"I'VE ALWAYS SPOKE LIKE THIS, YOU SEE": PRETERITE-TO-PARTICIPLE LEVELING IN AMERICAN AND BRITISH ENGLISHES

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ABSTRACT: Some English verbs use distinct forms for the preterite (i.e., simple past; e.g., *I broke the door*) and the past participle (e.g., *I've broken the door*). These verbs may variably show use of the preterite form in place of the participle (e.g., *I've broke the door*), which the authors call PARTICIPLE LEVELING. This article contributes the first detailed variationist study of participle leveling by investigating the phenomenon in perfect constructions using data collected from three corpora of conversational speech: two of American English and one of British English. A striking degree of similarity is found between the three corpora in both the linguistic and the extralinguistic constraints on variation. Constraints on participle leveling include tense of the perfect construction, verb frequency, and phonological similarity between preterite and participle forms. The variable is stable in real time and socially stratified. The article relates the findings to theoretical linguistic treatments of the variation and to questions of its origin and spread in Englishes transatlantically.

KEYWORDS: morphological variation, analogical leveling, American English, British English

THE ENGLISH VERBAL PARADIGM is subject to quite a bit of variation, from the well-described (ING) variable in the progressive (e.g., Labov 1966, 2006; Trudgill 1974; Forrest 2017), to clear regional patterns in the present tense like the Northern Subject Rule (McCafferty 2003; José 2007), to a range of variability in the preterite and past participle. Investigation of the latter kinds of variation has often focused on the presence of noncanonical forms in regional varieties (Anderwald 2009) or the use of the past participle form

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for the preterite, as in Tagliamonte's (2001) study of past-reference *come*. In this article, we turn our focus to variation in the form of the past participle.

For some speakers, variation in the past participle can be found for the set of English verbs with typically distinct preterite (i.e., simple past) and past participle forms. In this variation (as in example 1), the canonical preterite (e.g., *broke*) appears in contexts in which the canonical past participle (e.g., *broken*) would surface. Such contexts include both perfect and passive constructions.

1. Realizations of English Past Tense
   a. I BROKE the door — preterite (simple past)
   b. I've BROKEN the door — past participle
   c. I've BROKE the door — leveled form

Leveling in the participle is rather understudied for two reasons. The more minor of these is that the variable has taken on multiple names over the years, in addition to being viewed by some as being restricted to specific verbs (e.g., Cheshire 1982). The leveling has alternatively been called PRETERITE SHIFT (Lass 2008) and PAST-TENSE SPREADING (Kemp et al. 2016). Multiple names for a sociolinguistic variable can make it difficult for researchers to review the literature, which may play a role in this one being understudied.

Recognizing this, we will nevertheless contribute to this cacophony by proposing another name for the variable. Throughout this article, we will refer to the realization in example 1c as PARTICIPLE LEVELING. We believe this is a more theory-neutral stance, as labels describing the variable as a spread of the preterite seem to posit a particular view of the morphosyntactic status of the participle. Describing the variable as participle leveling places our emphasis on the context—the past participle—while at the same time recognizing that the variation appears to resemble paradigm leveling, in which a single morphological form (in this case, the preterite) plays two morphosyntactic roles. Although a full discussion of this is beyond the scope of this article, we also believe this view of the variable more accurately reflects the best formal approaches to the variation (see Duncan 2021).

The second, and more major, reason why participle leveling is understudied is that it is not common. Contexts involving a past participle are uncommon enough, but the variable context includes only the subset of verbs with canonically distinct preterites and past participles (see the appendix for the list of verbs). As such, the actual variable context is not a common occurrence. For this reason, previous accounts of this phenomenon have often been less rigorously quantitative (Cheshire 1982; Bloomer 1998) or have concerned prescriptive attitudes toward the variable (Tieken-Boon van Ostade and Kostadinova 2015). Recent work has made use of corpora, like the British National Corpus (Geeraert 2010), or online speech (Kemp

et al. 2016) to obtain larger datasets. However, resources such as these cannot shed light on the linguistic and social factors that contribute to the discussion the same way that a primarily informal, spoken dataset can. The present article fills this gap, contributing the first detailed, large-scale study of participle leveling from a variationist perspective by making use of three corpora of vernacular speech data from the United States and England: the Philadelphia Neighborhood Corpus (Labov and Rosenfelder 2011), the Diachronic Electronic Corpus of Tyneside English (Corrigan et al. 2012), and Switchboard (Godfrey and Holliman 1997). Even with such a dataset, the infrequent nature of the variable leads us to focus on perfect constructions to the exclusion of other participle contexts, such as passives.

Our analysis confirms past observations that participle leveling is more frequent when the auxiliary of the perfect construction is nontensed *have* or past-tense *had*. At the same time, we shed light on novel language-internal factors that constrain variability: for example, the morphophonological similarity between the participle and preterite conditions variation. Our crucial finding with respect to such factors is that the three corpora we examine largely share language-internal constraints on variation. In addition, we shed particular light on social constraints: participle leveling is a socially stratified, stable sociolinguistic variable. The stability on both sides of the Atlantic and the shared linguistic constraints raise the possibility of an early shared origin. We discuss the possibility that variability observed in Middle and Early Modern English has simply continued through to the present.

The rest of this article is organized as follows. First, we discuss the history of, and previous research into, the preterite form in participle contexts. This section additionally discusses existing morphosyntactic analyses and outlines the research questions we address in our own study. We then present our methodology, detailing our data sources, the protocol for coding social and linguistic factors, and the procedure for statistical modeling. The results of these models are presented next, first as a broad picture of the results and then for each potential factor in individual detail. Discussion of the implications for our results is presented next, followed by the conclusion.

BACKGROUND

Despite how often it has been commented on prescriptively throughout the last few centuries (Tieken-Boon van Ostade and Kostadinova 2015), participle leveling is rather understudied. In this section, we define the variable and review prior work that has discussed it in some form. Drawing on this background, we outline the still outstanding research questions that we seek to address.

THE VARIABLE. The regular paradigm of the bare, past participle, and preterite verb forms in Present-Day English shows syncretism between the preterite and participle, achieved through addition of the *-ed* affix to the bare form (e.g., *walk-walked-walked*). In addition to this regular paradigm is a set of irregular verbs or irregular paradigms (see Anderwald 2009 for a detailed discussion) in which the preterite and participle of many frequently occurring verbs are derived via vowel changes (e.g., *swim-swum-swam*) and/or use of the participial *-en* affix (e.g., *break-broken-broke*). The paradigm for *go* stands out for being suppletive (*go-gone-went*). While some irregular paradigms display preterite/participle syncretism (e.g., *buy-bought-bought*), many others maintain distinct preterite and participle forms. The "irregular" and "regular" paradigms found in Present-Day English represent what remains of the Germanic strong/weak verb distinction. In this sense, "irregular" English verbs are typically descendants of strong verbs, which declined via ablaut. "Regular" English verbs follow the pattern of weak verbs, which originally declined through a grammaticalized conjugation of *do* (see Hill 2010 for discussion), although this has since reduced to a single form with full syncretism for person/number.

The vast majority of Present-Day English forms follow the regular paradigm as a result of language change continuing through to the present. This change is a cross-Germanic phenomenon in which novel verbs are coined in the weak paradigm and strong verbs shift to the weak paradigm. In general, this shift of strong verbs into the weak paradigm is frequency driven: less frequent strong verbs over time are more likely to have become weak verbs in English (Lieberman et al. 2007), German (Carroll, Svare, and Salmons 2012), and Dutch (De Smet and Van de Velde 2019). However, cross-linguistic changes in the strong verbs also involve leveling within the paradigm itself. This is particularly common in the West Germanic languages, which tend to level ablaut patterns to achieve preterite/participle syncretism (Dammel, Nowak, and Schmuck 2010).

The English verbal paradigm has therefore seen considerable change over time, which, in keeping with variationist principles, entails quite a bit of variation (Weinreich, Labov and Herzog 1968). Note that both regularization of strong verbs (e.g., the adoption of *climb-climbed-climbed*; Lieberman et al. 2007) and ablaut leveling (e.g., the adoption of *spin-spun-spun*; Dammel, Nowak, and Schmuck 2010) involve the adoption of preterite/participle syncretism where there once was a distinction. We would expect, then, to find variation in verb form such that speakers have variably syncretic systems. Because regularization and ablaut leveling continue to occur to the present, we expect such variation to be found among present-day speakers in the irregular paradigms that (currently) maintain a preterite/participle distinction. As a general point, we do find such variation. Many previous

observations have focused on preterite verbs taking the form of the participle or weakening (Bybee 1985; Anderwald 2009). Variationist studies of specific lexical items, such as Tagliamonte's (2001) study of preterite *come* in York, England, have shown that variable use of the participle form in the preterite follows language-internal and -external constraints.

In addition to variable use of the participle for the preterite, we also find variable use of the preterite form in the participle. From a historical perspective, there are two aspects of ablaut leveling in the English verbal system that suggest we should take particular interest in this latter variable. First, English is messier than its West Germanic neighbors. Whereas Dutch and German predominantly achieve syncretism among strong verbs by adopting the participle form for the preterite, English has historically done this as well as adopt the preterite form in the participle (Dammel, Nowak, and Schmuck 2010). This means that historical changes in the English strong verb system have involved variability in the form of the participle. Second, English, like Swedish but unlike Dutch and German, maintains a robust aspectual distinction between the preterite and the perfect.[1] The distinction does not mean they occur equally often; in English, the preterite context occurs more often than the perfect (Dammel, Nowak, and Schmuck 2010). Setting aside potential variation or lexically specific differences in the frequency of one context or the other occurring, this fact means that preterite forms of irregular verbs are used more than participle forms. There are thus countervailing pressures on the remaining strong verbs: the trend toward ablaut leveling and overall greater frequency of the preterite constitutes pressure to level the preterite and participle by adopting the preterite form in the participle, while the strongly maintained aspectual distinction between preterite and perfect constitutes pressure to maintain a distinction between the preterite and participle forms. These countervailing pressures suggest that the form of the participle is ripe for variation.

In fact, variation in the form of the participle has been attested since the late Middle English period and appears to be robustly attested since the early Modern English period (Lass 2008). Examples abound in writing, and seventeenth and eighteenth century grammarians note that several verbs have competing variants for the participle, in which the present-day preterite and participle are at least two options (for discussion and examples, see Greblick 2000; Tieken-Boon van Ostade and Kostadinova 2015). Although these grammarians worked to standardize the English verbal paradigm (Tieken-Boon van Ostade and Kostadinova 2015), variability has been attested in several varieties of English in the United States (Bloomer 1998; Kemp et al. 2016; Wolfram 2003), the United Kingdom (Cheshire 1982; Smith 2004), and Australia (Eisikovits 1987).

Given these attestations, we suggest that the form of the participle in irregular paradigms is indeed a linguistic variable. There are two variants under consideration: the preterite form and the participle form. This means, therefore, that the envelope of variation under consideration includes only those verbs that do not already display preterite/participle syncretism (i.e., we are concerned with a subset of a subset of verbs: the nonsyncretic irregulars). This also means that for verbs in this subset, we treat local variants of the participle (e.g., *getten* for *gotten* in the North East of England; Beal 2004) as instances of the participle variant rather than a different variable.

