

Between Whispers and Screams: Loudness Standard Deviation as a Proxy for Explicit Content Detection in US Romance Novels

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Abstract

This study proposes and tests loudness standard deviation (SD) of fictional sound events as an acoustically grounded proxy for detecting explicit content in romance fiction. Working with a subcorpus of novels from the Harlequin *Men Made in America* series, scenes were annotated for *character sound* and *ambient sound* with loudness levels. Additionally, the scenes were annotated on a ternary severity scale with two content advisory categories drawn from the PG-story taxonomy, SEX & NUDITY and VIOLENCE & SCARINESS (Tsai et al., 2024), and tested whether within-scene loudness SD of *character sound* and *ambient sound* correlates with either category. Loudness standard deviation analyses of *character sound* and *ambient sounds* in scenes featuring explicit content reveal that *erotic* scenes are acoustically marked by significantly higher variability in character-produced sounds, reflecting the dynamic range from whispered dialogue to vocalized arousal. *Character sound* SD is likewise significantly elevated in scenes of elevated VIOLENCE & SCARINESS, suggesting that loudness variability may mark narratively significant scenes more broadly rather than eroticism specifically, while no significant correlation was found between *ambient sound* loudness SD and either content category.

1 Introduction

Near the end of Carla Cassidy’s *Midnight Wishes* (1997), two characters are tied back-to-back to chairs in a burning room. The scene unfolds across two passages of mounting acoustic intensity: first an eerie silence broken only by frantic breathing and muffled struggling, then screaming, coughing, the growl of the fire, the snap and crackle of burning fabric, and finally a moment of quiet resignation in which the two protagonists entwine their fingers and wait for death through being burned alive. In Guhr’s sound annotation framework (Guhr

and Algee-Hewitt, 2024; Guhr, 2026; Guhr and Mahlberg, 2026), this scene moves from *ambient* silence through *character sounds* of escalating distress to the roaring din of the fire itself, with loudness values oscillating across the full scale.

A content advisory system would flag it without hesitation: sustained, explicit VIOLENCE & SCARINESS, with detailed depictions of smoke inhalation, physical restraint, and psychological terror. It is also the climax of a Harlequin romance novel. The Harlequin series *Men Made in America* (MMiA) delivers precisely this unsettling mix of violent, erotic, and tender romance elements that readers browsing for a cosy love story might not anticipate. Anne Stuart’s *Tangled Lies* (1984), for instance, opens its very first page with a bomb blast, its fictional soundscape spiking from Christmas carols to an explosion before subsiding into distant screams and approaching sirens. What unites these scenes is that both are encoded in the text’s acoustic structure: dynamic oscillation between loud events and silence produces a distributional pattern in the loudness annotations that I argue constitutes a candidate textual signal for the presence of content that rating systems, such as those for movies, would identify.

This paper proposes and tests a method for locating such scenes computationally, using sound and loudness annotations applied to the corpus of 50 MMiA romance novels, with a subset of 10 novels being manually encoded with scene boundaries in TEI XML (Guhr et al., 2025). Doing so I want to find out to what extent the standard deviation of loudness levels across sound events per scene (loudness SD) serves as a candidate proxy for identifying scenes flagged under two content advisory categories drawn from the PG-story taxonomy, SEX & NUDITY, and VIOLENCE & SCARINESS (Tsai et al., 2024), annotated on a ternary severity scale (*absent*, *weak*, *strong*) extended from Tsai et al.’s binary scheme to capture the gradations that are

narratologically significant in adult literary fiction. To test this, I compare loudness SD of both *character sound* and *ambient sound* against both content categories, rather than treating one sound type as a dedicated proxy for a single category.

