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Rhyme as resonance in poetry comprehension: An expert–novice study

R. Brooke Lea[1] · Andrew Elfenbein[2] · David N. Rapp[3]

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Abstract
Previous research has identified alliteration as a powerful device for investigating implicit memory effects. For example, alliterative phrases can provide retrieval cues that extend to a sublexical level and reactivate previous information that shares alliterative content (Lea et al., *Psychological Science*, *19*[7], 709–716, 2008). But it is an open question if other surface forms might provide similar effects in line with these empirical findings, and in accord with writer intuitions. The present study examined whether rhyme produces analogous memory-reactivation effects, given the ubiquity of its use and endorsement of its power in a range of materials and experiences. We also examined whether the surface benefits attributed to rhyme might support anticipatory processes such as those traditionally examined with semantic content. In Experiment 1, participants exhibited faster recognition responses to previous poetic content as a function of rhyming cues. In Experiment 2, we recruited participants identified as experts on the study and use of rhyme, replicating the probe facilitations obtained in Experiment 1, but also revealing anticipations of imminent rhymes. The results are discussed in terms of implications for theories of memory-based text processing and of nonsemantic anticipatory processes during the reading of poetry, and perhaps for discourse experiences more generally.

Keywords Memory-based processing · Resonance · Rhyme · Poetry comprehension, Anticipatory processes

Alliteration and rhyme are common in poems (*"Jack and Jill went up the hill";* "*Do you like green eggs and ham / I do not like them, Sam-I-am*"; Seuss, 1960), where they enhance people's enjoyment and the memorability of the materials. Writers can use such poetic devices to create artistic effects as well as to refocus reader attention on earlier portions of text. In his poem "The Raven," Edgar Allan Poe did both to enhance his verse: "*And the silken sad uncertain rustling of each purple curtain / Thrilled me—filled me with fantastic terrors never felt before / So that now, to still the beating of my heart, I stood repeating: / 'Tis some visitor entreating entrance at my chamber door'*" (Poe, 1845). The repeated /s/ phonemes in "silken sad uncertain rustling" onomatopoetically mirror the swishing curtains, while the internal rhyme of "thrilled me / filled me" helps the "thrill" to linger by repeating the same phonemic combination. Oral poets, students, and defense attorneys, among others, deliberately use alliteration and rhyme as mnemonic devices to help commit content to memory (e.g., *On Old Olympus' Towering Tops, A Finn And German Viewed Some Hops* to memorize the 12 cranial nerves; *i before e except after c,* to assist with unruly spelling in English; "If it doesn't fit, you must acquit," to convince jurors).

The aesthetic and memorial effects of these poetic devices are well known and understood with respect to their explicit and strategic use (e.g., Elfenbein, 2018; Rubin, 1995). But research has also reported evidence for *implicit* (i.e., without intention or awareness) memory benefits obtained during the reading of alliterative poetry and prose (e.g., Lea et al., 2008). Are these effects restricted to alliteration and to reactivation benefits? The present work examines the implicit memory effects of rhyme during poetry comprehension to further understand whether and how poetic devices can have surprisingly powerful effects. The key to such effects is the ability of poetic devices to help reactivate previously read material. In the case of rhyme, such reactivation might occur, for those proficient in reading rhyming materials, even before a particular rhyme has actually been read. We discuss the implications

✉ R. Brooke Lea
lea@macalester.edu

[1] Department of Psychology, Macalester College, 1600 Grand Ave, Saint Paul, MN 55105, USA

[2] University of Minnesota, Minneapolis, MN, USA

[3] Northwestern University, Evanston, IL, USA

of such anticipatory reactivation for theories of memory-based processing (e.g., Cook & O'Brien, 2014; Gerrig & O'Brien, 2005), and frameworks for predictive inference and anticipatory processing (e.g., Cook et al., 2014; Ferreira & Chantavarin, 2018; Lupyan & Clark, 2015).

The psychological examination of rhyme as offered here can prove useful for understanding broader issues in language comprehension. For example, poetry as a form of linguistic communication may foreground and conventionalize features of repetition, such as alliteration and rhyme. Poetry offers a naturalistic means of studying memory phenomena arising from repetition, including the degree to which information is anticipated and reactivated through repeated sounds in a context that renders such phenomena conventional. Several accounts of discourse processing have focused on how language serves as processing instructions that help comprehenders anticipate and reactivate concepts during reading (e.g., Gernsbacher, 1990; Givón, 1992; Rapp & van den Broek, 2005; Zwaan & Radvansky, 1998). Here again, poetry can prove useful: In studying these issues, psychologists can struggle with developing experimental designs because of the challenge of deriving theoretically informative claims while also using highly controlled textoids that intentionally manipulate rhyme (cf. Graesser et al., 1997). Poetry offers the chance to study these issues in more authentic contexts, since psychologists can examine the role of rhyme using materials that require only modest intervention from a researcher, especially when actual poems are used. We turn specifically to the ways in which rhyme has been defined, and will be considered in this project, next.

Rhyme

Rhyme in English consists of two different words whose final syllable share core phonemes. The minimal requirements are that the final syllables' nuclei and codas match if the syllables share both nuclei and codas (e.g., "cat–bat") or that the syllabic nuclei match if the syllables do not have a consonantal coda (e.g., "day–ray"). Such rhyme is a property of phonemes rather than of graphemes: Syllables may share the same graphemes but not rhyme (e.g., "tough–cough"), or may rhyme without sharing identical graphemes (e.g., "day–weigh"). Interestingly, although rhyme is a property of most of the world's languages, only a few make systematic use of rhyming as a feature of poetry (Brogan et al., 2012). In English, though, rhyme is a pervasive feature not only of traditional poetry but also of slogans, song lyrics, and hip hop.

Rhyme more generally has been conceptualized as a tool for supporting memory for hundreds of years (Coleridge, 1817). Given this association, psychologists have turned to rhyme as a tool for understanding human memory in at least two broad areas of empirical investigation. One has examined rhyme as supporting the storage and retrieval of information from memory and contrasts the availability of word-associates linked by rhyme with word-associates linked by meaning. For example, Bower and Bolton (1969) hypothesized that rhyme can work as a mnemonic device by priming and constraining the range of possible targets. In their work, neither rhyme nor categorical similarity alone were effective mnemonic cues (recall probabilities were .19 for rhyme cues, .14 for category cues), but when combined offered substantial retrieval benefits (recall probability of .97; Rubin & Wallace, 1989; see also Horton & Pavlick, 1993). Other researchers have reported that the supportive effects of rhyme are enhanced when individuals specifically attend to it (Hoorn, 1996; Nelson et al., 1987; Nelson et al., 1992). These projects demonstrate that rhyme can be a powerful tool for memory, especially if category similarity and explicit awareness are co-present with the rhyme.

