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Complement set focus after positive quantifiers: The influence of context

During reading, different cues influence readers' focus. One of these is natural language quantifiers. Negative quantifiers, such as *few* (e.g., "Few attended the lecture"), have a complex influence on focus. They convey a sense of shortfall – a quantity that is less than what was expected (e.g. Moxey, 2006; Moxey & Sanford, 1987). This, in turn creates focus on the complement set (e.g., those not attending). Upadhyay et al. (2018) demonstrated the influence of story context on these focus effects. In three experiments, we investigated the influence of story context on focus effects with positive quantifiers. Although positive quantifiers are less diffuse in their meaning than negative quantifiers, context can lead positive quantifiers to convey shortfall, as negative quantifiers do. When the story context creates an expectation for a large quantity (e.g., *many*), the positive quantifier *a few* was understood as shortfall, leading to focus on the complement set.

Key words: reading, focus, text processing, natural language quantifiers

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AFTER POSITIVE QUANTIFIERS: THE INFLUENCE OF CONTEXT

Introduction

An important component of reading involves a continual shifting of attention. Readers shift their focus to different elements of the story, including characters, locations, and goals. Successful comprehension requires readers to focus on elements of the story that are currently salient and central to the unfolding narrative. This changing spotlight of attention allows readers to build a mental representation, or situation model, of the story that is rich and coherent (Johnson-Laird, 1983; O'Brien, et al., 2010; Levine, et al., 2000).

Among the many cues that guide readers' attention are natural language quantifiers—words that specify a quantity without denoting an exact number, such *as few, a few, many*, and *all*. What is intriguing about these small words is that, in addition to specifying an amount, they play a powerful role in influencing a reader's focus of attention (e.g., Filik et al., 2011; Ingram & Moxey, 2011; Moxey, 2006; Moxey & Sanford, 1987; 1993a, 1993b, 2000; Moxey et al., 2001; Paterson et al., 1998; Sanford et al., 2007; Sanford et al., 2002; Sanford & Moxey, 2003; Sanford et al., 1996; Upadhyay et al., 2019).

Consider the following example from Moxey and Sanford (1987; 1993a):

(1A) A few of the fans went to the match.

(1B) Few of the fans went to the match.

Both sentences describe a situation where a small number of fans went to the match. Despite this, they are comprehended differently. When readers were asked to generate sentence continuations starting with the pronoun They, they prefer different patterns of continuation after 1A than after 1B, indicating that different sets of fans are in readers' focus after each of the sentences.

After reading 1A, which contains the positive quantifier *a few*, sentence 2A follows easily:

(2A) They enjoyed the game greatly.

The pronoun *they* refers to the fans who attended the match. This group is the reference set as these are the fans who were explicitly referred to in 1A. The reference set tends to be in focus after a positive quantifier. In contrast, after sentence 1B, which contains the negative quantifier, *few*, the continuation in 2B is preferred (Filik et al., 2011; Ingram & Moxey, 2011; Moxey & Sanford, 1987, 1993, 2000; Paterson et al., 1998):

(2B) They watched it at home on TV instead.

In this sentence, the pronoun *they* refers to the fans who did not attend the match. This group is the complement set; these fans were not explicitly referred to in 1A. Although pronominal references such as *they* tend to be used for entities in readers' focus of attention, negative quantifiers sometimes license reference to an unmentioned set because the complement set is in focus. In addition to these

findings with sentence continuations, the same pattern was found with reading times (e.g., Paterson et al., 1998) and ERPs (Filik, et al., 2011).

According to the presupposition denial account (Moxey, 2006; Sanford et al., 2007), negative quantifiers convey an amount as well as the fact that a greater amount was expected. In other words, negative quantifiers communicate that there was a denial of a presupposition. "Few fans attended the match," connotes an expectation for a larger number to have attended. The presupposition denial account argues that it is the sense of shortfall that leads to focus on the complement set. Shortfall can include "reason-why-not" inferences about the complement set, such as "I wonder if the fans who did not attend skipped the match because it was too hot."

The polarity of a quantifier—positive or negative—largely determines focus effects, with positive quantifiers (*a few*) leading to reference set focus and negative quantifiers (*few*) leading to complement set focus. However, polarity is not the only factor influencing focus. The story context can interact with the polarity of the quantifier to alter these effects (e.g., Moxey, 2006; Moxey & Filik, 2010; Upadhyay et al., 2019). For negative quantifiers, the context can increase or decrease readers' sense of shortfall which, in turn, increases or decreases readers' focus on the complement set. Consider a scenario in which the expectation was for none of the audience to applaud, but instead few applauded. In this case, the negative quantifier *few* conveys a surplus rather than the shortfall that is usually expressed by a negative quantifier, and, in turn, increases focus on the reference set.