I hypothesize, first, that scenes annotated as *weak* or *strong* under VIOLENCE & SCARINESS will show significantly higher loudness SD in *ambient sounds* than *absent* scenes, reflecting the dynamic oscillation between loud events and silence characteristic of action and threat (H1) (see also Guhr and Algee-Hewitt (2024)); and second, that scenes annotated under SEX & NUDITY will show a distinctive loudness profile with a significantly higher loudness SD in *character sounds*, a high diversity of loudness ranging from soft whispers and sighs to vocalized peaks, distinguishing them acoustically from *neutral* scenes through the predominance of *character sounds* over *ambient sounds* (H2). Beyond these two directional hypotheses, the fully crossed design also allows for the exploratory possibility that loudness SD in either sound channel is elevated across both content categories, which would suggest that the acoustic signal tracks narrative intensity more generally rather than being specific to either category.

The paper makes three contributions: (1) it extends Guhr’s sound annotation framework to the US-English romance genre and to scene-level content analysis; (2) it proposes a scene-level explicit content assessment annotation schema for literary fiction; and (3) it provides preliminary empirical evidence that loudness standard deviation is a candidate acoustic signal for identifying *erotic* scenes in romance fiction, and, unexpectedly, for *violent/scary* scenes as well when carried by *character sound*, while the parallel hypothesis for *ambient sound* in *violent/scary* scenes remains inconclusive given the limited data.

2 Related Work

The computational study of sound in fiction builds on the auditory turn in the humanities (Bull and Back, 2003) and Schafer (1994)’s categorization of sounds. While traditional literary studies approaches rely on single-text analysis and close reading (Ackermann, 2003; Picker, 2003; Schweighauser, 2006; Glotova, 2021; Molyneux, 2022; Foley, 2023), early computational approaches identify sound words and references to auditory experiences via dictionary matching al-

gorithms (Bernhart, 2008; Häußler et al., 2024). More recent work moves from transformer-based *ambient sound* word detection (Guhr and Algee-Hewitt, 2024) toward the classification of sound events for German-language fiction, defined as sound-representing narrative events with asserted *realis* (Vauth et al., 2021; Sims et al., 2019), distinguishing *ambient* from *character sound* events and assigning loudness levels on a 0; 1–5 scale (Guhr, 2024). Guhr and Mahlberg (2026) extend parts of this framework to English-language fiction via cross-lingual BERT fine-tuning, confirming its transferability to 19th-century British prose.

To analyze how sound event distributions relate to narrative content, a spatially and temporally coherent unit of analysis is required, such as scenes. Scene segments, defined by consistency in time, place, and characters and understood to center around a particular action (Gius et al., 2019, 2021), constitute self-contained units within which loudness SD can be meaningfully computed and compared (Zehe et al., 2021, 2025).

For explicit content assessment, I adopt two categories from the PG-story taxonomy (Tsai et al., 2024) for content safety in narrative text. Automated content rating has a longer history in film, where audio-based approaches detect violent and sexual content from acoustic features (Gianakopoulos et al., 2006), and text-based approaches classify risk-relevant content directly from movie scripts (Martinez et al., 2019). Zhang et al. (2021) predict MPAA ratings from film dialogue using a graded severity scheme (*none*, *mild*, *moderate*, and *severe*). To my knowledge, however, no existing work applies content advisory annotation at the scene level to adult literary fiction, nor proposes an acoustically grounded narratological feature as a proxy for content advisory relevance. I address both gaps, retaining the SEX & NUDITY and VIOLENCE & SCARINESS categories from Tsai et al. (2024) and extending their binary scheme to a ternary scale (*absent*, *weak*, *strong*). While PG-story was originally designed for child-safe story generation, its content categories are sufficiently general to transfer to adult literary fiction: the categories name phenomena (sexual content, nudity, violence, scariness) rather than presuppose a particular audience or register. What changes in adult romance fiction is not whether they are applicable, but how they are calibrated: the ternary extension is specifically designed to capture the gradations between implicit and explicit representation that are

narratologically meaningful in this genre, and that a binary *present/absent* scheme would collapse.

3 Method

3.1 Data Set

The corpus consists of 50 Harlequin romance novels from the *Men Made in America* (MMiA) series (1982–2002), each set in a different US-State and written exclusively by female authors. Despite their shared romance premise, the novels frequently blend detective fiction, Gothic suspense, and high-stakes drama, making the series a generically rich testing ground. All volumes have been digitized, OCR-processed, manually cleaned, and encoded in TEI XML. 20% of the corpus has been manually annotated for scene segments.