PREVIOUS RESEARCH INTO THE VARIABLE. Although (variable) use of the preterite in the participle is reasonably well attested across modern varieties of English, there is a tendency for some researchers to remark upon the variable in passing rather than investigate it in depth. For example, the variable earns about a paragraph or two in Cheshire's (1982) monograph on grammatical variation in Reading, England. Somewhat similarly, Wolfram (2003) mentions it as a variable found in enclave dialects of the Southern United States but goes no further in discussion. Perhaps because it has been more remarked on than studied, the variable has drawn further attention in relatively recent years from a variety of linguistic perspectives. In addition to an early variationist study (Eisikovits 1987), researchers have examined the variable from corpus linguistic (Geeraert 2010; Geeraert and Newman 2011), morphosyntactic (Greblick 2000; Munn 2015; Tortora et al. 2015), psycholinguistic (Geeraert 2012), and language-ideological (Tieken-Boon van Ostade and Kostadinova 2015) perspectives.

That there are relatively few variationist studies of participle leveling is perhaps surprising, but likely due to low token counts. Cheshire's (1982) work, for example, seems to suggest that the variable would have been explored further had there been sufficient data. The one clear variationist study by Eisikovits (1987) has relatively few tokens when compared to studies of other variables from that period. Kemp et al. (2016) only examine use of *gone/went* as opposed to further variability in the participle. While this is in part due to the project being used as a teaching example and therefore somewhat constrained in focus, another contributing aspect to the limitation may well have been that other, less frequent verbs may have not occurred enough to be worth sampling in a classroom exercise. The study with the largest number of tokens has taken a corpus linguistics approach (Geeraert 2010; Geeraert and Newman 2011). In this study, the authors use the British National Corpus (BNC Consortium 2001) and Corpus of Contemporary American English (COCA; Davies 2008–) to obtain large numbers of perfects with which to examine participle variation. Geeraert (2010) also uses Google NGrams to obtain tokens for a more variationist-style analysis. These

corpora, while useful, are not quite vernacular data in the sense that Cheshire (1982) and Eisikovits (1987) sought. All the same, although variationist sociolinguistic studies of the variable are limited in scope by token count, it is worth considering what they do reveal.

Findings Regarding Internal Factors. The most robust finding by far has been that the presence of a modal verb in the utterance favors selection of the preterite form, as in the following:

2. I should have (GONE/WENT) to the store yesterday.

This constraint has been found in local vernacular speech (Eisikovits 1987), large-scale corpora (Geeraert 2010; Geeraert and Newman 2011), and internet language on Twitter (Kemp et al. 2016). Bloomer's (1998) work also suggests a modal effect; while the data presented does not take the full envelope of variation into account, the overwhelming majority of preterite-form participle tokens collected in the study have a modal in them. The modal effect appears to be strong enough that introspective research methods can also reveal it, as morphosyntacticians have noted that the preterite-form participle is more acceptable to them and other informants when a modal is in a constructed test sentence (Greblick 2000; Munn 2015).

Whether language-internal factors other than the presence/absence of a modal constrain variation in the participle is less clear. We summarize findings regarding this question below. Eisikovits (1987) shows that use of the preterite form is strongly favored in the perfect (as in 3) over the passive (as in 4).

3. I had (GONE/WENT) to the store yesterday.
4. The window was (BROKEN/BROKE) by the vandals.

Within the perfect, both Eisikovits (1987) and Kemp et al. (2016) find that past tense (as in 3) favors the preterite over present tense (as in 5).

5. I have (GONE/WENT) to the store already this week.

It is important to note that "favoring" and "disfavoring" here is relative; the past perfect is still disfavored overall when considered alongside the modal perfect tokens. Most other studies (and indeed, this present one) only analyze data collected from perfect constructions, which limits the replicability of the finding that leveling is dispreferred in the passive. At the same time, that so few studies have considered the possibility of variability when participles occur in the passive is likely anecdotal evidence that the perfect does display more variability than the passive. Another potential language-internal factor that has been suggested to constrain leveling is negation; Geeraert

(2010) finds limited evidence that negation disfavors the preterite variant, but whether or not the effect emerges from the data depends in part upon the inferential statistics used in the analysis. Greblick (2000) suggests that the preterite-form participle is ungrammatical when there is intervening material, particularly a full adverb, between HAVE and the participle:

6. ?Mary had hurriedly RAN out of the house.

Kemp et al. (2016) find an effect of subject person/number: first-person subjects, regardless of number, favor the preterite form, while third-person plural favors the participle form. Finally, Geeraert (2010) finds that verb frequency conditions variation, such that infrequent verbs are more likely to see the preterite-form participle than frequent verbs.

Findings Regarding External Factors. As with the nonmodal language-internal factors, there is limited evidence of language-external factors constraining variation. Wolfram (2003), for example, suggests that the variable fits into the classic pattern of social stratification whereby lower social classes are more likely to use the preterite-form participle. This is possible; Miller's (1987) examination of *bite*, *ride*, and *shrink* in Georgia indicates that there are class- and race-based distinctions in usage of the preterite or participle form, especially for *bit/bitten*. Tieken-Boon van Ostade and Kostadinova (2015) note that prescriptivist attitudes against the preterite-form participle from the eighteenth century are still present in the modern day, with American Englishes in particular seeing nonstandard participle production as a usage problem. As part of their study, they solicited qualitative evidence from American English speakers, some of whom claimed that there is a stylistic difference between use of *gone/went* for the participle.

This stylistic difference may be register variation. Geeraert (2010) and Geeraert and Newman (2011) show that the preterite-form participle is favored in the spoken sections of the BNC and COCA compared to written sections, with COCA additionally favoring the preterite-form participle in fiction writing compared to nonfiction writing. These findings are consistent with a variable displaying social stratification, although Geeraert (2010) notes that there is not sufficient demographic data to know whether this is indeed true of the BNC and COCA. There is less evidence of other language-external factors conditioning leveling. Some authors suggest an age effect without evidence, although Smith (2004) is the only researcher to clearly find one. In a study of Buckie Scots, she finds that younger speakers use the preterite-form participle more than older speakers. This potential change in progress, however, seems to be linked to a larger reorganization of the past-tense/aspect system in Buckie Scots. As such, it is not clear whether we should expect a similar age effect in varieties with more stable past-tense/aspect systems.

PREVIOUS MORPHOSYNTACTIC ANALYSES OF THE VARIABLE. Morphosyntacticians have extrapolated some strong claims about the variable based in part on the results outlined above, specifically the modal effect. In conjunction with the modal effect, these analysts note rampant phonetic reduction when a modal is present. The phonetic reduction in question involves *have* reducing to [əv] or [ə] when following a modal. This reduction is often operationalized in orthography (as in 7 and 8).

7. Anyone wish we WOULDA GONE hard after Chris Petersen? [Maine Duck, *Duck Territory* (University of Oregon Ducks forum), Dec. 5, 2017, https://247sports.com/college/oregon/Board/45/Contents/Anyone-wish-we-woulda-gone-hard-after-Chris-Petersen-111799756/]
8. This act of fascism against the press MIGHT OF SAVED her life. [SolutionsCost, comment on Esther Wang, "A NYT Reporter Got Kicked Out of a Trump Rally After Simply Reporting on the Maskless Crowd," *Jezebel*, Sept. 11, 2020, https://theslot.jezebel.com/a-nyt-reporter-got-kicked-out-of-a-trump-rally-after-si-1845025005]

Based on this, Kayne (1997) proposed that *have* in these contexts has been reanalyzed into a complementizer *of*. It is unclear why exactly this may yield the preterite form when following this complementizer, but a more basic reading of this claim is that modal + *have* perfects have a different syntactic structure than *have* perfects. Other approaches have similarly proposed reanalysis and grammaticalization of modal + *have* such that perfects in this context differ syntactically from other perfects. Boyland (1998) proposes that *would* (and presumably other modals) has merged with *have* into a single auxiliary verb. Greblick (2000) suggests that reduced *have* combined with the modals into an adverb: *coulda*, *woulda*, *shoulda*. Bloomer (1998) suggests something along these lines as well. An advantage of this particular proposal of reanalysis and grammaticalization is that if the modal verb has become a modal adverb, the verb to be tensed in modal perfect constructions would be the main verb. The Kayne and Boyland proposals, unlike the Greblick one, do not clearly explain why the preterite would sometimes surface. On the other hand, the modal adverb proposal seems to suggest a categorical distribution: the preterite always occurs in modal perfect constructions, while the participle always occurs in nonmodal perfect constructions. Along this view, there is no variation in the form of the participle; it is a true preterite surfacing in the modal perfect. This proposal could be adapted to permit variation through grammar competition (Kroch 1994) by which modal + *have* is variably produced as a modal adverb or set of auxiliaries, in which case the main verb would vary between appearing as a preterite or participle. However, were Greblick's proposal to admit such a competition between grammars, it would still rule out the preterite form from appearing in perfect constructions in which no modal is present.

Although he relies less on the phonetic reduction of *have*, Munn (2015) similarly extrapolates a morphosyntactic analysis from the modal effect. He follows Bobaljik (2012; see also Adamson 2019 for further discussion) in noting that when arranging the verbal paradigm as bare-participle-preterite, English verbs seem to exclude ABA patterns (e.g., **give-gave-give*). In Bobaljik's account of patterns like this, the syntactic structure of the preterite would contain the structure of the participle. Munn adopts this view within a Distributed Morphology (Halle and Marantz 1994) approach to suggest that the modal effect is contextual allomorphy. In this view, an impoverishment rule conditioned by the presence of a modal could spell the participle out as a preterite form. He does make room for variability in his analysis, as he allows for the impoverishment rule to be variable (Nevins and Parrott 2010). However, the reliance on contextual allomorphy still predicts that in nonmodal perfect contexts the participle form will categorically surface.

The above extrapolations assume that English maintains the past/perfect aspectual distinction. It should be noted that some authors suggest that this distinction is disappearing. Sampson (2002) draws mainly on evidence from the use of bare *got* in British English varieties to argue that such varieties have collapsed the past and perfect into a single category. He notes that this would also explain why speakers are able to use the preterite form for the participle: they are essentially both forms for a single category. Tortora et al. (2015) make a similar claim regarding Appalachian English on the basis of the seeming interchangeability of forms like *drank/drunk* in both the preterite and participle contexts. However, this would seem to imply that variable use of the participle form in the preterite and variable use of the preterite form in the participle would work in the same way. This is not the case; Geeraert (2012) offers experimental evidence that clearly shows that variable forms in the preterite, but not variable forms in the participle, are lexically and phonotactically constrained.