Upadhyay et al. (2019) asked how sensitive negative quantifiers are to contextual manipulations. Does story context have to be highly salient to reduce focus on the complement set? In the materials used by Moxey and Filik (2010), the expectation for a large or small quantity was stated definitively and tied "… to a character – in fact, the only individual character – mentioned in the text. Essentially, this character is, therefore, the main character whose expectations and desires will be highly salient" (Moxey & Filik, 2010, p. 614). In a series of six experiments, instead of stating expectations about quantity explicitly and connecting them to the story's main character, Upadhyay et al. (2019) wove the expectations about quantity throughout a more complex story. Critically, the expectation was not tied to a story character's expectations or desires, was not described explicitly, and was not central to the story. For example, in the passage below, the context suggests that only a small number of students will be admitted to a program, but this is far from certain:

(5A) Seton Hill High School is a poor urban high school in Chicago, Illinois, and has consistently been ranked as a school in critical need of improvement. The school has a program providing college-level courses for advanced students. Most years, a lot of weak students apply to the program. (Expect Few version)

If passage context is effective in leading readers to expect a small number, this should have decreased readers' sense of shortfall when they encounter the

negative quantifier *few*:

(6) This year, few of the juniors were accepted into the program.

Although *few* can carry "less than expected," or a sense of shortfall, as part of its meaning when a small number is expected, this may no longer be the case. Upadhyay et al. (2019) found exactly that. Reading was facilitated when an ambiguous anaphor, the students, was resolved to refer to the reference set—the students who were accepted:

(7A) The students were really excited about the program. (Reference set)

This was in comparison to a passage that created an expectation for a large quantity:

(5B) Seton Hill High School is an exclusive private high school in New England, and has consistently been ranked in the top ten high schools in the United States. The school has a program providing college-level courses for advanced students. Most years, a lot of strong students apply to the program. (Expect Many version)

With the Expect Many version, *few* was understood, as it usually is, to mean less than expected. In this case, the negative quantity *few* (Sentence 6) was understood as shortfall, leading to complement set focus and slower reading when the ambiguous anaphor, the students, referred to the reference set (7A).

Interestingly, reading times did not differ after the Expect Few and Expect Many versions when the anaphor referred to the complement set:

(7B) The students had really slacked off. (Complement Set)

Upadhyay et al. (2019) concluded that negative quantifiers, such as *few*, carry a presupposition of denial in their meaning and, thus, processing the complement set (e.g., the students not accepted) was fluent after *few* regardless of the context. In the Expect Few version, where readers expected a small quantity, shortfall was reduced, but not eliminated. Thus, reading of the complement ending remained fluent. Upadhyay et al. speculated that activation was divided between the complement set and reference set in the Expect Few version. The pragmatics of the passage interacted with the semantics of the negative quantifier, leading to activation of both the reference set and the complement set. This led to faster reading time on the reference set ending than after the Expect Many version, where focus should have been entirely on the complement set after the negative quantifier.

In the current study, we investigated focus effects created by positive quantifiers. Although negative quantifiers are often diffuse in their focus, causing them to be malleable in their interpretation, positive quantifiers create stronger focus effects. This is despite the fact that negative and positive quantifiers, such as *few* and *a few,* can carry a similar meaning. For example, when asked to estimate the proportion that each quantifier denoted, the responses for *few* (13%) and *a few* (15%) were almost identical (Sanford et al., 1996). However, Sanford et al. found

that 15% of sentence continuations after a negative quantifier referred to the reference set whereas after a positive quantifier, only .5% referred to the complement set. In addition to the reversal in the polarities of the sentence continuations, the positive quantifiers led to more consistent focus.

In the current set of experiments, we explored the comprehension of positive quantifiers. Given the consistency with which positive quantifiers lead to reference set focus, to what extent are focus effects influenced by the story context? First, we asked if the answer is dependent on the particular positive quantifier. Some positive quantifiers may be more malleable in their meaning than others. With a strong context, readers might comprehend a positive quantifier as communicating shortfall if it suggests a small quantity (e.g., *a few*) rather than a large quantity (e.g., *many*). Second, and more generally, we asked if focus effects after a positive quantifier can be influenced by the context in a naturalistic passage, as has been found in short, highly constrained, vignettes:

(3A) Robert expected none of the audience to applaud. A few…

(3B) Robert expected all of the audience to applaud. A few…

Using a sentence continuation task (Moxey & Filik, 2010), after Sentence 3A, all continuations were to the reference set (e.g., "A few applauded"), as would be expected after a positive quantifier. In contrast, after Sentence 3B, 25% of the continuations were to the complement set, "those who did not applaud" (e.g., "A few walked out"). By setting up an expectation for "all," the quantifier *a few* created a sense of shortfall, leading to complement set focus, at least some of the time. We expanded on this finding by examining positive quantifiers embedded into longer passages in which expectations about quantity are neither particularly salient nor tied to the story character's expectations. The question was if the story context would be influential enough to alter readers' focus, as it did with negative quantifiers. With positive quantifiers, when the context communicates shortfall (Expect Many…a few), the manipulation might be less powerful than it with negative quantifiers (Expect Many…few). With the negative quantifiers, both the context (Expect Many) and the semantics of the quantifier (*few*) communicated shortfall, leading to strong focus on the complement set. We asked if contextual information would be sufficiently influential to impact readers' focus when they encounter a positive quantifier. More specifically, if the story context leads readers to expect a large quantity, might this, in some situations, increase readers' sense of shortfall even after a positive quantifier? And might this, in turn, reduce focus on the reference set? In Experiment 1, we examined three different positive quantifiers to norm the materials. In Experiment 2, we compared two different positive quantifiers, *a few* and *many*, to determine if the complement set might be in focus after a positive quantifier such as *a few*, which can be understood to mean a small quantity. And finally, in Experiment 3, we asked if a reduction of reference set focus, or an increase in complement set focus, might be created after a positive quantifier if the story context leads readers to experience a sense of shortfall.