3.2 Sound Classification and Loudness Labeling

Fictional sound events are operationalized following Guhr (2026), who defines a fictional sound as a sound event with asserted *realis* in the fiction¹, explicitly represented by sound words in the narrative. Sound events are classified into *ambient* and *character sound* events and assigned loudness levels on a 0; 1–5 scale via dictionary matching. The loudness dictionary was originally validated for 19th-century German literary prose (Guhr, 2026) and subsequently extended to 19th-century British English (Guhr and Mahlberg, 2026); its application to 20th-century US romance fiction is a further transfer step.² The loudness scale (0.0–5.0) is an *ordinal* scale: its values encode a ranked ordering of perceptual loudness categories, but intervals between adjacent levels are not empirically validated as equal. Computing arithmetic means and standard deviations from ordinal values is strictly speaking statistically impermissible, since it presupposes equal-interval structure that an ordinal scale does not guarantee (Mari et al., 2023; Gius, 2026); human loudness perception follows an approximately logarithmic rather than linear progression (Stevens, 1946), further complicating this assumption. Following Guhr (2026) and the principle that measurement results are valid within their model context

¹The definition builds on the understanding of narratological event by Vauth et al. (2021) and asserted *realis* by Sims et al. (2019).

²Ambiguous sound words (i.e. items not present in the dictionary) are assigned no loudness value and excluded from the SD computation; only scenes with at least two labeled sound events of the relevant type are included in the statistical analysis (see section 4).

(Gius, 2026), loudness mean and SD are retained as a *corpus-comparative heuristic* for relative comparison across scenes within a consistently applied operationalization, interpreted as *categorical spread* rather than a claim about absolute acoustic quantities. While average loudness levels enable comparative analysis of sonic profiles across texts, authors, or literary movements (Guhr, 2026; Häußler et al., 2024), they suffer from a balancing effect: a scene containing equal parts soft whispers at level 2 and loud peaks at level 4 produces a misleading mean of level 3, obscuring the dynamic range that characterizes specific scene types. The standard deviation (SD) of loudness levels addresses this by measuring the degree of variation within a scene: a high SD indicates substantial sonic variation, with some sounds significantly louder or softer than others. By computing SD separately for *ambient* and *character sound* events, it becomes possible to investigate whether specific scene types carry distinguishable acoustic signatures (Guhr, 2026). This study is the first to apply this SD-based approach to US-English romance fiction, foregrounding it as the primary analytical feature. As detailed in section 1, I test loudness SD of both sound channels against both content categories in a fully crossed design, with directional predictions that *ambient* SD is particularly diagnostic of *violent/scary* scenes through dynamic oscillation between loud events and silence (H1), and that *character* SD is particularly diagnostic of *erotic* scenes through the whisper-to-scream-of-pleasure profile characteristic of intimate encounters (H2). For adaptation to 20th-century US-English romance fiction, three MMiA novels were manually annotated for *character sound* and *ambient sound* events and enriched with loudness levels (see Table 1), following the annotation guidelines of Guhr (2024) and using an adapted version of the translated English loudness dictionary Guhr and Mahlberg (2026). A state-of-the-art English BERT model (Devlin et al., 2019) was fine-tuned in the NEISS NTEE software environment (Zöllner et al., 2021). Evaluated against the manually annotated gold standard, the model achieves a span-level classification F1 of 0.79 (any overlap) and 0.66 before post-processing, rising to 0.81 and 0.67 respectively after post-processing, with a Gamma coefficient (Mathet et al., 2015) of 0.72. These results compare favorably to the 0.66 entity-level F1 reported for 19th-century British English (Guhr and Mahlberg, 2026, 277), though direct comparison is complicated due to the differ-

entity	all	train	devel	test (internal)	test (external)
ambient sound	222	175	24	23	21
character sound	3,073	2,441	318	314	77
unlabeled words	212,578	170,297	21,212	21,069	9,823
total words	215,873	172,913	21,554	21,406	9,921

Table 1: Distribution of training, development, internal and external test set for fine-tuning the US-English-language SoundBERT.