A second focus for psychological investigations of rhyme examines its role in poetry, most often for use in pedagogy for children. That rhyme supports phonological awareness is a well-established finding (Anthony et al., 2002; Bryant et al., 1990; deCara & Goswami, 2003; Dugan et al., 2004; Kintsch, 1994), with such awareness associated with literacy development. While very young children are capable of producing rhyming poetry (Dowker, 1989), evidence is mixed as to whether children's semantic understandings are supported by rhyming poetry (Goldman et al., 2006; Hayes et al., 1982). Far less work has considered adult reading of rhyming poetry, in part given the difficulty of isolating the effects of rhyme from more general effects of poetic language, such as meter or alliteration, as well as from semantic processing. The presence of rhyme and meter in poetry increases readers' affective intensity and aesthetic appreciation (Obermeier et al., 2013). Readers process poetry with rhyme and meter more easily than they process poems that are nonrhyming and/or nonmetered, at least as measured with event-related brain potentials associated with fluency (Obermeier et al., 2016). The generally positive effects associated with fluency, such as easier availability and associated perceptions of validity, have also been associated with rhyme so that, for example, participants judge rhyming aphorisms to be more true than nonrhyming versions of the same aphorisms (McGlone & Tofighbakhsh, 2000).

The current study merges the two psychological areas of focus (rhyme as a cue for memory and the effects of rhyme in poetry) by examining the effects of rhyme on memory with adult participants and actual poems. Unlike previous projects, this study examines whether and how rhyme may influence comprehension at a nonconscious level, over and above any strategic considerations on the part of the reader. We focus on how rhyme might engage memory processes that drive the activation and comprehension of related phonological contents and examine how such processing effects might differ between novices and experts.

Memory-based processes in reading

Previous work has argued that poetry provides a powerful tool for investigating the role of implicit, memory-based processes in language comprehension (Lea et al., 2008). These processes have been studied extensively over the past 25 years and play a crucial role in comprehension (e.g., Cook & O'Brien, 2015; Gerrig & McKoon, 1998; Long & Lea, 2005; McKoon & Ratcliff, 1992; Rawson & Middleton, 2009). According to one account, during reading, each newly encountered text element enters the focus of attention and triggers automatic activation of associated information in a reader's long-term memory (Myers & O'Brien, 1998). That information can include prior knowledge and/or information previously encoded during the text experience, "resonating" in response to re-mentions. Numerous studies have found that when readers encounter contents that share features with earlier portions of a text, passive memory processes (possibly but not necessarily accompanied by effortful, strategic processes) can reactivate the distant material, labelled as resonance effects (e.g., Albrecht & Myers, 1995; Albrecht & O'Brien, 1993; Lea et al., 1998; McKoon et al., 1996; O'Brien et al., 2010). Feature overlap is thought to be the engine that drives the reactivation of earlier text elements, with most research defining feature overlap in terms of protagonists in a narrative returning to discourse focus (e.g., Albrecht & O'Brien, 1993; Lea et al., 1998; McKoon et al., 1996) or with repeated contextual cues (e.g., Albrecht & Myers, 1995, 1998; Lea et al., 2005).

But what constitutes evidence that a reader has passively reactivated information presented earlier in a text? A popular technique uses the so-called contradiction or inconsistency paradigm (e.g., Albrecht & O'Brien, 1993; Cook & O'Brien, 2014; Hakala & O'Brien, 1995; Lassonde et al., 2012; Rapp et al., 2001; Williams et al., 2018). In one example case, participants read a story in which a protagonist is introduced as a vegetarian, but then later in the narrative (when that trait was no longer in working memory) she orders a cheeseburger for lunch. Most readers find that action anomalous, as measured by longer reading times on the cheeseburger sentence compared with a control condition in which the protagonist was originally described as a junk food addict. Readers detected a global inconsistency, according to the authors, because a resonance process reactivated knowledge of the protagonist's traits described earlier in the passage (Albrecht & O'Brien, 1993).

This account was further tested by manipulating feature overlap, and therefore resonance, with "contextual cues" that were either repeated or not in story passages (Albrecht & Myers, 1995). In one example, a protagonist named Mary is home one evening, sitting in a leather chair, with the goal of making an important phone call by midnight. But before she can make the call her boss contacts her with an urgent task. The story follows Mary for several sentences as she works and eventually completes that new task. At this point in the story, her original goal (phone call) is both unsatisfied and backgrounded (i.e., not in the reader's working memory). The passage continues with Mary deciding to go to bed, which is locally coherent but anomalous if the reader remembers that Mary still needs to make that call. Reading times on the going-to-bed sentence, therefore, were used to detect reactivation of the original goal. The degree of feature overlap was manipulated by either repeating a compound noun phrase that appeared earlier in the passage (e.g., the leather chair), or repeating a simpler version of the phrase (e.g., the chair) to serve as a "contextual cue." Reading times on the target sentences were significantly slower when the contextual cue reappeared just before those target sentences as compared with conditions in which the cue was absent or the goal had been satisfied (Albrecht & Myers, 1995).

These results, again, can be framed in terms of a resonance process in which propositions in working memory (the contextual cue) reactivated propositions in long-term memory (the original goal), with feature overlap among explicitly mentioned propositional constituents (leather chair) triggering the process. Similar effects have obtained with other kinds of contextual cues and narrative features (Greene et al., 1994; Lea et al., 1998; McKoon et al., 1996). Across all these cases, resonance is triggered by the overlap of words containing identical semantic, phonological, and orthographic features (e.g., the repetition of a protagonist's name in the first examples and "leather chair" in the second). These bottom-up, resonance processes have come to be accepted as a necessary, though not sufficient, part of text comprehension (Gerrig & O'Brien, 2005).

Our previous work on alliteration extended these findings by broadening the scope and role of feature overlap and disentangling semantic from phonological contributions. Lea et al. (2008) revised existing poems to test the hypothesis that overlapping phonemes created by alliteration, rather than contextual cue words or protagonist names, should similarly trigger a resonance process. For example, consider the poem presented in Table 1. Note the line toward the end of the poem that reads, *the wooden willowy warp of wildcarrot leaf.* This is the second appearance of alliteration in two of the three experimental versions of the poem. The first instance appears earlier in the poem, where it was used to manipulate feature overlap in three conditions: (1) same alliteration (i.e., same phoneme as the later alliterative line appearing toward the end of the poem); (2) different alliteration (i.e., an alliterative phoneme different from the one at the poem's end); and (3) no alliteration. If repeated phonemes lead to the same resonance

Table 1 Example poem used by Lea et al. (2008) (original poem by William Carlos Williams)

SPRING AND ALL
By the road to the contagious hospital
under the surge of the blue
mottled clouds driven from the
northeast—a cold wind. Beyond, the
waste of broad, muddy fields
brown with dried weeds, standing and fallen
patches of standing water
the scattering of tall trees
Target Lines:
all along the creek-winding road, past Stuart's barn, *{no-alliteration condition}*
all along the raw and rutted road the reddish barn, *{different-alliteration condition}*
all along the way-winding road, wary whispers of the old barn, *{same-alliteration condition}*
purplish, forked, upstanding, twiggy
stuff of bushes and small trees
with dead, brown leaves under them
leafless vines—Lifeless in appearance, sluggish dazed spring approaches—
They enter the new world naked,
cold, uncertain of all
save that they enter. All about them
the cold, familiar wind —Now the grass, tomorrow
Pre-Probe Line and Probe Insertion Point (^)
the **wooden willowy warp of wildcarrot** ^ leaf *{recognition probe: BARN}*
One by one objects are defined – It quickens: clarity, outline of leaf
But now the stark dignity of
entrance—Still, the profound change
has come upon them: rooted, they
grip down and begin to awaken.

effects, then *wooden willowy warp of wildcarrot* should resonate with the earlier /w/ alliteration, if it was read, and reactivate that region of the poem in memory.

