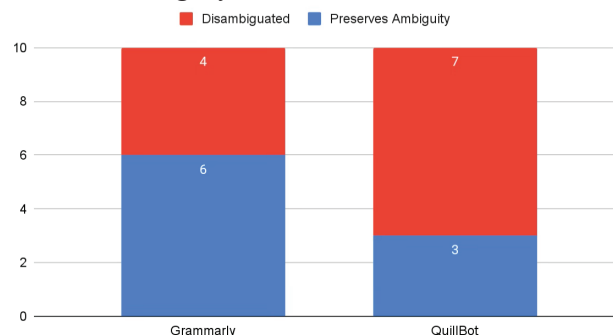


Figure 3: Sentences vs. tool disambiguation in structural ambiguity. Grammarly was more likely to preserve ambiguity in ambiguous sentences.

Figure 3 demonstrates that the rate of ambiguity preservation for Grammarly concerning structural ambiguity was 60%, while it was 30% for QuillBot. This follows the overall trend of Grammarly preserving ambiguity in more sentences than QuillBot. There was only one instance where the paraphrased sentence remained ambiguous for both tools, and just like the results for lexical ambiguity, the two cases with disambiguation for both tools yielded the same result. The only two sentences that both tools did not find ambiguous were "She plays the piano with a red bow" and "The fish is ready to eat." Compared to more confusing sentences like "I invited friends for a party on Friday," the disambiguated sentences both have one more likely meaning. Having a party on Friday is just as likely as sending invitations on that day of the week. Still, a woman wearing a red bow is more commonly seen than a piano with a red bow, and people are more likely to talk about a fish as food than a creature waiting to be fed due to the wording. The one sentence that remained ambiguous was "The parents said their children are stubborn and loud." Both tools only replaced some of the original words with synonyms, but neither tried to restructure the sentence.

Pronoun Ambiguity:

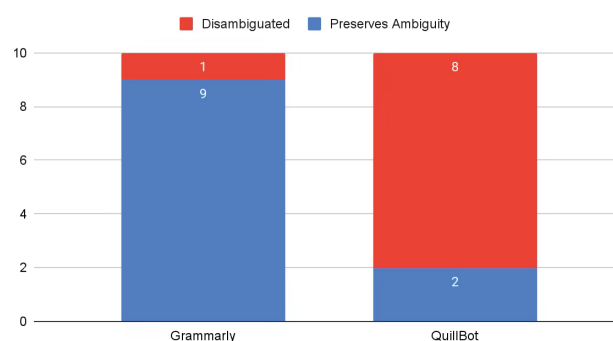


Figure 4: Sentences vs. tool disambiguation in pronoun ambiguity. Grammarly had a much higher chance of preserving ambiguity in sentences compared to QuillBot.

The rate of ambiguity preservation for Grammarly concerning pronoun ambiguity was 90%, while it was 20% for QuillBot, as highlighted in Figure 4. This is a very large difference and suggests that there might be a larger pattern that will persist even with a larger dataset. This could be due to QuillBot's algorithmic tendency to change the sentence structure, forcing it to pick one option.¹⁵ Another important thing to note is that out of the ten sentences, eight used specific names for people, one referred to two objects, while the last sentence involved animals, and it was the only sentence with pronoun ambiguity that Grammarly disambiguated. The sentence was "The puppy chased the squirrel, and it ran up a tree," while Grammarly paraphrased it as "The puppy pursued the squirrel, which scampered up a tree." When there are names, there is no way to predict which meaning is more likely, but in this example, many people would assume the squirrel ran up the tree, which could be why Grammarly also had a tendency toward that meaning.

QuillBot only preserved ambiguity for two sentences, and both of them share something in common. They were the only sentences to start with two names joined by the conjunction "and," which was then followed by an unclear pronoun. This could be because both names were the subjects in their sentence instead of having one subject and one object. Looking at the seven other sentences besides the dog and squirrel example, QuillBot consistently followed a pattern of selecting the subject of the sentence or the person performing the verb to be the one representing the ambiguous pronoun. This formula would not work for the two sentences, as it remains ambiguous because there is no reason to prefer one person over the other.

