Interpretations of Non-standard Capitalization on Twitter

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1   Introduction

Non-standard orthography on social media is a frequently referenced but largely under-studied phenomenon. Social media users deviate from the norms of English orthography in numerous, but often predictable ways, particularly in the areas of capitalization, punctuation and spelling. Examples (1) through (4) below exemplify just a few of the common patterns found in the text of Twitter messages (hereafter "tweets").

(1)   CUTEST DOG EVER

(2)   It's Thursday people! Last day of school for the week, woot woot!!!!

(3)   RT @user @user: they. better. not. fuck. this. up.

(4)   @user Helllll yesssssss

I postulate that non-standard orthography is meaningful, though the kinds of meanings it may carry and how those meanings are retrieved by readers remains to be explored in detail. Sociolinguistic research has become a popular topic in internet linguistics in recent years (Baym 2015; Seargeant & Tagg 2014; Zappavigna 2012), but it often takes common assumptions about orthographic patterns as given and builds upon them without further examination. There is also a range of research in computational linguistics dealing with internet language (Carvalho et al 2009; Gimpel et al 2011), which categorizes and analyzes social

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media language in purely quantifiable terms. However, this field also makes little attempt at a rigorous analysis of the pragmatic uses of innovative orthography, revealing a clear need for the development of a model which sociolinguists and computational linguists can build on when dealing with the functions of pragmatic orthography.

As a preliminary step toward filling in this gap, this study examines the use of one specific pattern of non-standard capitalization found on Twitter: using capitals for the entire tweet, or for a large portion of it, as in example (1) above. The stereotyped interpretation is that this pattern indicates anger or yelling, but more descriptive work on Twitter suggests that it actually serves to upscale the emotive content of the message (Zappavigna 2012). Using Twitter corpus data, I investigate judgments on the emotive strength of tweets with and without the capitalization pattern in question, and the results are consistent with an upscaled strength judgment in happiness. I also propose that this upscaling function derives from writers' attempts to encode prosody in writing, and from readers' recognition of such cues. Assuming this prosodic explanation, the data can all be clearly motivated, and predictions can be made about how we might expect other examples to behave. These predictions may also be extended to explain other orthographic patterns found in social media, although a detailed analysis of these other patterns, such as those seen in examples (2)–(4) above, will be the scope of future work.

2   Background

Though Twitter displays a wide range of orthographic variation beyond the formality we've come to associate with written language, it's clear that the ways in which people deviate from the formal orthographic norms of English are not random.[1] Rather, they are intended to be analyzed as relevant, and therefore to contribute to the interpretation of a text. Per Sperber & Wilson's Relevance Theory (2004), it is human instinct to search for relevance in communication, and communicators take advantage of this. They posit that:

> "as a result of constant selection pressure towards increasing efficiency, the human cognitive system has developed in such a way that our perceptual mechanisms tend automatically to pick out potentially relevant stimuli, our memory retrieval mechanisms tend automatically to activate potentially relevant assumptions, and our inferential mechanisms tend spontaneously to process them in the most productive way" (Sperber & Wilson 2004: 254).

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[1] Barring typos and other random factors, the majority of orthographic deviation found on social media should be considered to be intentional (Crystal 2011).

Intentional stimuli are presumed to be relevant enough to be worth the processing effort of the receiver, since they are worth the production effort of the communicator. In this way, a writer may utilize non-standard orthography as an ostensive stimulus, knowing that it will attract the attention of the reader, who will then pick it out as relevant and assign it a meaning. This assigned meaning will be strongly influenced by contextual clues, and may additionally require one to draw on other assumptions and competencies. I will return to these concepts in more detail in the Discussion section.

In this study, I focus on non-standard variations of capitalization in tweets. I specifically consider tweets with the "caps lock" pattern, where all or most of the tweet is capitalized, or a small but random portion is capitalized[2]. I have chosen to examine capitalization because it is a widely available and frequently used orthographic pattern across platforms, and internet users often have clear intuitions and strong opinions about its usage.

The caps lock pattern has a few stereotyped meanings associated with it. Typing in all caps may get you accused of yelling, or "flaming"[3], and may be interpreted as an indicator that you are angry. Example (5) below shows that this interpretation fits some cases. But a broader set of examples of this pattern on Twitter provides more nuance:

(5)   RT @user: THERE ARE ALREADY LAWS ON THE BOOKS CONCERNING GUNS BUT THEY ARE NOT BEING ENFORCED! MORONS!