OUTSTANDING RESEARCH QUESTIONS. Based on the above discussion, there appear to be language-internal and -external constraints on participle variation, but what exactly they are is unclear. As such, we aim to provide a variationist study large enough in scale to consider these issues. In particular, we aim to address the following points:

1. *What is the variable, actually?* Throughout the above discussion we have treated variation in the participle as though it is a system-level phenomenon. In other words, we have assumed that any verb that has distinct preterite/participle forms can vary in the form the participle takes between preterite and participle. We are in good company on this: Eisikovits (1987) and Geeraert (2010) take this approach in their quantitative work, as do

Greblick (2000) and Munn (2015). However, it should be noted that many researchers list specific verbs with preterite variants (Cheshire 1982; Beal 2004), which suggests that to them the variable is lexically constrained. Beal in particular does not seem to see this as a variable at all, as she claims that preterite usage in the lexically constrained set is categorical in the North of England. Other studies focus solely on *go* (Tieken-Boon van Ostade and Kostadinova 2015; Kemp et al. 2016) or a small set of verbs (Miller 1987), similarly suggesting the variable is lexically constrained.[2] This view is shared by Quirk et al. (1985), who describe English participles as mainly categorical in form with exceptions like *beat*. In this sense, a key question is whether the variable is morphosyntactic or lexical. In other words, what exactly is this variable under study?

2. *What conditions variation of the participle?* Given the robustness of the modal effect, we expect use of the preterite form to be favored when a modal is present relative to other contexts. The other proposed language-internal constraints have less evidence in favor of them, in part because of how the evidence was gathered. Introspective judgements may not be sensitive to fine-grained conditions favoring variation, for example. At the same time, some previous studies were simply not designed to consider all potential factors. Geeraert's (2010) corpus study, for example, was conducted by searching for HAVE + verb form, and therefore missed any examples with intervening material, such as *n't* or an adverb, between HAVE and the participle. As such, our study aims to shed light on whether these—negation and intervening material, as well as frequency and phonological form—do influence variation. Likewise, while it seems likely that variation is socially stratified, the roles of class and other language-external factors need to be explored in more detail. Previous datasets (Cheshire 1982; Eisikovits 1987) structured for sociolinguistic analysis have not had the token counts necessary to do so, while those with sufficient tokens (Geeraert 2010; Geeraert and Newman 2011) have by necessity not been structured to examine language-external constraints in detail. A key language-external factor to consider is age: does this variable represent a change in progress or not?

3. *Is the variable an Americanism?* Several sources suggest that the variable is an Americanism, as opposed to being a broader feature of English. Greblick (2000), for example, suggests that use of the preterite form in modal perfect constructions is a feature of Colloquial American English. To the extent that Quirk et al. (1985) acknowledge variation in the participle, they suggest that the preterite form (e.g., participle *beat*) is American. The key change highlighted in Boyland's (1998) argument for grammaticalization of modal + *have* into a single auxiliary is found in American English, which implies that

any variation in the participle as a result of this grammaticalization would be an Americanism. Of course, the variable is well documented globally. This does not, however, preclude it from having originated in the United States before spreading globally. This is a testable hypothesis; we would expect to see evidence of real- or apparent-time change in non-American data as the variable spread from the United States.

4. What else can a cross-Atlantic comparative approach tell us about this variable? As noted, the inclusion of non-American data will enable us to determine whether this variable is uniquely or originally American. Outside of the question of whether speaker age effects are suggestive of diffusion, attention to language-internal and -external factors will help to shed light on the history and grammar of the variable.

One specific contribution of our approach to the data is to evaluate previous morphosyntactic analyses of the variable. We take the view that linguistic variation can act as a window into morphological and morphosyntactic structure (see, e.g., MacKenzie 2013, 2020; Duncan 2019). In particular, we contend that a variationist study of the participle can help us to evaluate the proposals put forward by Greblick (2000) and Munn (2015). Namely, both of these proposals appear to suggest that the participle form should surface categorically in nonmodal perfect contexts. If we find consistent evidence of variation in these contexts, it would constitute evidence against these analyses because they would undergenerate the facts on the ground.

METHODS

The discussion of the methods is as follows: We first discuss the data sources and the process of extracting and selecting tokens, then describe the factors that each of these tokens was coded for. The next section discusses how we used these factors as predictors in our statistical models, and then we continue to results.

SOURCES OF DATA. Data were gathered from three corpora: two collections of American English and one of British English. The American English sources were Switchboard (Godfrey and Holliman 1997) and the Philadelphia Neighborhood Corpus (PNC; Labov and Rosenfelder 2011). Switchboard is comprised of 240 hours (3 million words) of telephone conversations between strangers that were recorded between 1991–1992. No two speakers were paired more than once, and the conversation topics (sports, travel, or political issues) were assigned by the researchers. Of the 542 unique speakers in the corpus, 55% were men, 60% were under age 40, and 89% were college-educated. Of the participants 29% were from the South Midland dialect

region, which is where the company that ran the project (Texas Instruments) is based. The PNC data come from 287 sociolinguistic interviews carried out by graduate students from the University of Pennsylvania beginning in 1973. The interviewed participants are adult speakers of Philadelphia English from a variety of educational, economic, and racial backgrounds. The 408 participants in PNC were 44% male, and 50% were under the age of 40. Though we do not have demographic data for all participants, they were majority Italian-American (61%) and at least 21% reported being non-white or having a mixed ethnic background. Of those who reported their education, 30% of PNC participants had some amount of schooling past high school.

The British English source was the Diachronic Electronic Corpus of Tyneside English (DECTE; Corrigan et al. 2012), a longitudinal compilation of three subcorpora of sociolinguistic interviews collected in the 1960s–1970s, mid-1990s, and late 2000s. Together, there are just under 72 hours of recorded interviews (804,266 words). The majority of the corpus consists of dyadic interviews, while the remainder is one-on-one interviews. Of the 160 people interviewed in the corpus, 46% were men, and 64% were aged 40 or below.

A comparison of the corpora can be found in table 1. Each corpus provides distinct advantages for our analysis. Switchboard is large and has potentially less-casual speech compared to the others, due to the nature of telephone conversations between strangers. The other two corpora (PNC and DECTE) are smaller but are constructed from vernacular sociolinguistic interviews. Using all three corpora allows us to (1) get a transatlantic perspective, (2) examine register within the conversational domain, and (3) potentially

TABLE 1
A Comparison of the Corpora Used

	Switchboard	*PNC*	*DECTE*
Dialect	mixed U.S., bias toward S. Midlands	Philadelphia (U.S.)	Tyneside (U.K.)
Demographics	mix of sex and age, bias toward college-educated	mix of education, socioeconomic status, and race	mix of age and gender bias toward working class
No. of speakers	542	408	160
No. of convos.	~2,430	287	99
No. of words	~3 million	~1.6 million	~800 thousand
Data type	one-on-one phone conversations between strangers on set topics	sociolinguistic interviews	dyadic sociolinguistic interviews
Date of collection	1991–92	1973–2012	1960s–1970s, 1990s, 2007–10

detect language-internal effects that are only apparent with higher statistical power. This being said, the fact that Switchboard differs from the other two corpora in both size and data type means we might expect the speech in Switchboard to pattern somewhat differently, and indeed we do find that.

From these three corpora, we analyzed tokens of 46 English verbs (see the appendix) with prescriptively unique preterite and participle forms in a perfect construction, that is, specifically those verbs subject to participle leveling. Tokens were extracted from corpus transcripts using a Python script designed to search for perfect constructions with any form of HAVE and any of the verbs from our list in either their participle or preterite form, with at most one word between the auxiliary verb and the past participle (to allow for intervening adverbs). Because of this strict maximum of one intervening word, the script picked up tokens with both negation and an adverb if the negation is part of a contraction (of the form *haven't actually* V-*ed*) but not cases where the negation and adverb are both transcribed independently (like *have not actually* V-*ed*), as this would count as two intervening words. Code for this query and the list of verbs are available in the appendix.

Because of the way our script searched for perfect constructions, it also captured some passives, causatives, and adjectives, along with spurious hits of preterite forms, infinitives, and some ambiguous constructions. Each extracted token was coded by two analysts according to these categories, with reference to the audio and/or to the wider discourse context (as transcribed) where necessary to resolve strings of ambiguous structure. Tokens were kept only if both analysts agreed that the construction was a perfect and thus relevant to the analysis.[3] This was done according to the protocol

TABLE 2
Codes for Broad Grammatical Structure

Type	*Code*	*Note/Example*
Perfect (keep)	k	Collocates of forms of HAVE, including contracted forms and forms found in larger constructions: *have/had/has/'ve/'d/'s/n't, would have/would've/woulda, could have/could've/coulda*, etc.
Passive	p	Collocates of forms of BE and forms of GET, as well as causatives (*had work done*)
Adjective	a	E.g., *No, because he might have a broken back* [y07i007a]
Irrelevant	i	E.g., *I just haven't got the nerve* [1180] (see note 3)
Ambiguous	x	Indeterminate structure, not resolvable by audio/context, e.g., *What's she beat you up for?* [PH85-3-11] could be: (1) 'What [has] she beat-PP you up for?' or (2) 'What [does] she beat-INF you up for?'

given in table 2. Note that in this table, and elsewhere throughout the article, examples are accompanied by speaker identifiers. Four-digit speaker IDs are from Switchboard, the speaker IDs starting with PH are from PNC, and other ID formats are from DECTE, with a different format for the various DECTE subcorpora.

This coding scheme allowed us to mark relevant tokens of perfect constructions as well as ones that might be relevant for future study (i.e., passives) while keeping these separate from tokens for which the structure cannot be determined definitively. Any tokens marked as ambiguous were checked by other coders to confirm that the structure could not be resolved and thus recategorized. After this step of determining grammatical structure, there were a total of 6,829 data points from the three corpora combined, which were then coded for a number of language-internal and social predictors, discussed in the following subsection.

Not all data points included complete social information about their speakers. If a relevant social factor was missing, the data point was omitted from the analysis. This was particularly common in the PNC, where a number of data points were from interviewers for whom demographic data was not collected, but Switchboard also has a handful of speakers whose education information was unknown. Following the exclusion of these data points, the dataset consisted of 6,404 tokens of perfect constructions from 44 verbs across the three corpora. A breakdown of token counts by corpus is provided in table 3.

DEPENDENT AND INDEPENDENT VARIABLES. Each token was coded for a number of language-internal factors chosen because of their possible influence on the leveling of participles based on previous work. Our decisions surrounding these variables and their categories are described below. We also included a number of social predictors in our models depending on the information available from the corpora. Each token was also coded with the corpus it came from (DECTE, Switchboard, or PNC), which allows us to examine the effects of the particular corpora on leveling overall, as well as to determine whether internal and external predictors apply consistently across the different corpora.

TABLE 3
Tokens for Analysis, by Corpus

Switchboard	4,411
PNC	911
DECTE	1,082
TOTAL	6,404

Dependent Variable. Each token was coded for whether it showed participle leveling (i.e., the preterite form was used for the participle) or not (i.e., the prescriptive form of the past participle was used). This served as the dependent variable in our statistical models.