A probe recognition task was used to measure reactivation: immediately after reading *wildcarrot* subjects were asked to verify, as quickly as possible, whether or not a probe word (*BARN* in this example) had appeared earlier in the poem. Note that *barn* appeared in all conditions, at the end of the "Target Lines" (see Table 1). If the repetition of consonant phonemes triggered a resonance response, then reaction times to the probe words should be faster as compared with in the two control conditions. Across two experiments, words presented early in a poem were more accessible when alliterative phonemes overlapped between lines than when there was no overlap, as measured with probe recognition latencies. Most strikingly, this increased accessibility obtained not just for words that alliterated, but also to nonalliterating words located in the same poetic line as alliterating words (e.g., *barn*). An implicit memory advantage emerged for sublexical cues and extended beyond those cues to affect proximal content.

An important question is whether rhyme, a different form of poetic repetition from alliteration, might produce similar effects. This offers a test of the generalizability of claims that, to date, have derived from one poetic trope defined in terms of repetition. But rhyme also offers the opportunity to examine the role that anticipation might play in processing predictable material. While alliteration stands on its own, requiring no preceding or following linguistic patterns, rhyme requires at least one acoustic pair, and often follows a systematic pattern. Rhyming schemes can therefore be more or less predictable, and anticipated, depending in part on the preparation of the reader and the content or form of the text. Limericks, for example, follow a familiar rhyming pattern. When a limerick begins "There once was an ape at the zoo," one knows the next line will end with a word like *you* or *flu*, and cannot end with a phoneme combination that fails to rhyme with "zoo." Rhyming schemes, therefore, impose constraints on possible future sounds, usually at the ends of lines, as defined by the scheme. Highly familiar patterns, such as those in Dr. Seuss books or limericks, provide an easy roadmap of sounds to come. For less familiar patterns, such as those found in some poetry, only individuals able to induce the rhyme pattern of a poem can anticipate upcoming sounds and maintain preparedness for the upcoming repetition of a rhyming syllable. Sensitivity to rhyme patterns, then, might constitute a special case of the ability of a reader with appropriate background to use context to constrain anticipated input.

Those constraints might also be imposed by the sound of a potential cue (e.g., Bower & Bolton, 1969). In paired-associate tasks, if *spoon* is the cue, candidates for the pair word can be narrowed to those that end with the phoneme combination /u:n/ (e.g., *moon; loon; June*). Such anticipatory processes are common in a variety of language comprehension contexts (e.g., Tulving et al., 1964). In general, the more constraining the context, the less stimulus-driven information is required. In the text comprehension literature, such anticipatory processes usually focus on future events and are called predictive inferences (e.g., Cook et al., 2001; Corbett & Dosher, 1978; Guéraud et al., 2008; Klin et al., 1999; Lassonde & O'Brien, 2009; McKoon & Ratcliff, 1986; Murray et al., 1993; Potts et al., 1988; Rapp & Gerrig, 2002, 2006). For example, if one reads about an angry husband who hurls a delicate porcelain vase against a brick wall (Potts et al., 1988), or an actress who falls from the 14th floor of a building (McKoon & Ratcliff, 1986), or a sailor who swept the floor in the cabin (Singer, 1979), one can infer, without reading further, that the vase broke, the actress died, and that the sailor used a broom, respectively.

The extent to which readers routinely activate such inferences has been controversial, though many researchers agree that the more constraining the context, the more likely these inferences are to be made (e.g., Murray et al., 1993; Singer & Lea, 2012). Indeed, predictive responses to text and unfolding discourse have received substantial and currently renewed interest among language researchers (e.g., Borovsky et al., 2012; Cook et al., 2014; Cook & O'Brien, 2015; Huettig, 2015; Kuperberg & Jaeger, 2016; Lupyan & Clark, 2015). Results from this work indicates that prediction is informed by current and prior contexts (Altmann & Mirković, 2009); that anticipatory eye movements involve both nonpredictive thematic priming and active prediction (Kukona et al., 2011); that general world knowledge is likely driver of linguistic expectancy generation (Metusalem et al., 2012); and that prediction can be strongly related to discourse, and not solely due to priming (Otten & Van Berkum, 2008). Some of this work emphasizes a role for anticipatory processes that, given sufficient constraining context, can prepare the reader for what might come next in a text (e.g., Ferreira & Chantavarin, 2018). All of this work assumes that "context," "discourse," and "world knowledge" enter into what Kintsch (1988) would call a "situation model," a meaningful discourse representation of a state affairs described in a text. Rhyme offers an intriguing and important opportunity to understand anticipation at the level of phonemes, or what Kintsch would call "surface code." This prompts us to ask whether readers spontaneously anticipate not only words but also sounds, understood as predictable line-ending rhymes while reading a poem, and if so, whether the predictions depend upon the reader's familiarity with rhyme. Here, again, poetry provides a rich and naturalistic testing ground for these hypotheses.

The present study

This project examined whether rhyme can produce both memory-reactivation effects such as those found with alliteration (Lea et al., 2008) and anticipatory processes such as those previously found with semantic content under specific constraints. In the current experiments, participants read poems whose rhyme schemes had regular patterns. We tested whether a word presented early in the poems was more accessible to readers when that word had appeared in a line that rhymed, or did not rhyme, with a line-ending word at the time of test (henceforth, the *rhyme* and *no-rhyme* conditions; see Table 2 for examples). If the repetition of rhyme produces reactivation effects similar to those obtained with alliteration, we should see recognition probe facilitation in the *rhyme* as compared with the *no-rhyme* condition. We obtained evidence for such effects in Experiment 1, but no evidence that the rhyme was anticipated before it was presented. In Experiment 2, we recruited participants especially experienced with rhyme (poets, rap artists, graduate students in English). These participants replicated the probe facilitations obtained in Experiment 1, but also revealed anticipations of upcoming rhymes. This suggests that rhyme can spontaneously reactivate associated information via bottom-up processes and, for experts, these reactivations can also be triggered by anticipatory processes. The results

Table 2 Example poems used in the present experiments. Participants read either the rhyme or no-rhyme version of the poem. Recognition probe locations are identified by the symbol ^. The original version of HOPE was written by Thomas Campbell; the original version of THE CASTLE was written by James Thompson. The original poems were modified to create both rhyme and no-rhyme versions

HOPE
Eternal Hope! When yonder spheres sublime
Pealed their first notes to sound the march of Time,
Thy joyous youth began—but not to fade.