Experiment 1

Different quantifiers vary in their influence on readers' focus. Sanford, et al. (1996) compared the focus effects of 10 quantifiers, half negative and half positive. After reading a sentence with a positive or negative quantifier ("Few/Many/Etc. of the parents allowed their children into the club"), participants completed a continuation sentence beginning with an ambiguous anaphor ("They…."). Continuations after negative quantifiers referred to the complement set 71% of the time whereas continuations after a positive quantifier never referred to the complement set. Despite the strong focusing effects of positive quantifiers, we asked if context in naturalistic passage can reduce or reverse this focus effect.

In Experiment 1 we began by examining three different quantifiers. The goal was to norm materials for the two experiments that followed. Instead of writing a continuation line, as was done in Sanford, et al. (1996), participants received the final line of a passage and produced the preceding three lines of the story. The final line began with one of three quantifiers, the negative quantifier *few*, a positive quantifier that conveyed a small amount, *a few*, and a positive quantifier that conveyed a large amount, *many*. If a quantifier was understood as "less than expected," the three-sentence passage context that participants created should describe an expectation for a larger amount than occurred. For example, if the final line of the story stated that "few customers bought the organic cat food," and *few* is understood as shortfall, then participants should write a story in which there was an expectation for more than a few customers to buy the cat food.

We expected to find an effect of polarity, with shortfall being understood more often with the negative quantifier *few* than with the positive quantifiers *a few* and *many*. The central question for this experiment was if the two positive quantifiers are understood differently. In Sanford et al. (1996), participants estimated that *a few* denoted 15% whereas *many* denoted 65%. Thus, they may differentially indicate shortfall.

Method

Participants

Based on the medium to large effect sizes reported in Upadhyay et al. (2019), a sample size of 72 participants is needed for 90% power (G*Power; Faul et al., 2007). Seventy-five Binghamton University undergraduates participated as part of a requirement for an introductory psychology course. All participants were native English speakers.

Materials and Procedure

Readers were instructed: "In this experiment, you will read 9 sentences which

are the last line of a short story. Your task is to write 3 sentences that precede the last line. The sentences that you write should create a story in which the given line is a sensible ending. There is no wrong or right answer. Simply read the story ending and write 3 sentences that you think make sense, and that seem to go with the story ending." Each packet consisted of nine single-sentence items. Three sentences began with each quantifier: *few, a few, many*. Each participant only read one version of each of the nine items—three sentences per quantifier. Three blank lines appeared above each of the sentences.

Results and Discussion

Across all responses, a total of 11 were illegible or incomplete and were not included in the analysis. Two independent raters scored the data, indicating for each item if the response provided an explanation for shortfall in the final quantifier sentence. In the cases of disagreements, a third rater provided a tie breaking score. See Figure 1 for a sample item.[1] In the Shortfall example, the story lines provide a "reason-why-not" inference; the story explained why more customers did not buy organic cat food. In the No Shortfall example, the participant did not treat the final quantifier line as indicating shortfall.

Participants interpreted the negative quantifier *few* as indicating shortfall 54.8% of the time. As has been found previously, as a negative quantifier, *few* includes a presupposition of denial in its meaning (e.g., Upadhyay et al., 2019). Readers almost never interpreted the positive quantifier many as indicating shortfall, with only 3.6% of the responses providing a response describing an expectation for a larger amount. In contrast, the positive quantifier *a few* led to an interpretation of shortfall 29.2% of the time. See Figure 2 for these results. All pairwise comparisons differed significantly ($p < .01$).