Language-Internal Factors. Auxiliary Tense. Each token was coded for whether the auxiliary of the perfect construction was nontensed (as in 9a–9e), present tense *has* (9f), present tense *have* (9g), or past tense (9h). We kept the two present tense forms of the auxiliary separate to see if there is any effect on leveling of the form of the auxiliary itself. Perfects with present-tense auxiliaries are most prevalent in the data.

Note from the examples that nontensed auxiliaries may either be preceded by a modal (which is most common, as in 9a–9d) or not (9e). In examples 9a–9h, the perfect is in small capitals and the auxiliary is italicized for reference.

9. Auxiliary tense
   a. I should'*ve* BIT my tongue. [PH91-2-15]
   b. Then I would*a* just BROKE it up. [PH94-2-4]
   c. I might not *HAVE* COME back alive. [PH12-1-10]
   d. They may *HAVE* DONE it. [1092]
   e. They used to *HAVE* COME on the school bus. [1pvc03b]
   f. It'*s* BECOME a big event. [PH06-2-3]
   g. Him and I *HAVE* BECOME great friends. [PH82-1-10]
   h. Somebody *HAD* BROKE a window. [PH02-2-9]

Negation. Each token was coded for whether the perfect construction was negated or not. Negation was defined as sentential negation of the perfect construction with *never*, *not*, or its contracted form *-n't*. This negation could appear either before the auxiliary (as in 10a–10c) or between the auxiliary and past participle (as in 10d and 10e).

10. Negation of the perfect construction
    a. I *never* HAVE SEEN any of those. [1413]
    b. I might *not* HAVE CAME back alive. [PH12-1-10]
    c. They should*n't* HAVE DONE it. [PH92-1-4]
    d. I'VE *never* BROKEN anything before. [PH00-1-3]
    e. I HAVE*n't* COME to that point yet. [PH82-1-9]

For the tokens with negation, we added an additional code capturing whether the negation appeared between the auxiliary and past participle (intervening negation present, as in 10d and 10e) or not (intervening negation absent).

Questions. Each token was coded for whether or not a question was present in the clause containing the perfect. Some examples of questions are

presented in 11; note that these include instances where there is subject-auxiliary inversion and also instances where there is not. Cases that include subject-auxiliary inversion but no question (e.g., *That would be gone had I written a check*) were coded as absence of a question.

11. Questions
    a. What HAD you DONE? [PH85-3-12]
    b. HAS he DONE this to you? [PH81-0-5]
    c. WHO HAD STOLEN it? [PH06-2-1]
    d. Where would you like to HAVE GONE? [PH82-1-7]
    e. What would you HAVE DONE differently? [1244]
    f. So that was after you'D COME out the Wrens? [2y07i011a]
    g. It's on bleach, you HAVEN'T SEEN it? [2y07i007b]

Intervening Material. This predictor codes for whether any linguistic material besides contracted *-n't* and *not* intervenes between the auxiliary and the past participle. These interveners were most typically adverbs, but could also be quantifiers or discourse markers. Some examples of tokens with interveners are shown in 12, with the intervener italicized and the perfect construction in small capitals. Because this is intended primarily as a code to capture intervening adverbs, we include *never* as an intervener (as in 12d), but note that in cases like that in example 12c, the contracted *-n't*, along with cases of *not*, are not counted as interveners as they are not adverbs. Along these lines, disfluencies such as *uh* and *um* are also not considered interveners, nor are the auxiliary-inverted subjects of the type presented in 10 above.

12. Intervening material
    a. He's *always* DONE a lot for us. [PH82-1-12]
    b. I wouldA *just* BROKE it up. [PH94-2-4]
    c. She didn't—HADN'T *really* COME out to my father. [PH97-3-5]
    d. I'VE *never* BROKEN anything before. [PH00-1-3]
    e. They'VE *all* GOTTEN married. [PH10-1-4]

Person, Number. All tokens were coded for person (first, second, third) and number (singular, plural) of the subject of the perfect construction, as two separate predictors.

Verb Frequency. Verb frequency measures come from SUBTLEX (for the U.S. data; Brysbaert and New 2009) and SUBTLEXuk (for the DECTE data; van Heuven et al. 2014), and measure the frequency of each verb lemma. A verb's raw frequency was calculated by summing its frequencies in all of its verbal forms. As an example, take the verb *bite*, which has the past participle *bitten* and the preterite form *bit*. The frequency for *bite* was calculated as shown in table 4 (numbers are from U.S. SUBTLEX). Where a lexeme could

TABLE 4
Calculating Verbal Frequency for *bite*

bite	1,210
bit	638
bitten	188
biting	191
bites	114
TOTAL	2,341

occur as more than one part of speech (e.g., *bite* can be both a verb and a noun), care was taken to ensure we obtained its frequency only as a verb (as SUBTLEX provides part-of-speech-specific frequency counts).

Raw frequencies were then transformed to van Heuven et al.'s (2014) Zipf scale by taking the $\log_{10}$ of the frequency per million words. As a check, we determined the Pearson's correlation between the Zipf frequencies of the lexical items in the U.S. data and those in the U.K. data. This was 0.959 ($p < .001$), indicating that the verbs that are more frequent in U.S. English are also more frequent in U.K. English. That is, the varieties are consistent about which verbs are more frequent than others.[4]

Phonological Difference from Preterite. One crucial way in which the verbs involved in leveling differ from one another is in how the standard form of the participle is phonologically different from the preterite form. Standard participles may differ from their corresponding preterites in one of four ways:

1. The participle has an AFFIX that the preterite lacks (e.g., *beaten-beat*, *bitten-bit*, *frozen-froze*)
2. The participle has a DIFFERENT VOWEL than the preterite (e.g., *become-became*, *run-ran*, *rung-rang*)
3. The participle has BOTH AN AFFIX AND A DIFFERENT VOWEL from the preterite (e.g., *eaten-ate*, *grown-grew*, *taken-took*, *written-wrote*)
4. The participle is a SUPPLETIVE form, with no phonological relationship to the preterite (only *gone-went*)

We coded each token for which of these four differences the verb standardly shows. This allows us to account for these phonological differences without grouping verbs into conjugation classes, which depend on theoretical motivation.

Language-External (Social) Factors. Gender. Each token was coded for the gender of the speaker as a binary (male or female) when the information was available.

Social Class, Education. All three corpora have different ways of coding for social class or education. DECTE is coded for speaker social class (self-reported), PNC provides a speaker's years of schooling, and Switchboard bins speakers based on years of schooling:

DECTE: Middle class, lower middle class, or working class.
PNC: Education was treated as a continuous measure (number of years of schooling).
Switchboard: Education level was rated on a 4-point scale: less than high school, less than college, college, more than college.

Real Time. Switchboard data was all collected in a 14-month period from March 1991 to May 1992, so effects of real time (that is, whether the general application of participle leveling has changed over time) cannot be examined. By contrast, the other two corpora are diachronic. The earliest PNC interview in our data is from 1973 and the latest is from 2012. DECTE consists of three subcorpora: the first from the late 1960s, the second from the 1990s, and the third from 2007–10. The latter two corpora, then, offer potential for looking at real-time change, with the caveat that the speaker samples in the different DECTE subcorpora were not equally balanced for social factors like class.

Age. DECTE bins speakers into eight age groups, corresponding to teenagers, 20s, 30s, and so on up to 80s. Switchboard and PNC provide speakers' year of birth, from which age can be calculated as year of recording minus year of birth. It is crucial to calculate age for the PNC data, rather than using year of birth as a proxy for age, because the corpus was collected over four decades: thus, a speaker born in 1950 would be a very different age depending on whether they were interviewed in 1973 or 2012. The same is not true for Switchboard, whose data was all collected within 14 months; though we could in principle use either year of birth or age to investigate age-grading in Switchboard, we choose age for consistency with the other two corpora.

MODELING. The statistical models used in this study are mixed-effects logistic regressions fit using the lme4 package (v. 1.1-26, Bates et al. 2015) with the bobyqa optimizer (200,000 iterations) in R (v. 4.0.5, R Core Team 2013). Logistic regression considers all possible predictors simultaneously; this means that the significant factors presented below are significant after taking all other factors into account, that is, they cannot be reduced to each other.

In this study, we are interested not only in the factors that condition participle leveling, but also in the extent to which those factors are shared across our three datasets. The best way to test this is by creating one single

model containing data from all three corpora and including a statistical interaction with corpus for each predictor. These statistical interactions tell us whether the effects of each predictor are significantly modulated across the different corpora.

It is only possible for a model to contain a statistical interaction between corpus and some predictor when that predictor has been coded identically across the different corpora. This is the case for all of our internal factors and for speaker gender. Accordingly, our full model analyzed data from all three corpora and tested the significance of every internal predictor, speaker gender, and the interaction of each of these with corpus. We will refer to this model as the "full model" throughout the article.

Other social factors, however, were not coded the same way across the different corpora (e.g., age, class/education). To assess the significance of these factors, we have to construct one model for each individual corpus. In this case, we cannot directly compare the size of effects or the *p*-values across the different datasets. That is, we can say that an effect is or is not statistically significant in one dataset or another, but not whether that effect is stronger in one dataset compared to another. This contrasts with the types of conclusions that can be drawn from the full model with interactions.

Speaker and verb were included as random intercepts in each model (as the "by participant" and "by item" corrections, respectively). For modeling year of recording in the PNC data, we center year of recording around its median and rescale it to decades.[5] We do the same for age in PNC and Switchboard. Age group in the DECTE corpus was reverse-difference coded, which allowed us to compare the rate of leveling in each age group with that of the age group directly below it (following, e.g., Röthlisberger and Tagliamonte 2020). Level of education in Switchboard was likewise reverse-difference coded. All other fixed-effect predictors were sum-coded for modeling unless there was an obvious default option, in which case that default option was set as the reference level of a treatment-coded predictor.[6] Additionally, when a sum-coded predictor turned out to significantly improve model fit, we re-ran the model with treatment-coding of that predictor and carried out post hoc comparison of contrasts with the emmeans package in R (Lenth 2020), using the Tukey adjustment for multiple comparisons. This allowed us to determine exactly which pairs of levels of the predictor differed from one another.

Model-building proceeded as follows. For each model, we started with only the random effects (speaker and verb), adding one predictor at a time, in an order that was based on the apparent strength of their effects as assessed through visualization of the data. Then we used ANOVAs and comparison of AIC and BIC to test for significance in the addition of each predictor, keeping the predictor in the model if it significantly improved the model

fit and lowered AIC and/or BIC. In the case of the full model, we tested the interaction of each predictor with corpus as well, regardless of whether that predictor significantly improved model fit on its own. The final output for the full model is available in table 5; output for the by-corpus models is presented later in tables 6–8.

RESULTS

GENERAL PATTERN. Use of the preterite for the participle varies both within and across speakers in our data. Examples 13–15 demonstrate variability within individuals, table 5 provides the output from the full regression model with by-corpus interactions, and figure 1 depicts the leveling rates in the three corpora under study.