ent test sets and English-language variations: the model reliably identifies sound-bearing passages and assigns the correct label, but often does not reproduce precise annotator boundaries, a known challenge in span-level literary annotation.³

3.3 Adapting the Explicit Content Taxonomy

For the explicit content assessment of scenes, I adopt two of the five categories from the PG-story content safety taxonomy (Tsai et al., 2024, 79): SEX & NUDITY, defined as text containing “sexual activities, implied sex reference, or nudity”; and VIOLENCE & SCARINESS, defined as text containing “violent, risky or unhealthy dangerous activities; reference to weapons, anti-social, or self-harming behaviors; intense frightening or scary situations.”⁴ Where Tsai et al. (2024) apply a binary *present/absent* annotation, I extend both retained categories to a ternary severity scale (*absent*, *weak*, *strong*) to capture gradations in adult literary fiction (see operationalization in the Tables 8 and 7). The extension from Tsai et al. (2024)’s binary scheme is motivated by the romance genre specifically: implicit references to sexual content via creative metaphors and an explicitly sexual scene are both *present* under a binary annotation, same counts for a scene containing violence or a scene being about violence, yet, they differ fundamentally in narrative function, editorial content policy, and, I hypothesize, in their loudness variance profiles. The *absent* category additionally serves as the reference group in the statistical analysis (see

section 4).

A total of 100 scenes from the MMiA corpus were manually annotated for explicit content to serve as training data (109,227 words). An additional 30 scenes were independently annotated by two annotators (15,632 words), yielding an inter-annotator agreement of $\kappa = 0.82$ (Cohen’s kappa) for the SEX & NUDITY class and $\kappa = 0.79$ for the VIOLENCE & SCARINESS class. This doubly-annotated subset serves as the held-out test set for evaluating the automated prediction of both content categories.

Since the MMiA series is structurally sparse with respect to scenes of the two categories, class imbalance would render any classifier trained solely on the annotated corpus unreliable.⁵ To address this, synthetic training passages were generated using the Anthropic *claude-sonnet-4-20250514* model, producing 150 romance novel passages distributed across the three severity levels (*absent*, *weak*, *strong*) for each content advisory category⁶, following the operationalization definitions in Table 7 and Table 8, and matching the prose register, genre conventions, and US-English setting of the MMiA corpus. The combined training set comprises 250 passages (100 human-annotated + 150 synthetic), with a stratified 80/20 split yielding the

³LLMs were not employed for the classification task: although they have been applied to annotation in computational literary studies (Bamman et al., 2024), their tendency toward hallucination in structured annotation tasks (Semin et al., 2026) makes them less suitable than fine-tuned discriminative models for reproducible span-level TEI XML annotation, particularly given that the copyright status of the MMiA corpus restricts processing to smaller local models.

⁴The remaining three categories (Profanity & Slurs, Substance Consumption, and Discrimination & Bias) are excluded on acoustic grounds: none maps cleanly onto either the *ambient* or *character sound* channel in ways that would produce theoretically interpretable loudness variance signals at this corpus scale.

⁵LLM-generated synthetic data for training augmentation in low-resource classification tasks has been shown to be an effective strategy for addressing class imbalance and data scarcity (Long et al., 2024), and is particularly appropriate here given that the copyrighted MMiA texts cannot be redistributed as open training data. To assess stylistic consistency, five randomly sampled synthetic passages per severity level were compared against human-written MMiA passages: synthetic passages reproduced the genre conventions (e.g. first-person interiority, dialogue-driven intimacy with low to moderate level of sensuality, “[w]armhearted stories offer[ing] a range of tones, from light humor to drama,” “fast-paced and plot-driven,” (see Harlequin Submission Guidelines for the *American Romance* series: <https://harlequin.submittable.com/submit> via the Internet Archive Way Back Machine, version from October 2015) but tended toward a slightly more contemporary register, which stylistic gap is a known limitation.