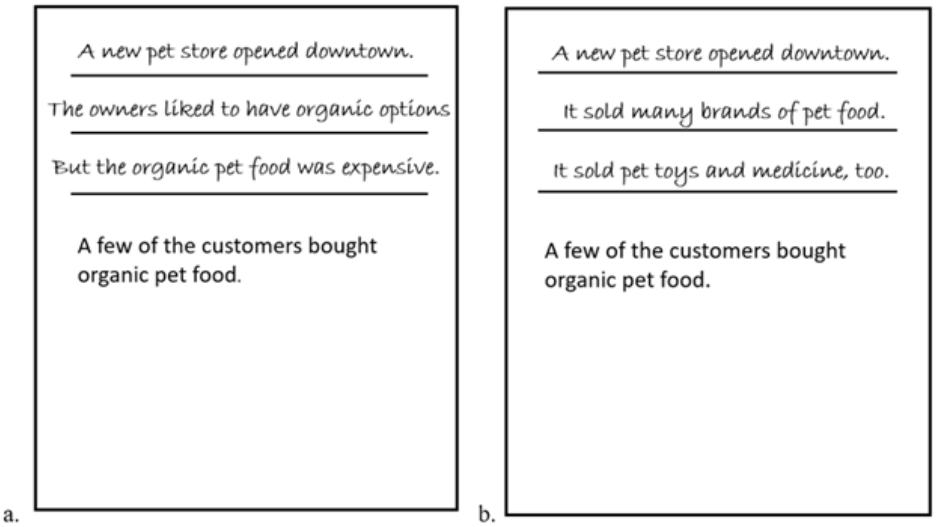
Readers were sensitive both to the polarity of a quantifier (*few* vs. *a few*) and differences in meaning for two different positive quantifiers (*a few* vs. *many*). Although the pattern is intriguing, the task was offline, inviting strategic processing. Further, the task was unconstrained, leading to subjectivity in scoring and requiring a third, tie breaking score 18% of the time. We explored the hypothesis that *a few* would be more malleable by context than many in Experiment 2 using an online task.

Experiment 2

In Experiment 2, we compared the positive quantifiers *a few* and *many*. Although the reference set was preferred over the complement set after positive quantifiers, we asked if focus effects are more nuanced during natural reading. Might the complement set be in focus, at least some of the time, after a positive

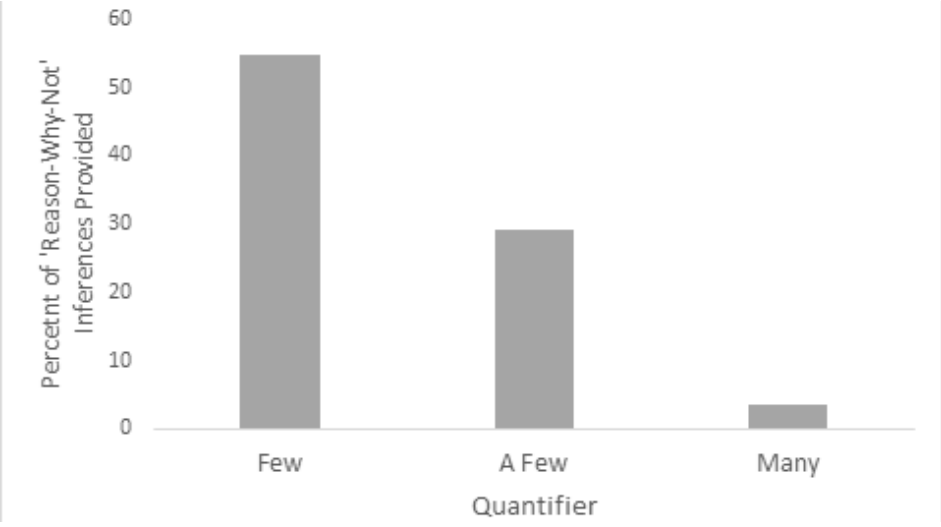
1 Coding data is available at https://osf.io/2ehjq/

Figure 1. *Example responses for Experiment 1.*



Note. Panel A: The participant provided a reason why more customers did not buy the organic pet food, namely, it was expensive. This response would be coded as Shortfall. Panel B: The participant did not provide a reason why more customers did not buy the organic pet food. This response would thus be coded as No Shortfall.

Figure 2. *Experiment 1 Results—Percent of 'Reason-Why-Not' Responses.*



Note. When the sentence provided began with the negative quantifier few, participants provided a 'reason-why-not' explanation 54.8% of the time, compared to 29.2% for the positive quantifier a few and 3.6% for the positive quantifier many.

quantifier such as *a few*, which is understood to mean a small quantity?

Participants read a series of short stories. The passage introduction was neutral, in that it did not create an expectation for a particular quantity. A Quantifier line began either with the positive quantifier *a few* or with the positive quantifier *many* and was followed by a Target line that began with an ambiguous plural noun phrase anaphor (e.g., The students). The anaphor could conceivably refer to the reference set (e.g., the students accepted), the complement set (e.g., the students not accepted), or another set (e.g., all students). The remainder of the sentence described a set of actions or attributes that were a better fit with the complement set than the reference set. For example, "The students had really slacked off" is an apt description of the students not accepted (the complement set) and a far less apt description of the students accepted (the reference set). The question was if this complement-set focused sentence would be easier to integrate after the quantifier *a few* than the quantifier many, despite there both being positive quantifiers, and despite the finding that readers prefer the reference set to the complement set after positive quantifiers.

Method

Participants

Using G*Power (Faul et al., 2007) and based on the medium to large effect sizes reported in Upadhyay et al. (2019) with a similar design, a sample size of 90 participants was needed to achieve 95% power in this experiment. Ninety-one Binghamton University undergraduates who were naïve to the experiment, participated as part of a requirement for an introductory psychology course. All participants were native English speakers.