Punctuation Ambiguity:

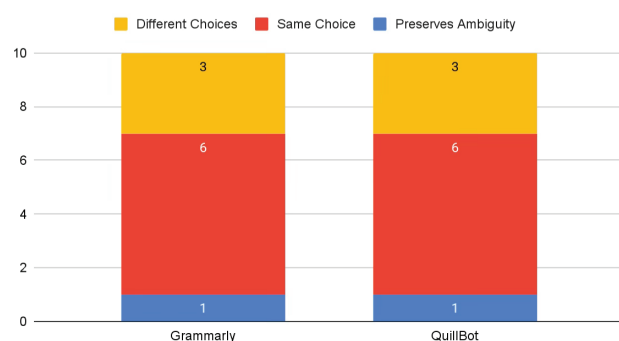


Figure 5: Sentence pairs vs. tool disambiguation in punctuation ambiguity. Grammarly and QuillBot had equal rates of ambiguity preservation and disambiguation.

The rate of ambiguity preservation for both Grammarly and QuillBot concerning punctuation ambiguity in Figure 5 was 10%. This is likely because the nature and testing of punctuation ambiguity is slightly different from other types of ambiguity. Because the interpretation could rely on the presence or absence of punctuation without changing the words, the analysis is a comparison of the two forms of the sentence, as well as Grammarly's and QuillBot's responses to them. For both tools, the sentences that remained ambiguous were from the same sentence pair, meaning all of the other sentence pairs can be evaluated based on their disambiguation.

Figure 5 demonstrates that Grammarly had three of the remaining nine sentences change their disambiguation when the punctuation was altered. Meanwhile, QuillBot also changed the disambiguation three times, but there was only one sentence that they both interpreted one way, and then changed once the punctuation changed. There were four sentences that both tools agreed on completely, defaulting to the same disambiguation option before and after the punctuation change, and selecting the same way the other platform did.

QuillBot was more likely to paraphrase both forms of the sentence the same way, with this occurring three times, while it only happened once for Grammarly. This suggests that even when using the paraphrasing tool that is QuillBot's strength, Grammarly might be more sensitive and aware of punctuation, and it has more variety when entering a similar sentence multiple times.

Synthesis:

Across multiple testing categories, Grammarly has a tendency towards preserving ambiguity, while QuillBot systematically operates as an ambiguity resolver. While the data for structural ambiguity, pronoun ambiguity, and overall performance confirm this, lexical ambiguity and punctuation ambiguity are exceptions. This pattern, especially found in pronoun ambiguity, where Grammarly preserved ambiguity in 90% of sentences tested compared to 20% for QuillBot, can be understood by each tool's main function. Grammarly is designed to focus on grammar and mechanics, and the tool's algorithm prioritizes structural and syntactic correctness, while QuillBot uses NLP to heavily paraphrase, forcing textual transformation.¹⁵ Grammarly has a tendency not to affect the framework of the sentence and instead substitutes synonyms, but QuillBot restructures the entire sentence. QuillBot also relies on structural formulas, such as defaulting to the primary subject of the sentence or assuming the most statistically common cultural interpretation, causing alternative meanings to not be preserved. Because both tools display a pattern of disambiguating sentences without extra context, it is important for writers not to blindly trust these systems. Grammarly is a safer tool to maintain nuanced writing with multiple meanings, while QuillBot's restructuring capabilities mean writers should be more cautious and post-edit to ensure the intended message is not changed.

Conclusion

Grammarly and QuillBot both seem to evaluate the probability of a certain meaning to be used when determining whether to preserve ambiguity or disambiguate sentences using their paraphrasing tools. While all four types of ambiguity showed interesting results, the clearest patterns emerged for pronoun ambiguity, demonstrating Grammarly's inability to disambiguate when there is no one more likely answer, and QuillBot's tendency to assign ambiguous pronouns to the subject of the sentence, even if there is no indication that only that meaning is possible. This is important to consider when using the tools to make sure that they do not change the understanding of a person's original message.

However, when evaluating these implications, several structural limitations must be considered. First, this study was designed to be a small-scale pilot project, resulting in a small dataset of 40 sentences tested overall. Because the built-in data models of the tools default to the most statistically probable meaning when they disambiguate a sentence, it can introduce bias in the ambiguous text toward what is most common or acceptable. These boundaries necessitate further scientific exploration to limit bias.

There are many possibilities for future research that expand on this study. While this study looked broadly at four types of ambiguity, there are even more specific categories within each group that could be analyzed to draw more concrete and generalized conclusions. It is also important to test these using a large dataset. Another potential variable to look at is how different modes for both Grammarly and QuillBot could affect the ambiguity of outputs, as they have models that focus specifically on increasing fluency or sounding a certain way.

■ Acknowledgments

I would like to thank Professor Kay Diaz, Dr. Monica Sava, and Professor Virgel Torremocha for their help throughout the research process.

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