TABLE 5
Best Full Regression Model

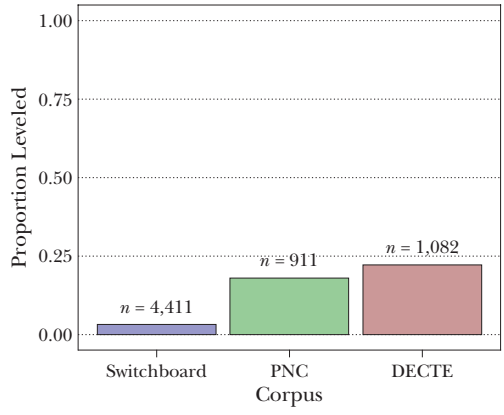
	Coefficient	*SE*		*Coefficient*	*SE*
Intercept	2.122	1.906	CORPUS × TENSE		
CORPUS (vs. Switchboard)			PNC × past	0.960*	0.432
PNC	–0.449	0.434	DECTE × past	–0.342	0.384
DECTE	3.522***	0.407	PNC × nontensed	2.290***	0.485
AUXILIARY TENSE (vs. Present)			DECTE × nontensed	0.289	0.450
Past	0.973***	0.265	CORPUS × DIFFERENCE FROM PRETERITE		
Nontensed	1.063**	0.334	PNC × affix + vowel	1.668***	0.441
DIFFERENCE FROM PRETERITE (vs. Affix only)			DECTE × affix + vowel	–0.959*	0.441
Affix + vowel	–2.540***	0.666	PNC × vowel	0.522	0.580
Vowel only	–0.073	0.740	DECTE × vowel	–1.762**	0.546
Suppletive	–0.683	1.453	PNC × suppletive	1.655***	0.475
FREQUENCY (Zipf scale)	–0.871*	0.349	DECTE × suppletive	–0.944*	0.479
INTERVENING NEGATION (vs. Absent)			CORPUS × SUBJECT PERSON		
Present	0.619**	0.192	PNC × 2nd	–0.947	0.698
SUBJECT PERSON (vs. 1st)			DECTE × 2nd	–0.130	0.567
2nd	0.298	0.420	PNC × 3rd	0.685*	0.349
3rd	–0.733***	0.221	DECTE × 3rd	0.720*	0.330
SPEAKER GENDER (vs. Female)			CORPUS × SPEAKER GENDER		
Male	–0.018	0.249	PNC × male	1.143**	0.401
			DECTE × male	–0.153	0.396

Observations	6,404	Akaike information criterion	2,312.284
Log likelihood	–1,125.142	Bayesian information criterion	2,521.989

*$p < .05$; **$p < .01$; ***$p < .001$.

NOTE: Coefficients of treatment-coded predictors should be interpreted in relation to the reference level, given in parentheses alongside the predictor name. Other predictors are continuous. Significant positive coefficients indicate that the environment in question promotes leveling.

FIGURE 1
Proportions of Participle Leveling by Corpus



13. Switchboard, speaker 1236:
    a. Latest one I've SAW, which was a mistake to go see, was *Lionheart.*
    b. I can't remember, it's been a while since I've SEEN it.
14. PNC, speaker PH94-2-4:
    a. Then I wouldA just BROKE it up.
    b. If it was a one-on-one fight then I'dA BROKEN it up.
15. DECTE, speaker tlsg25a:
    a. She's just CAME back fortnight ago from Cannes.
    b. Well I've just COME out of hospital, you see.

As figure 1 shows, the leveling rate is considerably lower in Switchboard (3%) than either PNC (15%) or DECTE (22%). Indeed, corpus is a statistically significant predictor of leveling in the full model (table 5), which finds DECTE to show significantly more leveling than Switchboard. The PNC-Switchboard comparison does not reach significance in this model, but post hoc pairwise comparison of contrasts with the Tukey adjustment for multiple comparisons does find significantly more leveling in PNC than Switchboard. PNC and DECTE, however, do not consistently differ from one another.[7]

Leveling is not restricted to a small subset of verbs, either. Of the 44 verbs represented in our study, all but eight show leveling rates greater than 0, and seven of those eight are infrequent, represented in our data by fewer than 10 tokens. We provide further discussion of verb-specific leveling patterns throughout this section and the next.

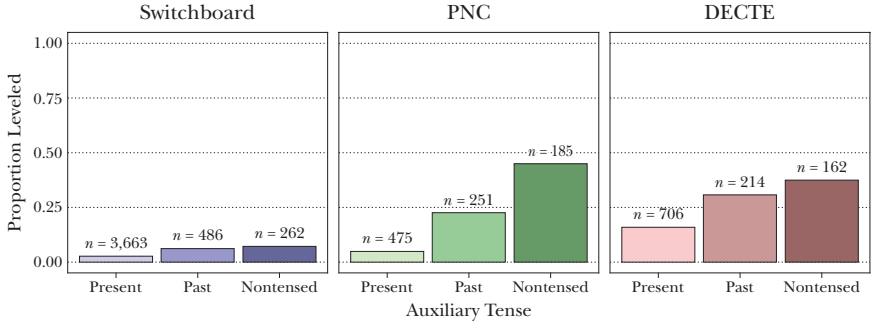
In the rest of this section, we will present the results of the different predictors under consideration one at a time, discussing by-corpus interactions where relevant. Because some external predictors pertain only to

particular corpora (e.g., Switchboard does not have a real-time component while the other two corpora do), those predictors will be discussed on a corpus-specific basis.

As we will see, there is a large degree of conformity across the corpora in the factors that condition leveling. This is despite the Switchboard corpus differing from the other two in several ways: modality (phone rather than in-person conversations), register (conversations on assigned topics rather than sociolinguistic interviews designed to draw out the vernacular), and participant demographics (from all over the United States as opposed to from a particular speech community). For all of these reasons, it is perhaps expected that the speech in Switchboard would pattern somewhat differently, and indeed, we see this in Switchboard's extremely low rate of leveling compared to the other two corpora. Nonetheless, the primary takeaway of this section will be that the majority of predictors operate in the same way across all three corpora, regardless of register, modality, or variety.

LANGUAGE-INTERNAL FACTORS. In all three corpora, as well as in the combined data, one of the strongest predictors affecting the variation is AUXILIARY TENSE. As shown in figure 2, all three corpora show more leveling when the auxiliary of the perfect is nontensed or past tense, compared to when it is present tense. The beta coefficients, standard errors, and *p*-values for the main effect of auxiliary tense in table 5 capture the effect of this predictor in Switchboard. (Significant positive coefficients reflect increased leveling compared to the reference level.) The interaction terms for DECTE do not reach significance, indicating no significant difference in the effects of nontensed or past-tense auxiliaries between the two corpora. The interaction terms for PNC are both positive, indicating even stronger promotion

FIGURE 2
Proportions of Participle Leveling by Corpus and Auxiliary Tense



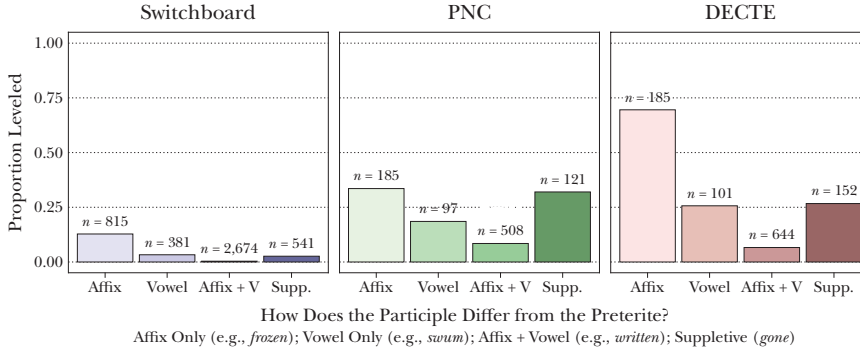
of leveling with nontensed and past-tense auxiliaries in that corpus than we find in Switchboard.

In 94% of tokens containing a nontensed auxiliary in our data, the auxiliary is preceded by a modal. Thus, the strong effect of a nontensed auxiliary replicates a large body of previous work that has found more leveling with a modal. The favoring effect of the past perfect is consistent with the findings of Eisikovits (1987) and Kemp et al. (2016).

Additionally evident from table 5 is that the boost in leveling when the auxiliary is nontensed (compared to present tense) is greater than the boost in leveling when the auxiliary is past tense (again, compared to present tense). That is, both nontensed and past-tense auxiliaries induce more leveling on the participle than present-tense auxiliaries do, but this effect is stronger for nontensed than for past-tense. This can be seen in the greater beta coefficients for nontensed than for past-tense auxiliaries, for both Switchboard (the main effect at the top of the table) and PNC (the interaction in the middle of the table). Post hoc pairwise comparisons find that nontensed and past-tense contexts differ from one another only in PNC ($\beta = -1.42$, SE = 0.32, $p < .001$).

Another particularly strong factor affecting the variation is the PHONOLOGICAL DIFFERENCE between the participle and the preterite in the standard language (figure 3). We treatment-code this predictor; the reference level in table 5 is verbs whose participle differs from the preterite only through the addition of an affix (e.g., *frozen* compared to *froze*). In Switchboard (the main effect near the top of the table), we find significantly less leveling of verbs whose participle differs from the preterite through both the addition of an affix and a different vowel (e.g., *written* compared to *wrote*). The significant

FIGURE 3
Proportions of Participle Leveling by Corpus and Phonological Difference between Participle and Preterite



positive coefficient of the PNC × affix + vowel interaction term indicates that this effect is weakened, though not completely erased, in PNC. The significant negative effect of the DECTE × affix + vowel interaction term indicates that the effect is even stronger in that corpus.

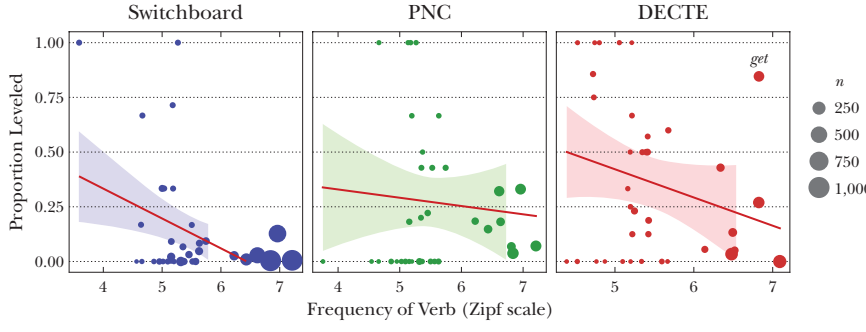
The other two phonological classes—participles that are formed by changing the vowel of the preterite (e.g., *swum* compared to *swam*) and the one verb whose participle form is suppletive (*gone* compared to *went*)—do not differ consistently from the affix-only class or from each other, as assessed through post hoc pairwise tests. These post hoc pairwise tests find that the only other pair with a robust difference in leveling is affix + vowel compared to vowel-only in Switchboard ($\beta = -2.47$, SE = 0.79, $p = .01$).