Materials and Design

Materials were adapted from Upadhyay et al. (2019).[2] There were 16 experimental passages with two versions of each. Each passage consisted of six sentences. The first three sentences introduced a story without reference to any quantity. The fourth sentence, the Quantifier line, included either the positive quantifier *a few* or *many*. The fifth sentence was the Target line. It began with a plural noun phrase anaphor (e.g., The students) that referred to entities in the quantified phrase. The remainder of the sentence disambiguated the anaphor by describing actions or attributes of the entities in the anaphoric phrase. The description was always a better description of the complement set than the reference set. See Table 1 for a sample story.

2 The full set of critical experimental materials for Experiments 2 and 3 is available at https://osf.io/2ehjq/

Table 1. *Experiment 2 Sample Story*

	A Few Condition	Many Condition
Neutral context	Seton Hill High School is a public high school in Rochester, New York, and serves approximately 1500 students. The school has a program providing a number of college level courses for some of their advanced students. Students are able to apply during their junior year.	Seton Hill High School is a public high school in Rochester, New York, and serves approximately 1500 students. The school has a program providing a number of college level courses for some of their advanced students. Students are able to apply during their junior year.
Pre-target quantifier line	This year, a few of the juniors were accepted into the program.	This year, many of the juniors were accepted into the program.
Target complement set line	The students had really slacked off.	The students had really slacked off.
Spillover line	The program needed to approve its new curriculum.	The program needed to approve its new curriculum.

Passages were presented one line at a time on a computer monitor. Stimuli were constructed in E-Prime version 3.0. Participants advanced through the experiment using Chronos response boxes. Each participant read half of the 16 experimental passages in the A Few condition and half in the Many condition. Each passage was presented to half the participants in each of the two conditions. Passages were presented in the same order across participants with conditions counterbalanced. Following the last line, a yes/no comprehension question about the story was presented to encourage participants to read carefully. There were three practice passages and twenty filler passages to obscure the manipulation. The filler passages varied from seven to ten lines and ranged in topic. Some of the filler passages included other quantifiers (e.g., some, a lot).

Procedure

Participants were tested individually. Passages were presented one line at a time on a computer monitor. Each trial began with the presentation of the phrase "READY FOR THE NEXT STORY" in the center of the screen. Participants controlled the presentation of the text with a line advance key. Each key press caused the current line of text to be erased and the next to be presented. After the final line of the passage, the string "???" appeared for 750 ms and was followed by a yes/no comprehension question. On trials in which participants responded incorrectly to the questions, the word "Error" appeared for 1 second. If participants responded incorrectly on 3 or more comprehension questions, the phrase "PLEASE TRY TO BE MORE ACCURATE ON QUESTIONS" was presented. Participants were given two breaks during the experiment. To familiarize participants with the procedure, they completed three practice passages before starting the experiment.

Results and Discussion

The data from three participants were excluded for failure to follow directions or because of external distractions during the experiment. Reading times less than 500 ms and greater than 6000 ms were eliminated; this constituted 3.2% of the data. Participants answered the comprehension questions correctly 89% of the time.

The target line, which described the complement set, was read more quickly following *a few* (2164 ms) than following *many* (2456 ms); $t_1(87) = 6.70$, SEM = 43.50, $p < .001$, $d = .41$; $t_2(14) = 1.70$, SEM = 76.46, $p = .05$, $d = .86$ (see Table 3).[3] Although both conditions included positive quantifiers, and thus, should have created focus on the reference set, reading times on a sentence referring to the complement set were almost 300 ms shorter after *a few* than after *many*. Given the results of Experiment 1, which indicated that *a few* led to an interpretation of shortfall at least some of the time, focus may have been on the complement set, facilitating comprehension of the complement set target line. Alternatively, after *a few*, focus may have been divided between the reference and complement sets. A final possibility is that focus was on the reference set in both conditions after the positive quantifier *a few*, but when readers encountered the target line, which described the complement set, they were able to change focus more quickly after *a few* than after *many*, with *a few* being reinterpreted to indicate shortfall.

Reading times were slower on the Quantifier line itself ("A few/Many of the students...") in the Many condition (2216 ms) than the A Few condition (2115 ms). These differences are difficult to interpret as the line was not identical in the two conditions, and the result was significant in an analysis by subjects, $t_1(87) = 2.39$, SEM = 42.51, $p < .05$, $d = .17$, but not by items, $t_2(14) = 1.96$, SEM = 152.61, $p = .07$. This was not predicted nor is it easily interpreted. Perhaps it is a function of the nature of the two quantifiers, or perhaps many was more difficult to integrate as the story had not previously alluded to an expectation for any particular quantity. As there was a nonsignificant difference in reading time on the pretarget quantifier line, it is unlikely that the reading time difference on the target line can be attributed to differences in the previous line.

In summary, the results of Experiment 2 reinforced the offline results from Experiment 1: Although sentence continuation tasks have suggested that positive quantifiers lead to reference set focus, the strength of these focus effects seem to depend on the particular quantifier. In Experiment 3, we asked if the pragmatics of a naturalistic passage can weaken or eliminate the focus on the reference set, at least for positive quantifiers such as *a few* that convey a small amount.