(6)   RT @user: IM OFFICIALLY IN CALIFORNIA AND IT IS BEAUTIFUL

(7)   RT @user: I NEED TO DO THIS

(8)   @user1 @user2 YOU GUYS ARE TOO NICE

(9)   RT @user: LISTENING TO THE SMITHS HAS MADE ME MOODY AND EMO.

It would be difficult to interpret the messages of (6) through (9) as being angry or as yelling based on their textual content. A range of possible emotions are represented, from happiness to desire to something akin to dramatic overacting. If

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[2] Examples in which a single word in its entirety is capitalized, where capitalization changes more than once within the same word, or where words which are not proper nouns are given initial capitalization were not included in this pattern, as they seem to exhibit different pragmatic functions than the caps lock pattern.

[3] Flaming is defined by Baym (2015) as messages which "include swearing, insults, name calling, negative affect, and typographic energy".

anger is not the only emotion associated with this pattern, then these writers must intend to convey a different meaning with their orthographic choices.

Zappavigna (2012) makes a more specific and intuitive claim, suggesting that both what she terms the "caps lock" pattern and the potentially related pattern of reduplicated exclamation points have similar functions, related to "upscaled graduation". She specifies that reduplication of exclamation points serves to upscale the "interpersonal meaning" of a written utterance, and that such an upscaling can be applied to both positive and negative meanings. The content and context of the tweet itself determines which meaning will be intensified. She ties this use of exclamation points and other similar patterns of punctuation to intonational or prosodic features of oral speech as the means of achieving this "graduation". Regarding capitalization, she only says that the caps lock pattern achieves a similar effect to that of the punctuation patterns she addresses.

Orthography as an indicator of prosody is a claim worth examining, as a framework for understanding the pragmatic functions of orthography. Internet linguists have long claimed that the instantaneous and prolific nature of the internet has offered orthography a chance to evolve and become more speech-like (Baym 2015; Crystal 2011; Werry 1996; Zappavigna 2012; Ferrara et al. 1991). Non-standard capitalization and other orthographic deviations may thus be an attempt to capture the prosodic features of speech. For example, a speaker can increase the strength of the emotion they intend to convey by altering their prosody in oral communication (Piotrovskaya 2003; Cruttenden 1997). If capitalization can be substituted for prosody, this would explain Zappavigna's claim that it can upscale emotive content. But this explanation also predicts that the effects of capitalization on emotional strength will depend on context and the specific emotion in questions, since different emotions are realized with different prosodic features (Burkhardt and Sendlmeier 2000). I will expand upon these issues further in the Discussion.

The first step toward determining the specific function of the caps lock pattern is to test the analysis laid out by Zappavigna (2012), which relies only on intuition and a few select examples, and would be better supported with quantitative data. She makes a falsifiable claim in suggesting that the caps lock pattern may correlate with higher judgments of emotive strength in tweets, and in the following section I will lay out an experiment testing this claim. More complex theories regarding the pattern's relation to prosody may then be built upon this foundation.

3   Experimental design

The working hypothesis for this experiment is that readers' interpretation of a tweet is influenced by the presence of the caps lock pattern. Specifically, I predict, based on initial observations of data items and following Zappavigna, that tweets including the caps lock pattern and which are also independently judged as being

exemplary for a specific emotion should be judged as having a lower degree of that emotion if the capitalization pattern is standardized[4]. In this study, I will be interested in happiness specifically, considering its frequency in the corpus and relative clarity of strength judgments.

I analyzed a sample of about 100,000 tweets, downloaded via the Twitter streaming application programming interface (API), run on June 23rd, 2016. From this sample, I pulled out every example which included the caps lock pattern and, after discarding duplicates, spam messages, and tweets in languages other than English, I was left with a 144-tweet corpus of non-standard capitalization on Twitter.

From this corpus, I selected several tweets including caps lock for inclusion in the test data. Items containing hyperlinks and emoticons[5] were dispreferred, and tweets were selected based on overall clarity of content out of context and possibility of exemplifying one of the test emotions. Identifying information, such as usernames, was removed from the test items. For each tweet, a minimal pair item was included which maintained all the spelling, punctuation, and other orthographic choices, but reduced the capitalization to occurring only sentence- and proper-noun-initially. An example of an original tweet and its standardized minimal pair can be seen in examples (10) and (11) below.