The general conclusion that can be drawn from this is that leveling is more frequent the more phonologically similar participle and preterite are: that is, when the two differ by only an affix or a vowel, leveling rates are higher; when two morphophonological features differentiate them (an affix AND a vowel), the verb resists leveling.[8] The suppletive category would seem to go against this, as participle and preterite are considerably different in a suppletive verb, but there is only one such verb, so it cannot tell us much about this category.

VERB FREQUENCY affects variation in Switchboard, and the lack of a significant by-corpus interaction for this term means that we have no evidence that this effect differs in either of the other two corpora. The direction of the effect is such that higher leveling rates are observed with less frequent words, in keeping with previous studies of analogical leveling (e.g., Hooper 1976). This can be seen in figure 4.

Close scrutiny of the DECTE panel of figure 4 reveals an outlier in this pattern: the verb *get*, which, despite its high frequency (6.83 on the Zipf scale), levels at a very high rate (85%). This high rate of *get* leveling is consistent

FIGURE 4
Proportions of Participle Leveling by Verb Frequency



with other research on the past participle of *get* in British English, which has found that *gotten* is "hardly used" and that *got* is the standard past participle to the point that prescriptivists express negative attitudes about *gotten*, which is perceived as an Americanism (Murphy 2018, 118). The high rate of *get* leveling to *got* in our DECTE data reveals that not only is *gotten* dispreferred in the North East of England, but the local form *getten* is as well. There is thus a case to be made for excluding *get* from the DECTE data entirely: unlike the other verbs under study, its standard form is the leveled one, not the *-en*-affixed form. We leave it in because it does nonetheless alternate in the English of the North East of England, but we return to the status of *get*, and other verbs that differ in their patterning between American and British English, below.

Like verb frequency, NEGATION of the perfect construction is significant in the pooled dataset, and its interaction with corpus does not reach significance. Negation is found to significantly increase leveling (figure 5); though PNC and DECTE appear to show the opposite pattern, this is not supported by the statistical modeling. We additionally find that refining this predictor to capture specifically negation that intervenes between the auxiliary and the participle (as in *haven't [participle]*) is a slightly better fit for the data than defining it to also encompass negation that does not intervene (as in *never have [participle]*). In other words, when auxiliary and participle are separated by a negator, leveling is increased, an effect that does not extend to a negator that precedes the auxiliary.

SUBJECT PERSON significantly affects the variation only in Switchboard, where third-person subjects are accompanied by significantly less leveling than first-person ones (figure 6). Post hoc comparisons do not find the other pairs (first versus second, second versus third) to differ significantly. SUBJECT

FIGURE 5
Proportions of Participle Leveling by Presence of Negation That Intervenes between Auxiliary and Participle

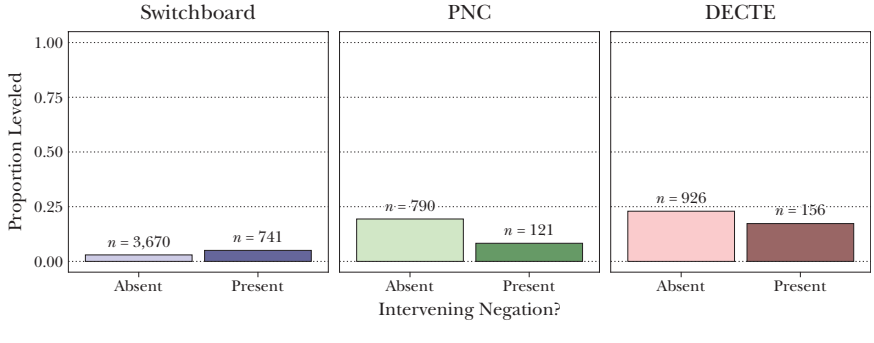
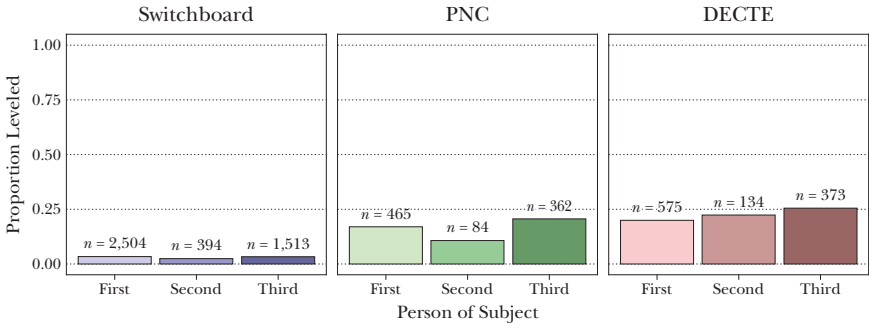


FIGURE 6
Proportions of Participle Leveling by Subject Person



PERSON interacts significantly with CORPUS such that the third-person effect is effectively erased in PNC and DECTE; post hoc tests do not find any pairs of persons to differ significantly in those corpora.

By way of explanation for the PERSON effect in Switchboard, one obvious difference between third person and the other two is that third person induces different morphology on the present-tense auxiliary when singular (*has*, as opposed to *have* with other persons). However, replacing the PERSON predictor with one that captures whether the auxiliary is *has* versus *have* does not improve model fit, nor does combining PERSON and NUMBER into a single category, suggesting that the observed PERSON effect is not being driven solely by singular present-tense contexts.

Finally, three predictors have no effect on the variation: SUBJECT NUMBER, QUESTION, and INTERVENING MATERIAL. There is no evidence of these predictors significantly improving model fit, either alone or with an interaction with corpus.

LANGUAGE-EXTERNAL FACTORS. As this subsection will show, the general pattern from the language-external factors is that participle leveling is a diachronically stable variable that shows the expected social correlates: that is, more nonstandard forms among men, younger speakers, and those with less education and/or of a lower social class (Labov 2001). Not all social factors examined are significant in every corpus, potentially demonstrating community-specific nuances in the socioindexical meaning of leveled participles (Eckert 2008) or perhaps due simply to the differences in corpus size and composition. A productive direction for future work will be to probe the social associations of this variable further, for instance through dedicated perception studies, given the dearth of perception research on the social meaning of morphosyntactic variation (Robinson and MacKenzie 2019; MacKenzie and Robinson 2019).

TABLE 6
Best Switchboard Regression Model

	Coefficient	*SE*		*Coefficient*	*SE*
Intercept	3.250	1.964	INTERVENING NEGATION (vs. Absent)		
AUXILIARY TENSE (vs. Present)			Present	0.925***	0.245
Past	0.971***	0.260	SUBJECT PERSON (vs. 1st)		
Nontensed	1.181***	0.333	2nd	0.462	0.413
DIFFERENCE FROM PRETERITE (vs. Affix only)			3rd	–0.642**	0.222
Affix + vowel	–2.719***	0.647	EDUCATION (vs. Previous)		
Vowel only	–0.650	0.726	Less than college	0.193	1.300
Suppletive	–0.990	1.221	College	–0.560	0.391
FREQUENCY (Zipf scale)	–0.962**	0.351	More than college	–0.590*	0.265

Observations	4,411	Akaike information criterion	1,005.422
Log likelihood	–487.711	Bayesian information criterion	1,101.299

*$p < .05$; **$p < .01$; ***$p < .001$.

NOTE: Coefficients of treatment-coded predictors should be interpreted in relation to the reference level, given in parentheses alongside the predictor name. Other predictors are continuous. Significant positive coefficients indicate that the environment in question promotes leveling.

TABLE 7
Best PNC Regression Model

	Coefficient	*SE*		*Coefficient*	*SE*
Intercept	3.682*	1.720	FREQUENCY (Zipf scale)	–0.607**	0.228
AUXILIARY TENSE (vs. Present)			YEARS OF SCHOOLING	–0.202***	0.057
Past	1.936***	0.350	AGE (centered)	–0.320***	0.086
Nontensed	3.100***	0.365	GENDER (vs. Female)		
DIFFERENCE FROM PRETERITE (vs. Affix only)			Male	1.020**	0.324
Affix + vowel	–2.120***	0.330			
Vowel only	–1.119*	0.447			
Suppletive	–0.232	0.364			

Observations	911	Akaike information criterion	594.123
Log likelihood	–285.061	Bayesian information criterion	651.897

*$p < .05$; **$p < .01$; ***$p < .001$.

NOTE: Coefficients of treatment-coded predictors should be interpreted in relation to the reference level, given in parentheses alongside the predictor name. Other predictors are continuous. Significant positive coefficients indicate that the environment in question promotes leveling.

The regression model output for the three corpora are provided in tables 6–8. As stated above, several external predictors could not be included in the full model due to their being operationalized differently across the three different corpora, so we had to model them separately. These separate by-corpus models necessarily include significant internal predictors, too, but our focus here is on the external ones.

TABLE 8
Best DECTE Regression Model

	Coefficient	*SE*		*Coefficient*	*SE*
Intercept	5.142	3.178	AGE GROUP (vs. Previous)		
AUXILIARY TENSE (vs. Present)			20s	–0.999*	0.471
Past	0.869**	0.313	30s	1.394*	0.630
Nontensed	1.284***	0.347	40s	–1.301*	0.655
DIFFERENCE FROM PRETERITE (vs. Affix only)			50s	–0.520	0.670
Affix + vowel	–2.541**	0.893	60s	0.121	0.697
Vowel only	–0.723	1.037	70s	–1.010	1.423
Suppletive	–0.718	1.984	80s	0.595	1.568
FREQUENCY (Zipf scale)	–0.831	0.572			
CLASS (vs. working class)					
Lower middle	–1.655***	0.379			
Middle	–1.640***	0.398			

Observations	1,069	Akaike information criterion	604.796
Log likelihood	–284.398	Bayesian information criterion	694.337

*$p < .05$; **$p < .01$; ***$p < .001$.

NOTE: Coefficients of treatment-coded predictors should be interpreted in relation to the reference level, given in parentheses alongside the predictor name. Other predictors are continuous. Significant positive coefficients indicate that the environment in question promotes leveling.

The predictors capturing LEVEL OF EDUCATION or SOCIAL CLASS are all statistically significant across the three datasets. In Switchboard, speakers with postgraduate education ("more than college" in the regression output) level significantly less than those whose education stopped with a college degree. Post hoc pairwise comparisons find a similar difference between speakers with postgraduate education compared to those with less than a college degree ($\beta = -1.12$, SE = 0.43, $p = 0.04$) but no other significant pairwise differences. In PNC, where education is coded as a continuous measure of years of schooling, more education similarly correlates with less leveling. Finally, in DECTE, the only corpus coded for social class, both middle-class and lower-middle-class speakers level significantly less than working-class speakers (but post hoc pairwise comparisons do not find them to differ from each other). These patterns are depicted in figure 7.