Experiment 3

Although positive quantifiers almost always lead to reference set continuations (e.g., Moxey, 2006) might the pragmatics of a story influence this? Moxey

3 Raw data for Experiments 2 and 3 are available at https://osf.io/2ehjq/

and Filik (2010) created one-sentence contexts in which an expectation about quantity was stated explicitly and tied to the story's only character. For example, after reading "Robert expected all of the audience to applaud," 25% of the sentence continuations referenced the complement set even though the next sentence began with the positive quantifier *a few* (e.g., A few walked out). In this case, *a few* was understood as shortfall, in comparison to all, leading to a sense of shortfall.

In Experiment 3, we asked if a reduction of reference set focus, or an increase in complement set focus, might result from a naturalistic story context. This is in contrast with the materials in Moxey and Filik (2010) in which the expectations about quantity were stated explicitly, were definitive rather than probabilistic, and were tied to the vignette's only character. We examined the influence of a more naturalistic story context. To do so, we used the positive quantifier *a few*. In contrast with *many*, the positive quantifier *a few* represents a small amount, and thus might be more malleable in its meaning and more context dependent. The results of Experiments 1 and 2 suggest that some degree of focus on the complement set might be possible compared to a positive quantifier such as *many* that represents a large quantity.

Passages were presented in an Expect Few and Expect Many versions. In the Expect Many version, the context created an expectation for a large amount. In the Expect Few version, the context created an expectation for a small amount. In both versions, the Quantifier line began with *a few*. The question was if this would be understood as shortfall in the Expect Many version, and subsequently create focus on the complement set. Just as in Experiment 2, the Quantifier line was followed by a Target, anaphor line, that began with an ambiguous noun phrase anaphor (e.g., The students) that could refer to the complement set, the reference set, or another set. The remainder of the sentence described a set of actions or attributes that were a better fit with the complement set than the reference set. See Table 2 for a sample story. We asked if the complement set is easier to integrate in the Expect Many than the Expect Few version.

Method

Participants

Using G*Power (Faul et al., 2007) and based on the medium to large effect sizes reported in Upadhyay et al. (2019), a sample size of at least 80 participants was needed to achieve 95% power in this experiment. Eighty-one Binghamton University undergraduates who were naïve to the experiment participated as part of a requirement for an introductory psychology course. All participants were native English speakers. No additional demographic information was collected.

Materials and Design

Materials were adapted from Upadhyay et al. (2019). The passages were simi-

Table 2. *Experiment 3 Sample Story*

	Expect Few Condition	Expect Many Condition
Context	Seton Hill High School is a public high school in Rochester, New York, and serves approximately 1500 students. The school has a program providing a number of college level courses for some of their advanced students. Students are able to apply during their junior year. This year, a few of the juniors were accepted into the program. Seton Hill High School is a poor urban high school in Chicago, Illinois, and has consistently been ranked as a school in critical need of improvement. The school has a program providing college-level courses for advanced students. Most years, a lot of weak students apply to the program.	Seton Hill High School is a public high school in Rochester, New York, and serves approximately 1500 students. The school has a program providing a number of college level courses for some of their advanced students. Students are able to apply during their junior year. This year, many of the juniors were accepted into the program. Seton Hill High School is an exclusive private high school in New England and has consistently been ranked in the top ten high schools in the United States. The school has a program providing college-level courses for advanced students. Most years, a lot of strong students apply to the program.
Pre-target Quantifier Line	This year, a few of the juniors were accepted into the program.	This year, a few of the juniors were accepted into the program.
Target Complement Set Line	The students had really slacked off.	The students had really slacked off.
Spillover Line	The program needed to approve its new curriculum.	The program needed to approve its new curriculum.

lar to Experiment 2. Passages were presented one line at a time on a computer monitor. Stimuli were constructed in E-Prime version 3.0. Participants advanced through the experiment using Chronos response boxes. There were 16 experimental passages, with two versions of each, Expect Many and Expect Few. In the Expect Many condition, the context sets up an expectation for a large quantity. In the Expect Few condition, the passage sets up an explanation for a small quantity. In both versions, the quantifier line began with *a few*, and the Target line described a set of actions or attributes that were a better fit with the complement set than the reference. Experimental passages were separated by filler passages.

Procedure

The procedure was identical to that of Experiment 2..

Results and Discussion

Reading times less than 500 ms and greater than 6000 ms were excluded; this accounted for 3.3% of the data. Additionally, nine participants' data were excluded because of loud construction noise during testing. Participants answered

the comprehension questions correctly 93% of the time. There was no difference in reading time across the two conditions on the pre-target, Quantifier line ($p > .2$), or the post-target, spillover line ($p > .8$).

Critically, reading was faster on the Target, anaphor, line in the Expect Many (2149 ms) than in the Expect Few version (2300 ms); $t_1(71) = 3.23$, SEM = 46.52, $p < .01$, $d = .20$; $t_2(15) = 2.46$, SEM = 74.58, $p < .05$, $d = .62$ (see Table 3). When the passage described an expectation for a large quantity, even though this expectation was neither stated explicitly nor tied to a story character, the positive quantifier *a few* was understood as indicating shortfall. This in turn led to faster reading times on a sentence describing the complement set. In the Expect Few version, the positive quantifier *a few* did not create a sense of shortfall. Thus, focus was on the reference set. This led to slower reading on the Target line that focused on the complement set.