(10)   RT @user1: @user2 HI ITS MY BIRTHDAY!!!

(11)   RT @user1: @user2 Hi its my birthday!!!

The test was run in a survey format via Qualtrics, and test participants were recruited and compensated via Amazon Mechanical Turk. A total of 23 participants[6] took the survey, 12 male and 11 female. Participants' ages ranged from 18–60, but most the participants were in their 20s. Seventeen participants reported using Twitter, and all participants reported using some social media platform for at least an hour a week. Participants were compensated $1.00 for completing the survey, as per standard rates for a ~20-minute survey on Amazon Mechanical Turk.

Each survey contained 30 content items and 6 filler items. For each item, the participant saw either the original version of the tweet (containing the relevant

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[4] Standardization is here defined as following the formal rules of English orthography, namely capitalizing only the first letter of a sentence and the first letter of proper nouns.

[5] Emoticons are interpreted as paralinguistic non-verbal cues according to Zappavigna (2012) and others, and were thus excluded from this research, though future studies may benefit from examining the interrelation between emoticons and pragmatic orthography.

[6] 24 total participants were recruited, but one response set was discarded because the participant did not answer any of the content questions.

capitalization pattern) or the standardized version (without the capitalization), and no participant saw both versions of the same tweet. The question formatting as seen by the participants is shown in Figure 1 below. The participants were given three options of emotions for each item — happy, sad, and angry —   and were given the following instructions:

> Please read the following tweets and judge as best as possible what emotion(s) the author intended to express. Each emotion option will include a slider which you should move to indicate the strength of that emotion in the given tweet. You may slide the bars for multiple emotions per tweet. If you feel that an emotion is not at all present in the tweet, leave the slider for that emotion at the lowest setting. If you feel that none of the given emotion options are present in the tweet, please leave all sliders at the lowest setting.

No numbers were shown to the participants to quantify the degree to which they slid the bar, but Qualtrics recorded their scores on a scale of 0–100 for the purposes of analysis. Participants saw only three degree markings: "Not at all" at the lowest end of the scale, "Moderate" in the middle, and "Very strong" at the high end.

Figure 1: Question format

4   Results

The resulting data was analyzed in the statistical computing environment R (R Core Team, 2014). I first used the mean ratings by item to determine which tweets were independently rated as good examples of a tweet fitting one of the three emotions. If the original version of the tweet was rated above 60 out of 100 for an emotion (i.e., falling above the "Moderate" marking on the slider) on average for all participants, I selected it as a strong example of that emotion. Ten of the 30 tweets

were rated as happy by these standards, four were rated as angry, and no tweets were rated as sad. I placed the highly rated items into happy and angry subsets for comparison by capitalization condition.

The results of the experiment are summarized in Table 1 and presented graphically in Figure 2. The estimated means out of 100 for the happiness rating of the original condition was $\mu=75.06$ and the standardized condition was $\mu=67.75$. A pair of by-participants (F1) and by-items (F2) repeated-measures ANOVAs revealed a significant effect of nonstandard capitalization on the happiness ratings ($F1(1, 22) = 7.69$, $p < 0.05$; $F2(1, 9) = 6.49$, $p < 0.05$). The difference between the estimates for original ($\mu=69.27$) and standardized ($\mu=68.77$) angry tweets was not significant.

Table 1: Mean happiness ratings with standard error in parentheses

	Original	Standardized
Happy	75.06 (2.32)	67.75 (2.56)
Angry	69.27 (3.41)	68.77 (3.87)

Figure 2: Mean happiness ratings by capitalization pattern
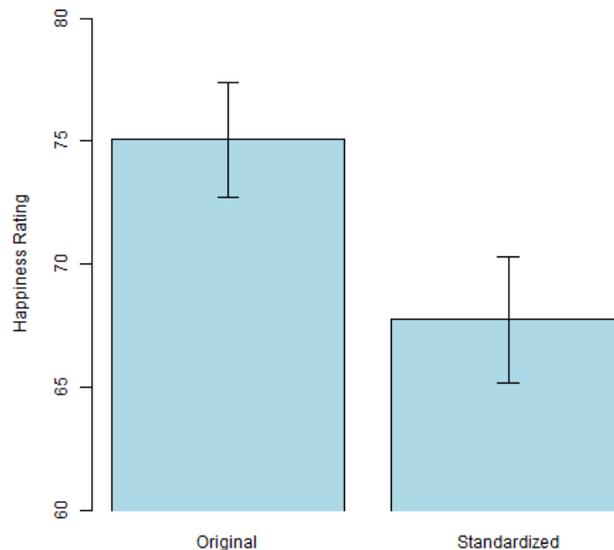
5 Interpretation and discussion