SPEAKER AGE is another influential predictor, affecting the variation in the two most vernacular corpora, PNC and DECTE (figure 8). In PNC, we find significantly less leveling among older speakers. Because the continuous age predictor in the regression model has been rescaled to decades, we can understand its beta coefficient as reflecting the change in log odds of leveling associated with each decade of increasing age. In DECTE, where speakers are binned into age groups by decades, and the logistic regression modeling compares each age group to the one below it, the picture is

FIGURE 7
Proportions of Participle Leveling by Speaker Level of Education (Switchboard), Years of Schooling (PNC), and Social Class (DECTE)

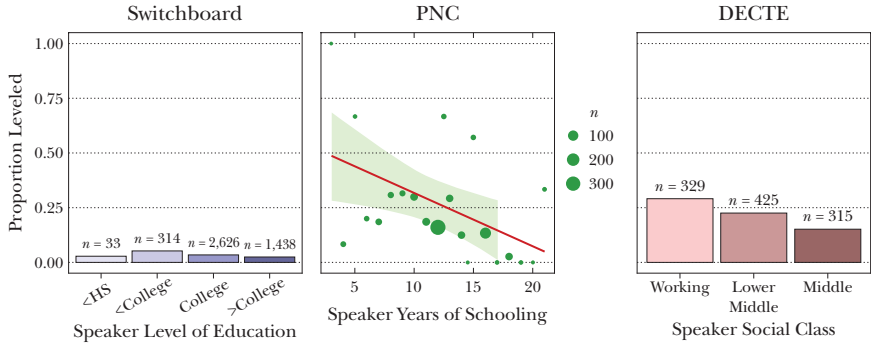
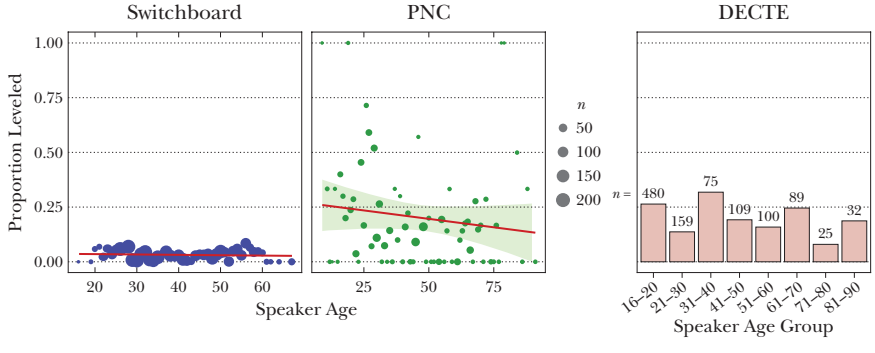


FIGURE 8
Proportions of Participle Leveling by Speaker Age



slightly more complicated. Speakers in their 20s level less than those in their teens—suggesting a similar pattern to that of PNC, namely decreased leveling with increased age—but then speakers in their 30s level more than those in their 20s, suggesting an apparent reversal. This reversal is then apparently re-reversed among speakers in their 40s, who level less than those in their 30s. We suggest that the low rate of leveling among speakers in their 20s is due to a large proportion of speakers in this group being university students at the time. The standardizing effect of being immersed in higher education (e.g., Wagner 2012) may thus be dampening leveling rates among this particular age cohort. Abstracting away over this anomalous group, the general picture is of more leveling among younger speakers, as we find in PNC.

While in principle this pattern could be compatible with either age-grading or change in progress, we can actually adjudicate between these two

FIGURE 9
Proportions of Participle Leveling in Real Time

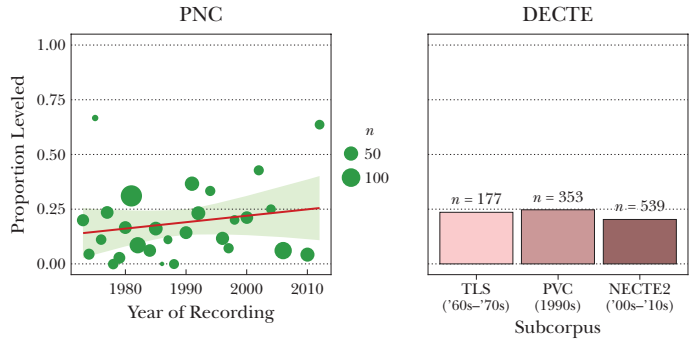
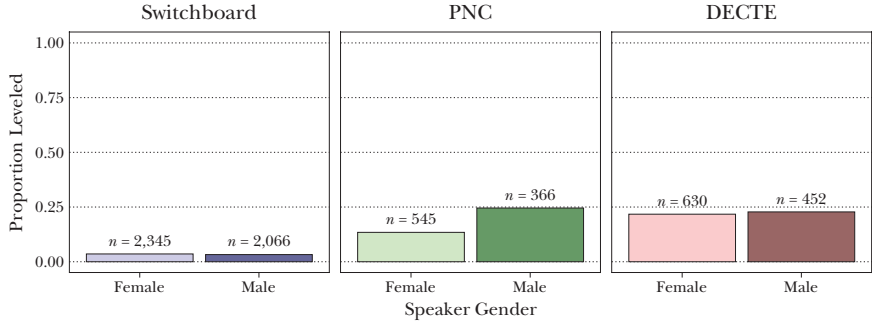


FIGURE 10
Proportions of Participle Leveling by Speaker Gender



interpretations because both PNC and DECTE have a real-time component, visualized in figure 9. In fact, neither real-time predictor (year of recording in PNC; subcorpus in DECTE) improves model fit when added. For this reason, neither real-time predictor is included in the final model outputs in tables 7 and 8. This means that there is no evidence of change in progress and that the age patterns are more likely to reflect age-grading, that is, speakers decreasing their use of leveling as they age.

Finally, SPEAKER GENDER plays a limited role in conditioning participle leveling (figure 10). Because this is the only extralinguistic factor that is present and operationalized in the same way across the three corpora, we were able to include it in the full model with a by-corpus interaction (table 5). Doing this reveals that gender affects the variation only in PNC, where speakers whose gender is recorded as male level more than those whose gender is recorded as female.

DISCUSSION

Here we return to the four questions we enumerated above. First, we address question 1, WHAT IS THE VARIABLE, ACTUALLY? The primary aim of this question was to determine whether any verb with distinct preterite/participle forms can vary in production of the participle or whether variation is lexically constrained. The answer to this question is that just about any verb we examined can vary; the variability appears to be largely systemic. Of the 44 verbs represented in our study, all but 8 show nonzero leveling rates.[9] Of the eight verbs that are categorically produced in their participial (that is, unleveled) form, 7 are extremely infrequent, surfacing fewer than 10 times across the three corpora combined, suggesting that their lack of leveling is simply due to a lack of opportunity to observe them in their leveled form.[10] The eighth invariant verb is *become*, which is actually fairly well represented in our data, with 118 total tokens. This suggests that this verb is truly an exception to leveling in these varieties, in a way that its phonological counterpart *come*—which levels at a rate of 7.5% across the three corpora—is not.

When we break the data down by the American datasets and the British dataset, the picture changes slightly, revealing that leveling is progressing through the language on a verb-by-verb basis differently in British than in American English. Namely, within the two American corpora, there are two additional verbs which are well represented (with more than 20 tokens each) but never leveled: *drive* ($n = 38$) and *eat* ($n = 34$). Each of these verbs is attested at least once in its leveled form in DECTE. By contrast, in DECTE, we find no leveling whatsoever of *do*, despite a large amount of data ($n = 259$). This contrasts with Switchboard and PNC, where *do* is leveled (albeit very infrequently).[11] We take up other variety-specific patterns of leveling again at the end of this section.

Having addressed the first of our research questions, we are now able to turn to the remaining three: 2. WHAT CONDITIONS VARIATION OF THE PARTICIPLE? Our results confirm the well-documented favoring effect of the presence of a modal verb on leveling; this is one of the strongest factors affecting our data. Less commonly demonstrated in the previous literature, but also apparent in our data, is that past perfect contexts also boost leveling compared to present perfect. Participle leveling also shows hallmarks of analogical leveling processes more generally, with more leveling of less frequent verbs, and more leveling the more phonologically similar the participle and preterite are. We additionally find limited evidence for an inhibiting effect of intervening negation on leveling, as suggested by Geeraert (2010) and Greblick (2000), though contra Greblick, this effect does not extend to adverbs that intervene between auxiliary and participle. Like Kemp et al.

(2016), we find a (weak) effect of subject person/number on leveling, with both studies agreeing that first person is a favoring context for leveling and third person (plural, in their case) a disfavoring one.

Finally, our finding of socially stratified, age-graded, stable variation accords with the impressions of a large number of sociolinguists who have speculated on the social patterning of this variable. The presence of a real-time component in two of our corpora gives no evidence that this variation is changing over the time span considered in our corpora (i.e., the second half of the twentieth century).

3. IS THE VARIABLE AN AMERICANISM OR BROADER FEATURE OF ENGLISH? We find leveling in both American and British Englishes; in fact, the rate of leveling is highest in DECTE, the British English corpus. Moreover, we find no evidence for real-time change in DECTE: the variability appears to be diachronically stable (likewise for PNC, the American real-time corpus). If leveling has spread from American to British English, then, it certainly did not happen recently, and any such incursion of leveling into British English has either been arrested or is progressing so slowly that it cannot be detected over the course of several decades.

4. WHAT ELSE CAN A CROSS-ATLANTIC COMPARATIVE APPROACH TELL US ABOUT THIS VARIABLE? We suggested that our data may additionally shed light on the history and grammar of the variable. One way in which it could do so was by providing examples for evaluating previous morphosyntactic analyses of the variable. Recall that some researchers have suggested that participle leveling to the preterite is triggered by a modal preceding the auxiliary verb *have*, implying that leveling should not be attested without a modal being present. The high rate of leveling in past perfect constructions in our data demonstrates that this analysis cannot be correct. Even in present perfect contexts, the least favoring tense for leveling, we find a leveling rate of 5%.

One suggestion put forth by previous researchers is that the phonetic reduction of *have* in modal contexts induces leveling, for instance by reflecting a modal + auxiliary unit that has grammaticalized to an adverb, which is then followed by a true preterite form. While this cannot be the only factor that triggers leveling, for reasons laid out in the previous paragraph, an open question is whether phonetic reduction of *have* boosts leveling rates compared to cases of modal + *have* that are not phonetically reduced. Coding the phonetic realization of *have* as a potential predictor of leveling is a worthy direction for future work, and one which was not undertaken in the present study, for which coding was primarily done from written transcripts. (See MacKenzie 2020 for evidence that orthographic transcriptions of contracted auxiliary verbs, at least in the Switchboard corpus, are not fully reliable.)