General Discussion

Quantifiers are fascinating words. On the surface, their purpose is simple—to express a quantity. Less obvious is that quantifiers sometimes have a powerful influence on readers' focus. The influence of negative quantifiers, words such as *few* and *not many*, is well understood: As stated in the presupposition denial account (e.g., Moxey, 2006; Sanford et al., 2007), negative quantifiers connote both an amount and that a presupposition of a larger quantity has been denied. This denial of expectation creates focus on the shortfall between the amount that was expected and the smaller amount that is indicated by the quantifier. This, in turn, leads to focus on the complement set. Further, as demonstrated by Moxey (2006), Moxey and Filik (2010), and Upadhyay et al. (2019), in addition to the semantics of negative quantifiers, the pragmatics of the narrative can influence readers' understanding of shortfall. Even though the expectations about quantity described in the stories created by Upadhyay et al. were relatively subtle—neither explicitly stated nor tied to a story character's desires and expectations—story context mattered. Regardless of the context, the negative quantifier *few* communicated

Table 3. *Experiments 2 and 3 – Mean Reading Times (SE), in ms., on the Pre-Target (Quantifier) and Target (Complement Set) Lines*

Experiment 2		
Line	A Few condition	Many condition
Pre-target (Quantifier)	2115 (62)	2216 (66)
Target (Complement set)	2164 (72)	2456 (77)
Experiment 3		
Line	Expect Few condition	Expect Many condition
Pre-target (Quantifier)	1910 (62)	1951 (63)
Target (Complement set)	2300 (87)	2149 (76)

shortfall, as would be expected; however, the narrative context reduced readers' sense of shortfall when it created an expectation for a small amount. This, in turn, led to focus on the reference set. The focus effects created by negative quantifiers are an interaction between the semantics of the quantifier and the pragmatics of the situation.

In the current study, we turned our attention to positive quantifiers, asking if their interpretation is similarly influenced by the pragmatics of the narrative. In contrast with negative quantifiers, which have been shown to be somewhat diffuse in their focus effects, and thus malleable in their interpretation, positive quantifiers are almost always understood as referring to the reference set. For example, Sanford et al. (1996) found that 90% of sentence continuations provided by participants after a positive quantifier referred to the reference set, with only .5% referring to the complement set. This is in contrast with negative quantifiers, in which only 71% of continuations referred to the complement.

In Experiment 1, we utilized an offline task to norm readers' interpretation of three different quantifiers. Participants wrote a three-sentence story that fit with an ending line that began with one of the three quantifiers: *few, a few*, and *many*. Participants interpreted the negative quantifier *few* as indicating shortfall the majority of the time. In contrast, the positive quantifier *many* was almost never interpreted as indicating shortfall. Of greatest interest was the profile for the positive quantifier *a few*—which differed from the positive quantifier manywith more responses indicating shortfall despite being a positive quantifier. Although the task was offline, with a fair amount of variability in ratings, the pattern is intriguing and suggests that the influence of the story context on the comprehension of positive quantifiers might depend strongly on the particular quantifier. Positive quantifiers such as *many* might lead so strongly to reference set focus that the story context will have little effect. In contrast, a positive quantifier such as *a few* might be more malleable.

To investigate this idea experimentally, in Experiment 2 we contrasted the two positive quantifiers, *a few* and *many*, in an online reading task. A Quantifier line began with one of the two quantifiers. This was followed by a critical, Target line that began with an ambiguous plural noun phrase (e.g., The students) and then described a set of actions or attributes that were a better fit with the complement set (the students not accepted) than the reference set (the students accepted). Although both versions included a positive quantifier, reading times on the Target line were faster after *a few* than after *many* indicating, as was suggested in Experiment 1, that the positive quantifier *a few* leads to an interpretation of shortfall at least some of the time.

Experiment 3 directly examined the influence of passage context on readers' attentional focus. Moxey (2006) found that when the amount indicated by a positive quantifier was less than what the character expected (e.g., "Robert expected all to applaud; a few of them did"), the positive quantifier *a few* was understood as shortfall, and complement set focus was increased. What remains to be known is

if story context must be highly salient to have this influence, with the expectations about quantity being both stated explicitly and tied to the character. As Moxey and Filik (2010) argue, "Clearly, there must be limits on the contextual variables that can form contrasts with quantifier information. For example, a piece of text can introduce several characters with expectations, desires, or knowledge vis à vis amounts described by quantifiers; and, indeed, the reader can attribute to the writer any or all of these. It is unlikely that readers will calculate and constantly update all of these" (p. 614).