Rhyme **condition**
With all the brother planets sad decayed;
When fiery the realms glow with bad grime

No-rhyme **condition**
When all the sister planets have decayed;
When fiery the realms glow with sad grime

And Heaven's last thunder shakes the world's prime
Thou shalt smile o'er the earth's ruined crusade,
And light thy torch at Nature's funeral ^ parade^.
We'll curse and cry as open blood to a lime,
And wonder how to undo our grievous crime.

Recognition Probe word: SAD

THE CASTLE
The doors, that knew no shrill alarming bell
Self-opened into halls, where who can tell
What cursed knocker plied by villain's hand,

Rhyme condition
What elegance and grandeur wide expand;
And endless pillows rise for heads that fell;

No-rhyme condition
What elegance and grandeur do expand;
And endless pillows rise for heads that wide fell;

So that each spacious room was one full-swell
And couches stretched around in seemly band;
The pride of Turkey and of Persia ^ land^.
Await the musicians whose sounds cast a spell
To delay our leave of their land they impel.

Recognition Probe word: WIDE

support memory-based accounts of reading by highlighting the role of sublexical cues for influencing the accessibility of previously read information. They also broaden previous findings about the overlap required for memory-based processing, and reveal how anticipatory processes interact with memory-based processes for experienced readers in the service of comprehension.

Experiment 1

Experiment 1 investigated whether overlapping rhyme sounds produce reactivation effects comparable to those observed for alliteration (Lea et al., 2008). The design also allowed for measuring the effects of anticipated rhyme in a relatively non-specialist sample.

Method

Participants Thirty Macalester College undergraduates participated for partial course credit. All were native speakers of English.

Materials We selected 24 published poems in the public domain as experimental stimuli. The criteria for selecting poems were (a) they were unlikely to be recognized even by people who frequently read poetry; (b) they each contained regularly *aabb* rhyming patterns; (c) none was longer than a page in length (average length = 77 words); (d) they were composed in English; and (e) they all used perfect rhymes in which the phonemes of the nuclei and codas of final syllables in adjacent lines matched. Two example poems are presented in Table 2.

We tested reactivation via a probe recognition task, following our previous work in this area (Lea et al., 2008) and other research related to reactivation (e.g., Cook et al., 2005; Green, et al. 1994; Lea et al., 2002; Lea et al., 1998; Love et al., 2010; McKoon & Ratcliff, 1992; Weingartner & Myers, 2013) . In the present study, the word "sad" served as the probe word in the first example passage in Table 2; the participants' task was to indicate as quickly as possible whether or not that word had appeared in the poem they were reading. The probe appeared either immediately *before* or *after* the word "parade" in the poem's eighth line (henceforth, probe position will be labeled as "*before*" or "*after*"). The word "sad" appeared in either the fourth line (*rhyme* condition) or fifth line (*no-rhyme* condition) of the poem. This poem was written with an *aabb* rhyming scheme. The *a* lines rhyme with /aɪm/ (sublime; time; grime; prime; lime; crime); the *b* lines rhyme with /eɪd/ (fade; decayed; crusade; parade). Note that the probe task occurred either at or near the end of a *b* line (^parade^). In the *rhyme* version of the poem, the target word "sad" appeared in a *b* line (… sad decayed). To create *no-rhyme* versions, we moved the target word to a position one line later in the poem (… sad grime) so that it was in an *a* line. Note that all versions of the poems rhymed; we labelled this condition "*no-rhyme*" because the target word appeared in a line that did not rhyme with the probe line. The distance between the probe position and the earlier presentation of the probe word was the three lines in the *no-rhyme* condition, and *four lines* in the rhyme condition. This pattern was the same in all experimental poems.

If the repetition of the *b* rhyme reactivated a word presented earlier in the passage, then recognition response times should be faster and more accurate in the *rhyme* as compared with the *no-rhyme* conditions. This prediction, however, would only hold in the *after* probe position. Responses to *before* probes should not be different between the two *rhyme* conditions because the rhyming component would not yet have been experienced. Thus, our design featured two control conditions with which to compare the critical *after*/*rhyme* condition: (1) the *after*/*no-rhyme* condition (no reactivation is predicted because the target word appeared in a line with a different rhyme); and (2) the *before*/*rhyme* condition (no reactivation is predicted because the probe is presented before the line-ending rhyme is read). If repeated rhymes produce reactivation effects, a rhyming condition by cue position interaction should be found.

Twenty-four filler poems (average length = 96 words) with varying rhyme schemes were included to provide negative cases for the recognition task and to obscure other patterns in the stimuli. Recognition probes appeared early in one third of the fillers, in the middle in another third, and toward the end of the remaining third. Positive recognition probes (i.e., those that matched a word earlier in the poem) were equally often taken from the early, middle, and late parts of the fillers.

Each poem was followed by a comprehension question (yes/no statement); half asked about propositional content (e.g., "The poem describes leaves in a forest"), and the remainder asked about thematic features (e.g., "This is a poem about falling in love"). Correct answers were balanced equally between "yes" and "no."

Procedure Poems were presented in a random order, with participants reading at their own pace. They advanced line-by-line through the poems by pressing the "continue" key on a response box; in a minority of cases (the Before probe conditions, and 25% of the fillers) a line of the poem was presented in less than its complete form, to accommodate presentation of the probe. At the test point in each poem, a "GET READY" signal appeared for 500 ms, followed by a word in capital letters and surrounded by asterisks (e.g., "*SAD*"). Participants responded "yes" if the word had appeared in the poem they were reading and "no" if it had not. Accuracy feedback was provided. The poem resumed after the response. A comprehension question followed each poem.

Results and discussion

Overall, the comprehension-question accuracy rate was 89% (rates were 87%, 90%, 91%, and 88% for the *no-rhyme/before, no-rhyme/after, rhyme/before,* and *rhyme/after,* conditions, respectively), and did not differ across conditions ($p >$ .30). The data of interest consisted of response times to recognition probes, and reading times to the poem contents were not collected. Only accurate probe recognition responses were analyzed (86% of responses). Responses more than three standard deviations from a participant's mean were identified as outliers and discarded, resulting in the loss of less than 5% of the data. The model-adjusted means appear in Table 3. Overall, recognition times were descriptively faster in the *after/rhyme* condition as compared with the other three conditions, indicating a 364-ms facilitation effect compared with when the probe was presented one word earlier (*before/rhyme*), and a 324 ms effect as compared with the *no-rhyme* control (*after/no-rhyme*).