Furthermore, we note that the lack of real-time change in our data suggests that this is a stable variable, one which, contrary to some claims, is likely not a novel Americanism. Beyond this observation, it is additionally noteworthy that our findings regarding language-internal constraints on variation are shared across corpora. In large part, the same constraints influence variant selection in the same direction in both U.S.- and U.K.-based corpora (not to mention their corroboration of Eisikovits's [1987] results from Australia). Work in comparative sociolinguistics (e.g., Carmichael and Becker 2018; Erker and Otheguy 2021; see MacKenzie 2019 for a recent review) has suggested that when two dialects share constraints on the same variable, they likely share an origin of the variation.[12] Following this logic, our cross-Atlantic comparative approach suggests that variable participle leveling on both sides of the Atlantic shares a common origin, given the crucial shared constraint of auxiliary tense on the variation, which is unlikely to have a universal nonlinguistic source. There are two reasonable hypotheses as to how this may be derived. The first is that because the dialects began to diverge several centuries ago, variable participle leveling has been stable in English for quite some time. Perhaps the variation observed in late Middle English/Early Modern English (Lass 2008) has simply continued to the present. An alternative possibility recognizes that the varieties included in our study and others (i.e., Eisikovits 1987) are either British English or settler colonial varieties. Given that settler colonial varieties can show parallel developments across vast spaces (Denis and D'Arcy 2019), it is possible that the varieties independently developed the participle leveling we see synchronically based on inherited constraints that predate the colonial enterprise. In either of these possibilities, however, our data ultimately suggests an early, English-specific shared origin for some element of the variability. We suggest that the investigation of variable participle leveling by researchers in historical (socio)linguistics would shed much-needed light on the development of this sociolinguistic variable.

At the same time, our cross-Atlantic comparative approach has revealed that leveling is constrained by lexical frequency in such a manner that it appears to be progressing through the language over a longer time-span than that sampled in this study. Such progress appears to be slightly different in British and American English. Earlier in this section, we noted that different verbs constitute apparent exceptions to leveling in the different varieties. Above we demonstrated that *get* behaves differently in the two varieties, too, with high rates of leveling in British English—where *got* has been standard for some time—and a much stronger tendency to use *gotten* in American English. Another verb that has been noted to behave differently in British and American English is *prove* (Murphy 2018, 117); our results corroborate Murphy's finding that American English prefers *proven* for the past participle

while British English prefers *proved*.[13] According to Murphy, the preference for *gotten* and *proven* in American English stems from nineteenth-century "resurrections" of historical forms that had long fallen out of use in British English. If this variable is a change over a large time-scale, it would have nearly gone to completion for these two verbs in British English, but reversed its course in American English. We suggest that it is a reasonable hypothesis that even though our real-time corpora found no change in leveling rates over the course of the twentieth century, the participle forms of these verbs are nonetheless changing over time, albeit in a frequency-driven, lexically specific way, very slowly over centuries. In this way, the change would resemble the regularization of irregular English past tenses over time, a similarly slowly progressing and lexically specific change (Lieberman et al. 2007). If further research in historical (socio)linguistics shows this to be true, this would likely imply that the shared language-internal constraints cross-dialectally reflect that the change began well before the varieties began to diverge.

CONCLUSION

This article has presented a variationist analysis of participle leveling that employed three unique corpora, each with its own strengths. We have shown that in both the United States and the United Kingdom, leveling is more frequent among younger speakers and those who are of a lower social class or have less education. We investigated structural factors as well: there is more leveling when there is more phonological similarity between the participle and the preterite, with less frequent verbs, when negation intervenes between the auxiliary and the verb, and when the auxiliary of the perfect construction is not in the present tense (i.e., nontensed or past tense). The variable appears to be stable and is a broad feature of English as opposed to being an Americanism.

To close, we reiterate that the type of leveling discussed in this article—where the preterite (i.e., the simple past) form is used in place of the past participle—is not the only kind that the verbs studied here are involved in. As summarized above, also attested is leveling in the reverse direction, that is, use of the participle form in place of the preterite (e.g., simple past *seen*, *come*). We suggest that this direction of leveling similarly demands renewed attention, particularly given Janda's (2020, 580–83) indication that such participle-for-preterite leveling is an incipient change in progress among the *-ing/-ink* verbs, with forms like *rung* and *sunk* hypothesized to replace their counterparts *rang* and *sank* by the end of the century. This subsequently raises the question of how the findings presented in this article may hold up in the face of countervailing trends driving leveling in the opposite direction. In our

data, we find relatively high rates of preterite-for-participle leveling among the *-ing/-ink* verbs. But among those speakers who do not extend, say, *rang* into the perfect, do we instead find extension of *rung* into the simple past? That is, might we find conflicting leveling strategies within the same speech community, both with the ultimate effect of preterite/participle syncretism, but from opposite directions? Or might the direction of syncretism instead be consistent within communities, but variable across them? Widening the envelope of variation to incorporate these alternations will likely be necessary to fully understand the patterns we have uncovered here.

APPENDIX
Data Retrieval Details

We searched Switchboard and PNC for the following search query:

```
(have|has|had|'ve|'s|'d|n't|ta|da) (\w+\s)?("+'|'.join(participles)+")\W
```

where `participles` are the two forms paired with each verb in the following list:

beat (*beat*, *beaten*); *become* (*became*, *become*); *begin* (*began*, *begun*); *bite* (*bit*, *bitten*); *blow* (*blew*, *blown*); *break* (*broke*, *broken*); *choose* (*chose*, *chosen*); *come* (*came*, *come*); *do* (*did*, *done*); *draw* (*drew*, *drawn*); *drink* (*drank*, *drunk*); *drive* (*drove*, *driven*); *eat* (*ate*, *eaten*); *fall* (*fell*, *fallen*); *fly* (*flew*, *flown*); *forget* (*forgot*, *forgotten*); *freeze* (*froze*, *frozen*); *get* (*got*, *gotten*); *give* (*gave*, *given*); *go* (*went*, *gone*); *grow* (*grew*, *grown*); *hide* (*hid*, *hidden*); *know* (*knew*, *known*); *mow* (*mowed*, *mown*); *prove* (*proved*, *proven*); *ride* (*rode*, *ridden*); *ring* (*rang*, *rung*); *rise* (*rose*, *risen*); *run* (*ran*, *run*); *see* (*saw*, *seen*); *shake* (*shook*, *shaken*); *show* (*showed*, *shown*); *shrink* (*shrank*, *shrunk*); *sing* (*sang*, *sung*); *slide* (*slid*, *slidden*); *speak* (*spoke*, *spoken*); *steal* (*stole*, *stolen*); *stink* (*stank*, *stunk*); *swear* (*swore*, *sworn*); *swim* (*swam*, *swum*); *take* (*took*, *taken*); *tear* (*tore*, *torn*); *throw* (*threw*, *thrown*); *wake* (*woke*, *woken*); *wear* (*wore*, *worn*); *weave* (*wove*, *woven*); *write* (*wrote*, *written*)

We excluded *lie/lay* due to confusion over what the standard form of the past participle was. As a result, we only included verbs for which we could definitively say what the prescriptively expected participle was, so that participle leveling was clear when it occurred.

NOTES

The authors would like to thank audiences at NWAV 48 at the University of Oregon as well as the NYU Sociolab for productive discussion. Additionally, we would like to acknowledge the three anonymous reviewers, whose constructive feedback strengthened this work. The quotation in the title comes from DECTE speaker tlsg25a.

1. The English data actually necessitates its own discussion for Dammel, Nowak, and Schmuck (2010). Because Swedish maintains the preterite/participle forms for strong verbs, Dammel, Nowak, and Schmuck suggest the aspectual distinction explains the lack of ablaut leveling. The immediate question for them is why English maintains the aspectual distinction but tends toward ablaut leveling. We have no further thoughts on this and refer the interested reader to Dammel, Nowak, and Schmuck's discussion of this.
2. It should be noted, however, that Tieken-Boon van Ostade and Kostadinova's (2015) discussion of *go* includes clear awareness of the variable extending to other verbs.
3. The verb *get* is one that required more care in determining relevance. It can operate in two different ways, which differ in their past participle possibilities. As a dynamic type, where *get* means something like 'obtain', it can take the past participle *gotten* (e.g., *I haven't* GOT/GOTTEN *a haircut in a while*). However, the stative type, where *have got* is synonymous with *have* (Tagliamonte, D'Arcy, and Jankowski 2010), cannot alternate in this way (e.g., *I've* GOT/*GOTTEN *a question*). Because only the dynamic type can show variation within the past participle, this type was kept in our dataset for analysis. Tokens of the stative possessive form were excluded.
4. The most frequent verb in both the U.S. and U.K. English datasets is DO (U.S. Zipf = 7.211, U.K. Zipf = 7.09). In the U.S. English dataset, the least frequent verb is MOW (Zipf = 3.585); in the U.K. English dataset, the least frequent verb is SINK (Zipf = 4.389). Neither of these verbs appears in the dataset for the other variety.
5. Centering the values around the median allows us to interpret the intercept value of the model as reflecting the predicted log odds of participle leveling for a speaker of median age, rather than for a speaker of age 0 (the default interpretation, when age is not centered). Rescaling the predictor to decades allows us to interpret the beta coefficient of the year of recording parameter in the model as showing the increase in log odds associated with each decade, rather than each year of age, a more interpretable output when investigating language change, which is more likely to proceed by larger time units like decades or generations than by individual years.
6. Specifically, this was the case for the predictors NEGATION, QUESTION, and INTERVENING MATERIAL, where the reference level was "absent"; NUMBER, where the reference level was "singular"; and DIFFERENCE FROM PRETERITE, where the reference level was "affix only," the default means of forming the participle of regular verbs in English.
7. The inclusion in this model of by-corpus interactions complicates performing pairwise post hoc comparisons on the predictor CORPUS, because the main effect of CORPUS in our model reflects the influence of this predictor only in the reference levels of the predictors it interacts with. When we carry out the pairwise comparisons of the different corpora separately across the various levels of the predictors that corpus significantly interacts with, we find that PNC and

Switchboard significantly differ ($p < .05$) in 10 out of 12 comparisons, while PNC and DECTE significantly differ in only 2.

8. Affix + Vowel verbs are also more frequent in our data, as the numbers at the top of the bars in figure 3 make clear, but since our models also include verb frequency as a separate predictor, this effect of phonological difference is not reducible to frequency.
9. In fact, two verbs—*drink* and *mow*—level 100% of the time in our data, but token counts are very low for them: 7 and 3, respectively.
10. These are *draw*, *ride*, *rise*, *shrink*, *sink*, *steal*, and *tear*. Indeed, all of these verbs have nonzero attestations in their leveled form in the Google Ngram Viewer (Michel et al. 2011). We found these attestations by searching for *have* + preterite and *should have* + preterite.
11. It seems likely that the lack of leveled *do* in DECTE is related to differences in American and British English with respect to ellipsis: whereas American English favors eliding material following *have*, British English favors eliding material following *do*.

    Question: Did you finish your homework?
    AmE answer: Ugh, I should have.
    BrE answer: Ugh, I should have DONE.

    Most of the instances of perfect *do* in DECTE occur in this kind of ellipsis. Thoms and Sailor (2018) argue that this *do* in British English is an enclitic that is distinct from the *do* that appears in *do*-support and as a main verb. As such, it is quite possible that this *do* lies entirely outside of the envelope of variation, in which case the lack of leveled tokens is less surprising because there are far fewer tokens of *do* in DECTE than meets the eye.
12. This excludes constraints that are grounded in universal principles of articulation or similar shared physiological or psychological factors. See Tamminga, MacKenzie, and Embick (2016) for discussion.
13. Switchboard: 33% *proved* (N = 12); DECTE: 100% *proved* (N = 3); no data on this verb from PNC.

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