To examine the limits on context, we embedded expectations about quantity into naturalistic passages. The expectations about quantity were neither tied to a story character nor stated in a way that was definitive. In an Expect Few version, the passage created an expectation for a small quantity; in an Expect Many version, the passage created an expectation for a large quantity. In both versions, a Quantifier line began with the positive quantifier *a few*. The question was if the focus on the reference set would be reduced, and focus on the complement set increased, in the Expect Many version. This is what was found: Reading times on the Target line were faster in the Expect Many than the Expect Few version. When the context provided an expectation for a large quantity, the positive quantifier *a few* conveyed shortfall.

Filik et al. (2021) also found that story context can be powerful in influencing readers' interpretation of positive quantifiers. In their study, positive quantifiers were used in an ironic context – "I see many of your students have passed" – after learning that many students received F's. Like our materials, the quantified sentence was followed by a target sentence consistent with the complement set: "They are now in trouble." Filik et al. found that the N400 component on a target word (trouble) consistent with the complement set was smaller in the ironic condition than in the non-ironic condition. Integration of the complement set proceeded more easily when the positive quantifier was used ironically because it was understood as indicating shortfall.

How does story context influence readers' focus? One possibility, a complement focus explanation, posits a strong role of context: When the story described an expectation for a large quantity in the Expect Many version (or, when a positive quantifier was used ironically), the positive quantifier was understood as a denial of a presupposition, or shortfall, leading to focus on the complement set, much like occurs with negative quantifiers. Although possible, we would argue that this explanation is unlikely. Positive quantifiers usually create strong focus on the reference set, which is the default set— the entities in a narrative which are being referred to. Even for negative quantifiers, which are more diffuse in their focus than positive quantifiers, and thus, more easily influenced by the story context, Upadhyay et al. (2019) concluded that focus was not fully changed from the complement set to the reference set by the pragmatics of the story. Thus, it is unlikely that the effects of the passage context fully eliminated any focus on the reference set after a positive quantifier.

In contrast with the complement focus explanation, focus may have simply been more diffuse in the Expect Many than the Expect Few version. In the Expect Many version, the positive quantifier may have led to focus that was distributed across the complement set and the reference set, and, perhaps, across the general set, such as all students (Moxey, 2006). In other words, when the anaphor was read, its signal may have been divided among all of these antecedent sets. Thus, the remainder of the sentence was easier to integrate than in the Expect Few version, in which focus should have been strongly on the reference set. Consistent with this, Levine et al. (2000) found that if an antecedent for an anaphor is not sufficiently activated, readers may fail to complete an anaphoric inference. The reference set may have been in greater focus than the complement set, which is almost always the case for positive quantifiers. Or perhaps the complement set was in greater focus than the reference set if the context created a strong sense of denial of expectation, or shortfall. Either way, context led not to a complete change in focus but to a weakening of the focus on the reference set.

A final possibility is that the focus remained on the reference set after the positive quantifier, even in the Expect Many version. This would be consistent with the idea that the polarity of a quantifier has strong and immediate effects. With this account, it was only when the noun phrase anaphor, the students, was disambiguated to refer to the complement set ("The students had really slacked off") that the passage context influenced processing. If this is the case, the shorter reading times in the Expect Many version were due to processes occurring after the anaphor had been understood.

To determine more precisely the role of story context on the comprehension of quantifiers, it would be necessary to examine the entire time course of activation, using measures that are time locked to processing such as eye tracking or event-related potentials (ERPs). A comparison is needed of the activation of the complement and reference sets at different points in processing. This would allow a fuller understanding of how the polarity of the quantifier and the passage context interact to influence comprehension of quantifiers and their effect on readers' focus. In addition, we need to examine a fuller range of materials. The pattern of results might vary depending on both the nature of the contextual manipulation and the particular quantifiers examined. For example, in the current experiments, the narrative context may have had a strong influence on readers' focus because the positive quantifier *a few* is more malleable in its meaning than, for example, the positive quantifier *many*. Further, the materials were somewhat formulaic. Future experiments would benefit from a wider range of materials.

Regardless of the precise cognitive mechanisms underlying the effect, we conclude that expectations about quantity conveyed through a relatively naturalistic passage can influence the usually strong focus effects created by positive natural language quantifiers. This offers additional support for the presupposition denial account: When the story context created shortfall between what readers expected and what was observed, reference to the complement set was facilitated,

even after positive quantifier. The context in which positive quantifiers are embedded—whether indicating irony or leading to an expectation for a large amount—influences the comprehension of the quantifier. In the current experiments, the pragmatics of the narrative interacted with the polarity of the quantifier to create a sense of shortfall. Subtle changes in context have the power to change readers' interpretation of these small, yet influential, words.

Conflict of Interest Disclosure

The Authors report there are no competing interests to declare.

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Research Ethics Statement

Followed guidelines consistent with the American Psychological Association's (APA) ethical standards, including informed consent, debriefing, data practices, and reporting practices. Institutional approval has expedited status due to minimal risk to participants. A standard informed consent form, as used by the department and approved by the IRB, was read and signed by participants before participating in the experiment. Binghamton University Institutional Review Board, HSRRC approval code 1237-09

Data Availability Statement

Data and materials associated with the current study are available on the Open Science Framework: https://osf.io/2ehjq/

Authorship Details

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