5.1 Orthography and prosody

The results show that the realization of a tweet's orthography as caps lock or standardized influences the reader's interpretation of the degree of happiness present. For tweets with happy content, those with the caps lock pattern are rated as happier than those without. This difference supports the hypothesis that capitalization plays a pragmatic role in text interpretation. Additionally, the high proportion of happy ratings for tweets with caps lock contradicts the stereotyped assumption that capitalization correlates to anger. But the lack of a significant difference in the ratings of the angry tweets also suggests that capitalization does not *always* indicate emotive strengthening in a text. To explain the results for all three emotions with one coherent theory, I propose that we adopt the theory that capitalization is a tool for indicating prosody in writing.

The idea that orthographic tools such as punctuation, spelling, and capitalization have been used to compensate for a lack of prosody, intonation, and paralinguistic cues in writing can be seen in early work on discourse patterns in online communities. Werry (1996) observes chatroom-users writing in all-caps and proposes that it is being used for emphasis. Nearly two decades later, Baym (2015) makes similar claims, pointing out that a variety of orthographic tools can be used to set certain words or phrases apart from other text visually, thus indicating that they should be emphasized. This analysis can be supported with Twitter data, as in example (12) below.

(12)   Is there REALLY a secret Starbucks menu, or are people just as demanding and annoying as I think they are? @user?

In this case, the capitalization of a single word seems to indicate linguistic focus on that word. In fact, this colloquial use of capitalization exactly mirrors the use of capitalization in linguistic texts on intonation to indicate stress and focus (Cruttenden 1997).

To understand why capitalization can be used for both prosodic emphasis and emotive strengthening, first we must understand what the two patterns have in common. Emphasis, or stress, can be indicated prosodically in English with either increases in pitch, length, or volume, with pitch being the most prominently used in English (Cruttenden 1997). Therefore, a word that is intended to be stressed should have at least one of these three features.

Since heightened emotional states lead to physiological changes which effect prosody, strong emotion is often indicated by increases in pitch, volume, or speed of speech (Piotrovskaya 2003; Cruttenden 1997). Though largely

unconscious, these changes are widely recognized and understood, and can be manipulated by speakers to affect a false emotional state, as in acting or sarcasm. Therefore, these prosodic features give the listener information beyond the literal content of the utterance about the emotion being expressed and its degree.

Note the overlap between prosodic emphasis and the prosodic realization of heightened emotional states: increased pitch and volume are prominently used in both cases. If both emphasis and heightened emotion are also frequently indicated using capitalization, is it possible that capitalization correlates to a change in pitch or volume? In such a case, readers would have to determine which linguistic role the prosodic features are playing in each utterance based on contextual clues, such as how much of it is capitalized. I will here turn to Relevance Theory and studies on the linguistic nature of orthography to suggest that this is exactly the case.

Recall that Sperber and Wilson (2004) state, "our memory retrieval mechanisms tend automatically to activate potentially relevant assumptions" when analyzing potentially relevant cues. In the case of phrasal capitalization, it follows that, in the search for relevance triggered by the deviation from orthographic norms, readers look for a phrase-level meaning that capitalization may be intended to convey. As prosody is currently not well represented in standard orthography, deviations such as the caps lock pattern may be all it takes to trigger a reader's prosodic competence and, drawing from other contextual clues, fill in the most appropriate prosodic realization of the utterance.

A more intuitive example may here serve to strengthen the claim that orthography can serve as an analog to prosody. Consider example (13):

(13)   Im soooooo hungryyy

What does the writer intend to convey by reduplicating the final letters of the second two words? Intuitively, the words with reduplication, if pronounced out loud, would be prosodically lengthened (Lamontagne & McCulloch 2017). Here there is a more obvious relationship between the orthography and the prosodic realization, due to the analogy between visual and aural length.

Capitalization may not inherently have a pitch or volume function that can be drawn upon for prosodic play, but recent work has shown that it does not need to. Studies have shown that some spellings have undergone self-standardization over time, similar to the way spoken dialects may standardize over time and across large groups of speakers with dialectal variation (Berg & Aronoff 2017). If spelling conventions can standardize through natural use, it stands to reason that pragmatic (or prosodic) usages of orthography could do the same.