⁶Used prompt: “Please generate [n] passages of max. 350 words each for the class [level] [category] following the operationalization definitions [xy]. Output a csv.”

task	class	train	val	total (%)	weight
VIOLENCE/SCARINESS	<i>absent</i>	68	17	85 (34.0%)	0.980
	<i>weak</i>	50	13	63 (25.2%)	1.323
	<i>strong</i>	82	20	102 (40.8%)	0.817
SEX/NUDITY	<i>absent</i>	66	16	82 (32.8%)	1.016
	<i>weak</i>	66	17	83 (33.2%)	1.004
	<i>strong</i>	68	17	85 (34.0%)	0.980
total scenes		200	50	250	

Table 2: Training and validation set statistics for the two classification tasks. Class weights are computed inversely proportional to class frequency to address label imbalance.

Class	P	R	F1	Sup
<i>absent</i>	0.81	0.81	0.81	16
<i>weak</i>	0.81	0.76	0.79	17
<i>strong</i>	0.89	0.94	0.91	17
macro avg	0.84	0.84	0.84	50
weighted avg	0.84	0.84	0.84	50

Table 3: SEX & NUDITY: validation ($n = 50$).

Class	P	R	F1	Sup
<i>absent</i>	0.85	1.00	0.92	17
<i>weak</i>	1.00	0.77	0.87	13
<i>strong</i>	1.00	1.00	1.00	20
macro avg	0.95	0.92	0.93	50
weighted avg	0.95	0.94	0.94	50

Table 5: VIOLENCE & SCARINESS: validation ($n = 50$).

Class	P	R	F1	Sup
<i>absent</i>	0.70	0.94	0.80	17
<i>weak</i>	0.75	0.30	0.43	10
<i>strong</i>	0.67	0.67	0.67	3
macro avg	0.70	0.64	0.63	30
weighted avg	0.71	0.70	0.66	30

Table 4: SEX & NUDITY: external test ($n = 30$).

Class	P	R	F1	Sup
<i>absent</i>	0.46	0.93	0.62	14
<i>weak</i>	0.00	0.00	0.00	10
<i>strong</i>	1.00	0.17	0.29	6
macro avg	0.49	0.37	0.30	30
weighted avg	0.42	0.47	0.35	30

Table 6: VIOLENCE & SCARINESS: external test ($n = 30$).

200/50 train/validation distribution reported in Table 2. The 30 doubly-annotated scenes are held out entirely as an external test set and do not contribute to training.

To automate the assessment of SEX & NUDITY and VIOLENCE & SCARINESS in scenes, I fine-tuned XLM-RoBERTa large⁷ (Conneau et al., 2019), adapting it for the three-class ordinal classification task. To address class imbalance in the training data, I applied balanced class weighting and used a stratified 80/20 train/validation split with a fixed random seed ($s = 42$) for reproducibility.

Model performance is evaluated on a held-out internal validation set (20% of the training data) as well as on the doubly-annotated external test set. The SEX & NUDITY classifier achieves an overall accuracy of 0.70 and a macro-averaged F1 of 0.63 on the external test set of 30 passages. Performance is strongest on the majority class *absent* (F1

= 0.80), while the *weak* class proves most difficult to identify (F1 = 0.43), likely reflecting its position as a transitional category between the two poles. Linear and quadratic weighted κ of 0.48 and 0.56, respectively, indicate moderate ordinal agreement, and a MAE of 0.33 confirms that misclassifications tend to occur between adjacent classes rather than across the full scale.

The VIOLENCE & SCARINESS classifier performs substantially higher on the internal validation set (accuracy = 0.94, macro F1 = 0.93) than on the external test set (accuracy = 0.47, macro F1 = 0.30), indicating a pronounced generalization gap compared to the SEX & NUDITY model. On the external test set, the classifier defaults heavily towards the *absent* class (F1 = 0.62, recall = 0.93), fails entirely on the *weak* category (F1 = 0.00), and identifies *strong* scenes with high precision but very low recall (precision = 1.00, recall = 0.17). Cohen’s κ of 0.024 and a MAE of 0.70 confirm that errors frequently span non-adjacent ordinal categories, in stark contrast to the SEX & NUDITY model whose misclassifications tend to

⁷A state-of-the-art multilingual transformer model pre-trained on 2.5 TB of text across 100 languages using a masked language modeling objective (Conneau et al., 2019).

remain within neighboring classes.