Using SPSS syntax provided by Carson and Beeson (2013); see also Chan et al., 2018), four crossed-random-effect models were constructed to analyze the data (see Table 4 for a detailed description of the models and analyses). The first model was a null model intended to estimate the amount of residual deviation from the grand mean before random and fixed effects were entered into the equation. The second model was a random-effects model, with participants and poems entered as random effects. Then, the main effects of rhyme and probe position were entered into the third model. Finally, the interaction term was also entered into the equation, giving rise to the fourth model. No predictions were made about the main effects, though for completeness we report that analyses of fixed effects revealed significant main effects for rhyme, $F(1, 1161) = 13.14$, $p < .001$, and probe position, $F(1, 1067) = 24.70$, $p < .001$. The latter main effect showed that, on average, response time to probes that followed the line-ending word were faster when compared with those that preceded that word; the former effect indicates that the marginal mean for the *rhyme* condition was smaller than the *no-rhyme* marginal mean. As shown in Table 3, these effects appear to be driven by the *rhyme-after* mean. The Rhyme × Probe interaction, which was the predicted critical comparison, was significant, $F(1, 1163) = 21.22$, $p < .001$. Post hoc comparisons on the estimated marginal means from the final mixed model with the Bonferroni adjustment for multiple comparisons indicated that the *rhyme-after* mean was significantly faster than the mean in the other three conditions (all $ps < .001$), which were not different from each other ($ps > .49$). In sum, the same sort of reactivation effects previously observed for alliteration were obtained for rhymes. This result further establishes that phonological overlap, in the absence of orthographic or semantic overlap, is sufficient to trigger passive memory processes like resonance.

Table 3 Experiment 1 recognition task mean response times in milliseconds (and standard errors of the mean) by rhyme and probe conditions

	Probe position		
	Before	After	Difference
No-rhyme	1,441	1424	17
	(43.98)	(44.09)	
Rhyme	1479	1109	370
	(46.30)	(44.84)	
Difference	−38	315	

At the same time, in contrast to alliteration, poetic rhyme can follow regularized and recurring patterns that allow upcoming instances to be anticipated. While considerable research has demonstrated constraint-based word anticipation in sentence processing, no research has demonstrated such capacity in connection with rhyme. We exploited the regular patterning of rhyme to explore the possibility that people who may be especially attuned to phonology in general, and rhyme in particular, might anticipate an upcoming rhyme before it is presented. For example, the *aabb* rhyme scheme of the first example poem in Table 2 ensures that the eighth line must end with a word that rhymes with "crusade." If an accomplished rhymer were to "hear" the /eɪd/ sound as the line marched toward its end, that internal stimulus might serve the same role that reading the word "parade" did in Experiment 1. In terms of memory-based processing, those expert in rhyme have considerable experience with rhyme in poetry that follows regular patterns. Such experience might mean that, once a reader had processed an initial rhyme in a rhyming pair, they could anticipate the same rhyme at the end of the succeeding line. Our hypothesis was that, if such preparedness involves anticipation of previously processed rhyming phonemes, it would create enough constraining context to support reactivation of previously read material.

Such internally derived, anticipatory cues are not uncommon in psycholinguistics, as discussed earlier. However, the undergraduate participants in Experiment 1 did not produce evidence for this sort of anticipatory effect. In Experiment 2, we recruited a sample of what we will call rhyme experts—poets, rap artists, graduate students in English—to test this anticipatory-sound hypothesis. We turned to experts so that we would have a sample of readers with sufficient background knowledge and experience thinking about and interacting with rhymes that rhyming patterns might create a state of preparedness or expectations for rhymes at the end of lines. In all cases, these readers possessed background knowledge that included extensive knowledge of poetry and rhyme. Consider that before 1900, almost all poetry in English was rhyming poetry; even today, rhyming poetry is prevalent in jingles, song lyrics,

Table 4 Models used in Experiment 1

Model # (description)	Participants (random)	Items (random)	Rhyme (fixed) Estimate	Probe (fixed) Estimate	Rhyme × Probe (fixed) Estimate	Model fit improvement
1 (empty)						
2 (add two random factors)	Wald $Z = 1.35$ $p = .176$	Wald $Z = 1.44$ $p = .151$				$\chi^2(2) = 7.05$; $p < .05$
3 (add two fixed factors)	Wald $Z = 1.60$ $p = .110$	Wald $Z = 1.48$ $p = .139$	143.37***	188.132***.		$\chi^2(2) = 54.76$; $p < .001$
4 (add Rhyme × Cue interaction)	Wald $Z = 1.60$ $p = .144$	Wald $Z = 1.51$ $p = .132$	315.25***	370.00***	−352.96***	$\chi^2(1) = 31.50$; $p < .001$

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

and hymns. Poets and graduate students in English are required by their course of study to know this material. As for rap artists, rhyme is one of the basic organizing principles of all rap lyrics; besides being a critical component of prepared lyrics and rehearsed lines, rap artists may participate in rap battling which requires spontaneously generating complex rhymes. In our study, as is true of other expert–novice studies involving literary expertise (e.g., Peskin, 1998), institutional recognition of expertise such as educational position, publication, or performance history, defined who counted as an expert. The question that we explored was whether experts, through their knowledge of rhyme, have a state of preparedness in reading rhyming poetry that might lead to resonance effects even in advance of the reappearance of a rhyming phoneme at the end of a line of poetry. We recruited a sample of novice college sophomores to compare with these experts and to replicate the results of Experiment 1.

Experiment 2

Experiment 2 was an expert–novice study testing whether experts' experience with rhyme affords the anticipation of the ending sound of a line of poetry. If it does, we expected to obtain resonance effects in the absence of an explicitly presented stimulus. This finding would (a) broaden understanding of what constitutes a memory cue in reading, and (b) reveal when during the reading process such a cue might have its effect. Rhyming experts were operationally defined as people who had extended and profession-related experience with poetry and/or rhyme.

Method

Participants A total of 81 people participated in this experiment. The expert sample included 33 poets, rap artists, English professors, and advanced graduate students in an English PhD program, ranging in age from 26 to 48 years. The poets and rap artists were recruited directly from community literary centers and artists groups, and by word of mouth; English professors were recruited from Macalester College; graduate students were recruited from the University of Minnesota English department. Each received a $12 gift certificate for their participation. The novice sample included 48 Macalester undergraduates who participated for partial course credit. All participants were native speakers of English.

Materials and procedure The materials and procedure were identical to Experiment 1 with the following exceptions: Participants made their responses on a keyboard rather than a response box. Expert participants were run on a laptop in a variety of quiet settings, while novice participants again were run in a research lab.

Results and discussion

Overall, the comprehension-question accuracy rate was 88% and did not differ across the conditions ($p > .60$) or between groups ($p > .20$). The accuracy rates for novices were 88%, 86%, 89%, and 87% for the *no-rhyme/before, no-rhyme/after, rhyme/before,* and *rhyme/after,* conditions, respectively; for experts, they were, in the same order of conditions, 89%, 88%, 89%, and 90%. Only accurate recognition probe responses were analyzed (87% of responses). Responses more than three standard deviations from a participant's mean were identified as outliers and discarded. This resulted in the loss of less than 5% of the data.