In fact, lengthening, as mentioned above, has been attested to be one such case. Lamontagne and McCulloch (2017) show that lengthening patterns in writing don't always phonetically match up with the way they would be lengthened orally. In the

previous example, we saw the vowels getting lengthened, as expected, but in the example (14), the reduplicated letter is not only not a vowel, but is an unpronounced letter.

(14)   RT @user: "You're the bombbbbbb" haha

The writer chose not to reduplicate the vowel because they are following a standard rule for textual lengthening which does not match its prosodic counterpart. As seen in both (13) and (14), the most popular choice of letter to reduplicate is the final letter of the word, a standard which has emerged and solidified through online usage, and is now widely employed (Lamontagne & McCulloch 2017).

It's worth noting that, although even arbitrary choices may standardize over time, certain facts about prosody do limit what kinds of orthographic realizations can best represent prosodic features. Prosody is a suprasegmental phonological feature, which means it extends across multiple sounds, and often multiple words (Cruttenden 1997). As such, it also requires suprasegmental transcription when it needs to be indicated. In intonation literature, there are several ways of indicating prosody, but many of them require markings not easily accessible on a traditional keyboard. Capitalization, as a universally-accessible feature that can be extended across any portion of a text, is thus a prime candidate for use as a suprasegmental marker of prosody.

5.2   Interpretations of results with prosodic framework

In terms of pragmatic function, if the caps lock pattern does correlate to increased pitch and volume, we can make certain predictions about how it might be used. For example, we would predict that it would only be used to indicate emotions that, when indicated prosodically, are expressed with an increase in pitch or volume. As noted earlier, acoustical research on the prosody of emotions reports that happiness is generally expressed with high pitch, so we should expect to see it correlate with orthography indicating raised pitch (Burkhardt & Sendlmeier 2000). In the survey results we do in fact see higher happiness judgments with the caps lock pattern.

Sadness, on the other hand, which is typically expressed with lower pitch, shouldn't regularly correspond with the caps lock pattern (Burkhardt & Sendlmeier, 2000). And in fact, though several the tweets in my survey were rated higher for sadness than for happiness or anger, none of them were rated high enough to pass the cutoff for being a strong example of a sad tweet. The average rating for the original versions of the 10 tweets with the highest sadness ratings was only 29.4, while for happiness that average was 75.1. These results are expected if the prosodic features conveyed by capitalization conflict with the prosodic features of stronger sadness.

The survey results for the angry tweets can also be explained by this framework. Recall, there was no significant difference in ratings between the original and standardized versions of the 4 angry tweets. This may seem puzzling if we assume that capitalization simply heightens any emotion, but consider examples (15) and (16) below:

(15)   @user fiGHT ME

(16)   @user fight me

These two examples were both rated highly for anger in the survey[7], and a finer distinction in the term "anger" may explain why. Example (15) may be interpreted as indicating "hot anger," which is expressed with a high pitch, or yelling. Example (16) can also be read as angry if we interpret it as "cold anger" which is generally expressed with a lower pitch (Burkhardt & Sendlmeier 2000). Since these two flavors of anger are realized with different prosody, and if capitalization is analogous to prosody, then we expect different capitalization patterns for the two versions of anger. This explains why we don't see a difference in ratings for angry tweets, since the test does not account for the difference between lack of anger and cold anger, neither of which are expressed with raised pitch or volume. Testing this distinction is a task more suited to a production test, in which we could observe readers' oral interpretations of text in more detail.

5.3   Prosodic orthography across platforms

It is clear even without having run production tests, though, that social media users understand that the manipulation of orthography can be an indicator of prosody. Take for example Figure 3 below. This is a post from Tumblr, a multi-media blogging website which allows for longer posts and a wider variety of text formatting options than Twitter. In the undeniably limited medium of written text, writers take advantage of every available optionality for nuanced expression. As Baym (2015) mentions, formatting options which set some text off from the surrounding text (or even just from the expected formatting) may be used for emphasis. Bolding and italicization, as suprasegmental formatting options, may thus also be indicators of prosody.

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[7] The average anger ratings for (15) and (16) respectively were 66.91 and 65.00 out of 100.