These results establish an asymmetry that shapes the analysis to follow: the SEX & NUDITY classifier reaches a level of reliability sufficient for exploratory corpus analysis, while the VIOLENCE & SCARINESS classifier's near-chance external performance renders its predictions unreliable as a standalone instrument. The latter's outputs are nonetheless retained in the analysis, treated not as reliable labels but as a weak signal to be interpreted against the statistical correlations and with the caveat that classification errors are both frequent and severe.

4 Analysis Results

"Are you going to be a noisy lover, Amy?"
<character_sound loudness="2.5"><speaker gender="man">he</speaker> **whispered, laughing softly**</character_sound>. "Let's see."

In the *erotic* scene of Diana Palmer's *Love by Proxy* (1985), the two protagonists find themselves alone together, the tension of their slow-burning attraction finally breaking into something more. The scene unfolds not through explicit description but through sound representation: "with rough breathing and wild heartbeats," the narrator depicts the interplay of whispering and moaning until

<character_sound loudness="4.0"><speaker gender="woman">She</speaker> **began to cry from the spiraling tension**</character_sound>.

These are not incidental details but a deliberate sequence of alternating low- and high-intensity *character sound* events that together construct the acoustic atmosphere of the *erotic* scene. Averaging these loudness levels would produce a misleading picture of moderate, undifferentiated intensity: the peaks and troughs canceling each other out into an unremarkable mean. Standard deviation, by contrast, captures precisely this oscillation: it is sensitive to the dynamic range between a barely audible whisper and a vocalized peak, making the scene stand out in comparison to the others.

To investigate the correlation between loudness SD and represented explicit content, I conducted two parallel analyses, each testing *character sound* and *ambient sound* SD against both content advisory categories rather than treating one sound type as a dedicated proxy for a single category: (1) I first examined whether *character sound* and *ambient sound* loudness SD correlate with scenes

annotated for explicit VIOLENCE & SCARINESS (following the operationalization in Table 8). The underlying intuition motivating H1 is that *ambient sound*, capturing environmental and atmospheric noise, should be diagnostic of *violent/scary* scenes through the oscillation between loud events and silence characteristic of action and threat, while *character sound* is tested in parallel to establish whether the effect is specific to the *ambient* channel. (2) I then examined the same pair of sound types against scenes annotated for explicit SEX & NUDITY (following the operationalization in Table 7). The underlying intuition motivating H2 is that *character sound*, reflecting the trajectory from whispered dialogue to vocalized arousal, should be the primary acoustic carrier of *erotic* content, while *ambient sound* is tested in parallel as a within-corpus comparison.

I worked with a MMiA subcorpus of ten TEI XML-annotated romance novels comprising 815 scenes in total. Each scene was assigned a SEX & NUDITY and a VIOLENCE & SCARINESS score on the ternary severity scale (0 = *absent*, 1 = *weak*, 2 = *strong*), and contained <character_sound> and <ambient_sound> elements with loudness ratings on a 0; 1–5 scale.

4.1 Loudness SD and VIOLENCE & SCARINESS

In the first analysis, I tested whether *character sound* and *ambient sound* loudness SD are associated with *violent/scary* scenes, comparing within-scene loudness SD for both sound types against the VIOLENCE & SCARINESS annotation.⁸ *Violent/scary* scenes showed markedly higher *character sound* SD than *non-violent* scenes (*violent*: $M = 0.749$; *non-violent*: $M = 0.509$; a 46.9% increase),⁹ with the effect concentrated in scenes of *strong* VIOLENCE & SCARINESS (score 2: $M = 0.883$). By contrast, no equivalent effect was found for the mean loudness of *character sound* (*violent*: $M = 3.036$; *non-violent*: $M = 3.036$), indicating that *violent/scary* scenes are not objectively louder, but specifically more variable in loudness.