Novice sample The model-adjusted means for the novice sample appear in the top half of Table 5. The pattern of means was similar to those obtained in Experiment 1. Overall, response times were descriptively faster for the novices in Experiment 2 than the novice participants sampled in Experiment 1. We have no ready explanation for this result. The only difference in materials and procedure was that keyboards were used to measure responses in Experiment 2, instead of the response boxes used in Experiment 1.

The same cross-random-effects models used in Experiment 1 were computed in Experiment 2 (see Table 6 for details about the four models). As predicted, the final and best-fitting model

Table 5 Experiment 2 recognition task mean response times in milliseconds (and standard errors of the mean) by rhyme and probe conditions for both novice and expert groups

		Probe position		
		Before	After	Difference
Novice group	No-rhyme	1,259 (44.63)	1,267 (44.07)	8
	Rhyme	1,274 (44.91)	1,106 (44.70)	168
	Difference	−15	161	
Expert group	No-rhyme	1,372 (79.11)	1,423 (79.23)	−51
	Rhyme	1,219 (79.75)	1,189 (79.72)	30
	Difference	153	234	

included participants and items as random variables, and rhyme, probe, and their interaction as fixed factors. As in Experiment 1, the main effects for both rhyme and probe were significant, $F(1, 1171) = 5.34$, $p = .021$, and $F(1, 1190) = 6.24$, $p = .013$, respectively. Once again, these effects appear to be driven by the predicted Rhyme × Probe interaction, which also was significant, $F(1, 1174) = 7.77$, $p = .005$. Bonferroni-adjusted post hoc comparisons on the estimated marginal means from the final mixed model found that the *rhyme-after* mean was significantly faster than the other three condition means (all *p*s < .001). No difference was found between the means in the two *no-rhyme* conditions, or in the two before conditions (all *p*s > 50). These results replicated the findings from Experiment 1.

Expert sample The model-adjusted means for the expert sample (bottom half of Table 5) reveal a different pattern than observed for the novice findings. Specifically, there was no evidence of a Rhyme × Probe interaction; probe response times were fast in both probe positions in the rhyme conditions, compared with in the no-rhyme conditions. The same set of four models (Carson & Beeson, 2013) was computed (see Table 7). As with the novice sample, the final and best-fitting model revealed a significant main effect for rhyme, $F(1, 566) = 15.71$, $p < .001$. Unlike the novice sample, the main effect for probe was not significant, $F(1, 580) = .044$ $p > .834$. This difference between samples was driven by the relatively fast *rhyme*-before mean, which appears to have eliminated the interaction. Indeed, the Rhyme × Probe interaction was not significant, $F(1, 572) = .69$, $p > .40$. Bonferroni-adjusted post hoc comparisons on the estimated marginal means from the final mixed model confirmed that neither the two rhyme means, nor the two *no-rhyme* means, were different (*p*s > .39), and that each of the two *rhyme* means were significantly faster than each of the two *no-rhyme* means (*p*s < .03).

Comparing experts and novices For the expert sample, the reactivation processes triggered by overlapping rhyme sounds were comparable *before* and *after* the second sound was visually available. We found no evidence for this sort of anticipatory effect in either of the novice groups. The difference between our expert and novice groups on the anticipating-sound effect could be captured by a three-way Rhyme × Probe × Expertise interaction, which would show that the Rhyme × Probe interaction exhibited by novices is statistically distinguishable from the lack of that interaction with experts. When the combined data from both groups were entered into a set of five mixed-effects models (see Table 8), this three-way interaction was significant: $F(1, 1753) = 2.69$, $p < .05$. Therefore, we found strong evidence for a difference in the way novices and experts responded to rhymes; experts showed evidence of reactivation effects in terms of speeded probe responses before the presentation of the rhyme, while novices did not.

General discussion

Poetic features such as rhyme and alliteration have long been discussed as aesthetic features of linguistic creations that potentially afford memorial and comprehension-related benefits

Table 6 Models used in Experiment 2 (novices)

Model # (description)	Participants (random)	Items (random)	Rhyme (fixed) Estimate	Probe (fixed) Estimate	Rhyme × Probe (fixed) Estimate	Model fit improvement
1 (empty)						
2 (add two random factors)	Wald $Z = 3.55$ $p < .001$	Wald $Z = 1.54$ $p = .124$				$\chi^2(2) = 70.25$; $p < .001$
3 (add two fixed factors)	Wald $Z = 3.52$ $p < .001$	Wald $Z = 1.53$ $p = .127$	74.96*	78.80*		$\chi^2(2) = 28.95$; $p < .001$
4 (add Rhyme × Cue interaction)	Wald $Z = 3.54$ $p = .001$	Wald $Z = 1.58$ $p = .114$	160.54*	167.55*	−17.55**	$\chi^2(1) = 17.86$; $p < .001$

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

Table 7 Models used in Experiment 2 (experts)

Model # (description)	Participants (random)	Items (random)	Rhyme (fixed) Estimate	Probe (fixed) Estimate	Rhyme × Probe (fixed) Estimate	Model fit improvement
1 (empty)						
2 (add two random factors)	Wald $Z = 3.30$ $p = .001$	Wald $Z = 1.99$ $p = .047$				$\chi^2(2) = 88.96$; $p < .001$
3 (add two fixed factors)	Wald $Z = 3.31$ $p = .001$	Wald $Z = 1.96$ $p = .050$	194.54***	−10.65		$\chi^2(2) = 34.99$; $p < .001$
4 (add Rhyme × Cue interaction)	Wald $Z = 3.31$ $p = .001$	Wald $Z = 1.97$ $p = .049$	234.68***	30.24	−81.60	$\chi^2(1) = 11.70$; $p < .001$

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

for author and reader. The mechanisms associated with these potential benefits include reactivations of previously encountered information, with repeating sounds and letter sequences serving as reminders of earlier poetic content, and established sequences affording cues for anticipating upcoming poetic content. The current study tested these claims by examining whether rhymes in poetry could help reactivate previously read information and whether some readers could anticipate those rhymes to afford reactivation.

In Experiment 1, undergraduate participants read poems containing systematic rhyme schemes that, by definition, recurred throughout the poem. Responses to recognition probe words were faster when they appeared in an earlier line that rhymed with, rather than did not rhyme with, the one being read. This was true even though the target word was closer to the probe location in the *no-rhyme* condition. A reactivation advantage did not obtain in the *rhyme* condition if the probe location preceded the line-ending rhyme. This pattern establishes rhyme as the key element that reactivated earlier elements of the poem. This represents both an extension of earlier work (Lea et al., 2008), and an advance in understanding the memory effects of rhyme. A debate in the field has centered on the topic of feature overlap as the trigger for associative memory processes. In previous work, we demonstrated that such overlap is not restricted solely to words with semantic content linked to unfolding narrative descriptions. Rather, this overlap can also extend to the sublexical level in both poetry and prose, associated previously with alliterations and, as demonstrated here, with rhyme. This extension expands how overlap has traditionally been understood by underscoring that resonance processes can be triggered by psycholinguistic elements beyond semantic ones. This has implications both for understanding the processes by which information might be reactivated in memory (i.e., based on not just meaning but also phonemes), but also the consequences of such reactivations with real world materials (e.g., one way in which poetry invokes reader responses and interpretations).