Figure 3: Stylization on Tumblr
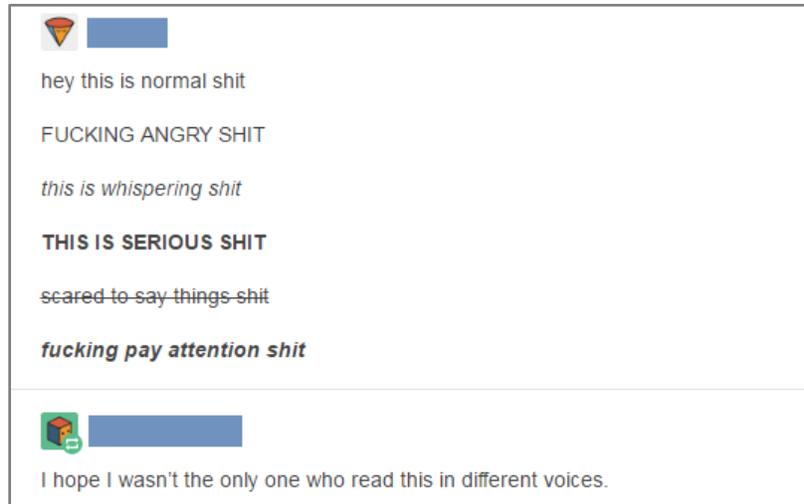
As Figure 3 shows, writers are aware, if only to a very general degree, of how they are using orthography pragmatically. The writer of the original post clearly states that they intend the differently formatted sentences to be interpreted differently. And perhaps most tellingly, the second commenter indicates that they accessed these different interpretations through the medium of prosody, even if only in their heads. This post and its comment have been shared over 300 thousand times on Tumblr, demonstrating that the content is highly relatable, and supporting the theory that orthography and prosody are closely related on social media.

5.4   Additional factors

Despite the tendency for usage to standardize over time, there are a few factors, both technological and social, which may affect the interpretation of orthographic patterns, and thus merit further study. First, as seen in the example from Tumblr, different social media platforms make different subsets of orthographic variation available to users, and so differences in usage may arise due to different social media use patterns. For example, the availability of a wider range of formatting options may lead to a more nuanced division of pragmatic labor on some platforms. Given a larger number of respondents and a more diverse sampling of test items, we may expect to see a difference in judgments by reader based on which social media platform they use most often.

Another factor that might play a role in reader interpretation of text is demographics. As Crystal (2011) points out, there are attested differences in language usage online between users of different age groups, men versus women,

users of different educational backgrounds, and so forth. I propose adding preferred social media platform as a demographic feature that may influence linguistic trends. In addition to differences in formatting options, social groups of internet users with similar interests tend to congregate on certain platforms, so there may be sociological "sub dialects" found in users of different social media platforms.

Finally, this project has so far only examined a small portion of pragmatic orthography. The function of capitalization also cannot be completely described without also looking at how it interacts with other orthographic patterns. For example, the pattern of including multiple exclamation points, which has been analyzed similarly to capitalization in previous studies, often co-occurs with the caps lock pattern, as in example (19).

(17)   I CAN NOT WAIT FOR TOMORROW!!!!!!!!!!!!!!!

To fully describe the function of caps lock in tweets, exclamation points will need to be independently studied.

Additionally, there are several other non-standard punctuation patterns which are interesting both in their own right and as they relate to other patterns. For example, the use of multiple question marks, ellipsis, and consecutive word punctuation may all potentially have pragmatic uses derived from prosodic analogies. Ultimately, if each of these patterns can be described individually, then a more complete picture of how people use non-standard orthography on social media for pragmatic purposes may be illuminated.

6   Conclusion

In this study, we observed that internet users often meaningfully deviate from the orthographic norms of English. Specifically, we examined the caps lock pattern on Twitter, hypothesizing that it might correlate to heightened emotional content in a tweet. This hypothesis held up in the experiment for happiness, but not for anger, which leads us to suspect that a subtler distinction may be at play. Adopting the theory that certain capitalization patterns intend to convey prosody allows us to explain the data for all three emotions by forcing us to consider the prosodic realizations of different emotions and how they might be represented orthographically. Ultimately, such an explanation is shown to be a powerful predictive tool for pragmatic orthography both on Twitter and beyond. Ultimately, there is much work yet to be done in terms of pragmatic orthography in social media, but this study has taken the first steps toward systematically determining what interpretations orthography may contribute to a text.

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