A critical difference between alliteration and rhyme as literary devices is that the latter presents the opportunity to test hypotheses about how sounds that can be anticipated may affect the moment-to-moment processing of poems. While re-mentioned sublexical information can reactivate earlier

Table 8 Models used in Experiment 2 to test the Rhyme × Probe × Subject Group interaction

Model # (description)	Participants (random)	Items (random)	Rhyme (fixed) Estimate	Probe (fixed) Estimate	Subject group (fixed) Estimate	Rhyme × Probe (fixed) Estimate	Rhyme × Probe × Subject Group (fixed) Estimate	Model fit improvement
1 (empty)								
2 (add two random factors)	Wald $Z = 4.94$ $p < .001$	Wald $Z = 2.42$ $p = .015$						$\chi^2(2) = 180.90$; $p < .001$
3 (add three fixed factors)	Wald $Z = 4.89$ $p < .001$	Wald $Z = 2.39$ $p = .017$	112.40***	49.82	−70.57			$\chi^2(2) = 49.06$; $p < .001$
4 (add Rhyme x Cue interaction)	Wald $Z = 4.91$ $p < .001$	Wald $Z = 2.41$ $p = .016$	*183.23****	*123.06*	*−70.94*	−145.16**		$\chi^2(1) = 17.16$; $p < .001$
5 (add Rhyme x Cue x Subject Group interaction)	Wald $Z = 4.92$ $p < .001$	Wald $Z = 2.42$ $p = .016$	*232.95****	*32.93*	*−72.30*	*−73.39*	134.75*	$\chi^2(3) = 39.18$; $p < .001$

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

information, it was a plausible but untested hypothesis that unmentioned but likely upcoming sounds could similarly afford reactivations before they were read. Expert readers may be prepared for the recurrence of rhyme in ways that would be sufficient to create resonance effects on their own, despite those readers never actually reading or hearing particular phonemes. We tested this hypothesis in Experiment 2. Under the right conditions, readers can activate inferences about predictable though-as-yet-unmentioned events (e.g., Cook & O'Brien, 2015; Murray et al., 1993). If the instantiation of a future text element (word; action; event; rhyme) is highly constrained by context, then the presentation of that element will be easier to process as a function of being anticipated by the reader. The triggering of memory-based reactivations could, in theory, not even require explicit presentation for processing to occur, and instead be driven by predictive inferences as suggested by the expert patterns.

This possibility is not just a theoretical extension of prior work, but was actually demonstrated decades ago by Tulving et al. (1964) in a classic word-identification study. The researchers manipulated the quality of a target stimulus (a word) by varying its presentation duration (0–140 ms), while also manipulating the amount of predictive context subjects saw via a sentence stem of varying length (0, 2, 4, or 8 words) that the target word completed. For example, parts or all of the sentence stem "The political leader was challenged by a dangerous . . ." preceded brief presentation (0–140 ms) of the target word "opponent." The subjects' task was to identify the word that had been flashed, and they were told that the sentence stems might help in identifying the word. When subjects were provided with all eight words of context but were shown a flash of light instead of a word (the 0 ms condition), subjects produced the "correct" answer approximately 15% of the time, compared with 0% when two or fewer words of context were provided. The context provided by the sentence stem prompted subjects to "see"—anticipate, really—a word that had not appeared. When top-down context is sufficient, no stimulus-driven processing is necessary—indeed, no stimulus is necessary.

In Experiment 2, we created a similar situation with the *rhyme/before* condition. Having induced the rhyme scheme, either consciously or not, experts anticipated the rhyme sound of the final word of the line they were reading. As the end of the line became imminent, that anticipated sound triggered a resonance process that immediately reactivated content associated with that rhyming sound. The rhyme sound was "heard"—anticipated, really—and processes unfolded unaware of or concerned with the provenance of the sound. As a result, the recognition-probe data for experts was indistinguishable for the two probe locations in the *rhyme* condition; recognition times were speeded whether participants read or anticipated the line-ending rhyme. These results stand in contrast to the patterns produced by non-experts who showed no evidence of anticipating rhymes, replicating the results of Experiment 1.

The post-rhyme reactivation effects produced by our non-expert participants are well explained by memory-based processing alone (i.e., reactivations of previous encoded poetic contents; e.g., Cook & O'Brien, 2015; Gerrig & O'Brien, 2005). An explanation for the anticipatory effects produced by our experts, however, may require the contribution of processes that lie beyond the scope of bottom-up memory processes. As mentioned earlier, predictive responses to stimuli have reemerged as a topic of interest as applied in the service of language processing (e.g., Boudewyn et al., 2015; Brothers et al., 2017; Ferreira & Chantavarin, 2018; Griffiths et al., 2010; Huettig, 2015). Much of the psycholinguistic research in this area concerns lexical prediction during sentence processing, not line-ending rhymes in poetry (although see Rapp & Samuel, 2002, for one example). Still, this literature provides rich new theoretical ground with which to understand our experts' behavior. One general approach to prediction assumes that the processor combines background knowledge (conceptualized as "backwards flow" or statistical "priors") with incoming sensory information to produce predictions in the form of hypotheses about the probable state of the world (e.g., Lupyan & Clark, 2015) or likelihood estimates about upcoming linguistic events (e.g., Griffiths et al., 2010). Related work also maintains a distinction between top-down and bottom-up processing in prediction, but emphasizes the role that strategies play in the top-down component (Brothers et al., 2017). These approaches thus focus on what readers might strategically enact or contemplate, highlighting top-down influences on unfolding language experiences.

In contrast, one could imagine a set of memory-based events that might explain our experts' behavior (e.g., Cook & O'Brien, 2015). By this view, schematic information about rhyme patterns could be passively activated from memory as experts read the first part of each poem, in much the same way that reading about a protagonist entering a restaurant passively activates knowledge structures related to dining out (e.g., Bower et al., 1979). The phonemic values present in the poem would be used to fill in the variable slots in the abstract schema (e.g., the *a*s and *b*s in an *aabbaabb* rhyme pattern). At this point the system has activated enough information in working memory to anticipate upcoming end-of-line rhymes. This approach eschews strategic, top-down assumptions associated with prediction in favor of passive memory processes that produce behavior that appears as though it had been predicted.

A recent proposal by Ferreira and Chantavarin (2018) adopts a similar stance by proposing that the term *prediction* be replaced by *preparedness*. By this view, as a reader progresses through a text, incoming linguistic information passively activates related background knowledge (e.g., via resonance). This leads to an increasingly rich representation of the text used to anticipate incoming content. This anticipation, however, is characterized as a passively emerging state of preparedness for what might come next, rather than active prediction. Importantly for explaining our experts' behavior, these authors propose that preparedness may apply not only to upcoming semantic events, but also to phonological features, and the preactivation of future content may well be how preparedness is instantiated in the system (Ferreira & Chantavarin, 2018, p. 445). This explanation affords the intriguing possibility that the observed effects reported in these experiments, usually discussed with respect to expert strategies, can emerge as a function of bottom-up memory activations, shaped by the expert memory representations invoked during reading. Indeed, Gerrig and McKoon (1998) used the term "readiness" to describe such functionality of memory-based text processing.

The expert–novice differences found in the present research fit well with this account. All of the participants were engaged in processes that prepared them for upcoming content in the poems. For the experts, but not the novices, this preparedness included information about rhyme patterns generally, and the rhyme scheme of the poem they were reading specifically. As they approached the end of a mid-poem line, the upcoming rhyme sound was preactivated, which triggered the resonance effects detected in the *before/rhyme* condition. This preactivation did not occur for the novices, who needed the rhyme to be activated by its explicit presentation.

These conclusions are qualified by questions that remain unanswered. For example, we have assumed that the key factor differentiating experts from novices involves their prior experience and proficiency with rhyme. However, other possibilities remain to be tested. The expert sample was, on average, older and probably more educated than the college sophomores. Given their professional interest in poetry and language, the experts likely were relatively high in verbal intelligence. Superior working memory (WM) capacity might also have afforded the experts an advantage by providing cognitive resources that could be devoted to activities such as anticipating rhymes. Indeed, some conceptions of working memory capacity allow a role for expertise. Ericsson and Kintsch (1995), for example, proposed that one element of expertise is the skilled use of mental representations that optimize what they describe as long-term working memory. According to these authors, experts can access content from these representations at a speed akin to information from ordinary WM. This account of what may set experts apart shares features with processes, as described earlier, that involve specialized schemas and automatic preparatory processes. Thus, while we can report that experts processed the poems differently than novices, we cannot pinpoint the complete set of factors that contributed to that difference. Future research is needed to identify how expertise with rhyme, and presumably other rule-based, predictable systems and comprehender characteristics, are instantiated cognitively.

Another question for future research concerns the limits of processes such as resonance in returning information to WM. This study, our previous work with alliteration, and other research projects have shown that overlapping features in a text can reactivate information from a reader's long-term memory of the text. Less is known about the boundary conditions of these processes. For example, one might wonder if all lines in a poem are reactivated when a matching rhyme is read. That seems unlikely given limits to WM, but we cannot be sure. Resonance theorists have identified several textual factors such as distance in a passage, amount of elaboration of the backgrounded target, and amount of feature overlap that all affect the probability of successful reactivation (e.g., Myers & O'Brien, 1998). Questions remain, however, as to how much overlap is needed to trigger such processes; what limits exist to the quantity of overlapping information that can be reactivated by a single concept; and what cognitive processes, if any, might compete or interfere with resonance. Further theoretical development of memory-based models of text processing is needed to address these questions.

It might be argued that the use of recognition probes in our experiments opens the possibility that our effects are partially due to backward integration between the probe and the text (e.g., Potts et al., 1988). Tasks that require binary decisions, such as recognition and lexical decision, but not naming, are thought to be sensitive to processes other than those under investigation (Keenan et al., 1990). This issue, sometimes called *context checking*, can be especially problematic when researchers are trying to distinguish between inferences that were drawn *during* the reading of a text from inferences that were drawn *at the point of the task response*. For example, if the "inference" version of a text is contextually more similar to a probe word than the "no-inference" version, decision thresholds for "yes" responses times can be reduced simply because of that similarity, thus speeding probes in the inference condition (Balota & Chumbley, 1984; Forster, 1981). In the present study, by contrast, creating different versions of the poems did not require creating different contexts. Indeed, in the *before* condition we found that the difference in response times between the *no-rhyme* and *rhyme* conditions for novices were small, −38 and −15 milliseconds in Experiments 1 and 2, respectively (the negative sign indicates that the "inference" condition [rhyme] was slightly slower, not faster, than the control; see Tables 3 and 5). Therefore, backwards integration processes, such as context checking, are unlikely to have contributed to our results.

A related backwards integration account of our effects might propose that when the probe word was combined with a rhyme cue, retrieval is easier and faster. This explanation is consistent with research described in the introduction that demonstrates how rhymes can be effective mnemonic retrieval cues, especially when combined with other information (e.g., Bower & Bolton, 1969; Rubin, 1995). This alternative account assumes that a more strategic retrieval process is in play—one driven by the presentation of the probe word together with the rhyme, which differs from our claim that responses were speeded because resonance, triggered by overlapping rhyme sounds, automatically reactivated previous poetic content. There are several problems with this alternative strategic account, but the most compelling is that it is inconsistent with the data. Consider the *no-rhyme/after* condition in which the subject can use both the rhyme (parade) and the probe word (SAD) as retrieval cues to determine if SAD had appeared in the poem. From the perspective of this alternative account, the subject would begin searching memory for the combination of SAD and the phoneme /eɪd/, which would lead to several places in the poem other than the non-rhyming line that contained SAD. Since the rhyming sound would be an especially poor retrieval cue in this condition, we would expect recognition to be slower as compared with in the *no-rhyme/before* condition where the word that preceded the probe did not produce a rhyme. Looking at the data, however, the *no-rhyme/after* probes were 17-ms faster—not slower—than *no-rhyme/before* probes (see Table 3). In Experiment 2 the novice response times in these conditions were essentially identical (Table 5). Therefore, this strategic account is an unlikely explanation of our results.

Our data are not diagnostic with respect to identifying the amount of bottom-up or top-down activity invoked in the task, nor with respect to whether any associated processes and responses are best characterized as prediction, anticipation, preparedness, or something else. Further research is needed to adjudicate among the competing theoretical accounts of this, and related, effects. The patterns reported in the current work highlight the potential benefits on memory and comprehension of poetic features. Features like rhyme and alliteration have long been argued to influence both affective and cognitive responses to text. As we noted earlier, cognitive considerations have been foregrounded in a variety of developmental accounts and interventions intended to support emerging reading, conversation, and literacy skills. The benefits, though, are not limited to supporting children's developing abilities; they also support people's general thoughts and understandings of language contents. The psychological consequences of exposure to rhyme prove beneficial both for helping remember earlier portions of texts that may enhance a poetic experience and in fostering recall of related text content (whether related by semantics or sound). The current results indicate that these effects also become more powerful with experience, affording guidance for a skilled reader to enact associative recall when it may be most relevant, and perhaps even beforehand.

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