⁸Annotation of 815 scenes: 589 contained at least two *character sound* events (557 *non-violent*, 32 *violent/scary*), and 138 contained at least two *ambient sound* events (124 *non-violent*, 14 *violent/scary*); two sound events of the same category are the minimum required to compute SD.

⁹ M denotes the mean of the per-scene SD values: loudness SD is computed *within* each scene, across that scene's sound events, and these per-scene SD values are then averaged across all scenes in each group.

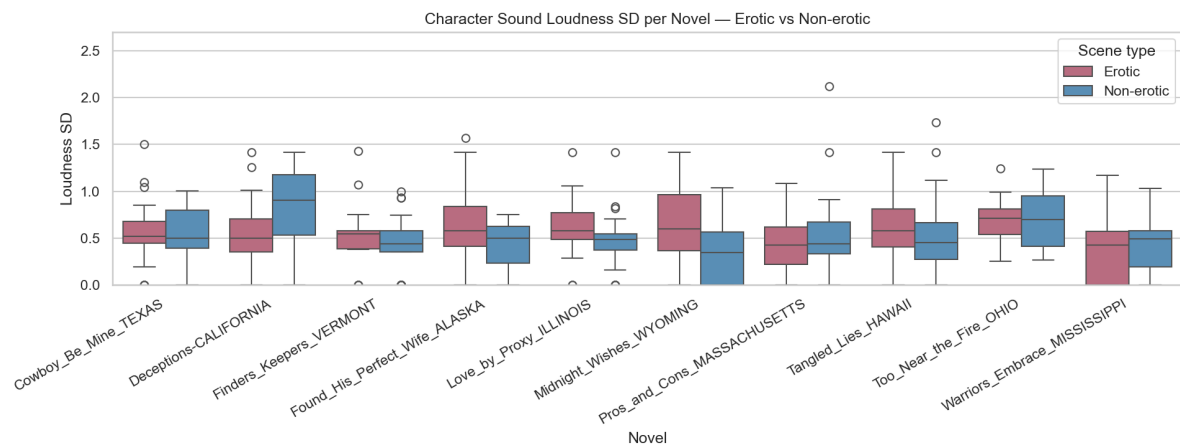


Figure 1: *Character sound* loudness SD per scene, classified in *erotic* vs. *non-erotic* scenes of ten MMiA novels.

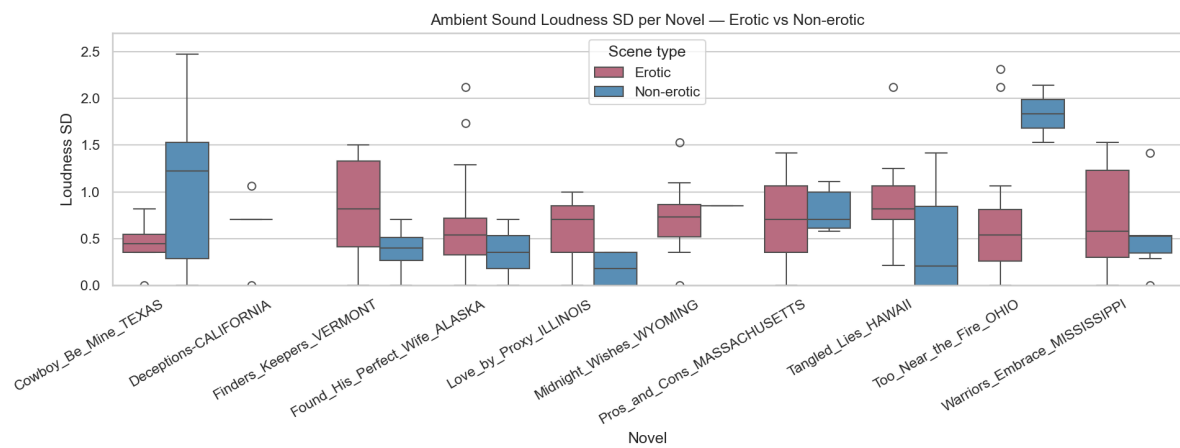


Figure 2: *Ambient sound* loudness SD per scene, classified in *erotic* vs. *non-erotic* scenes of ten MMiA novels.

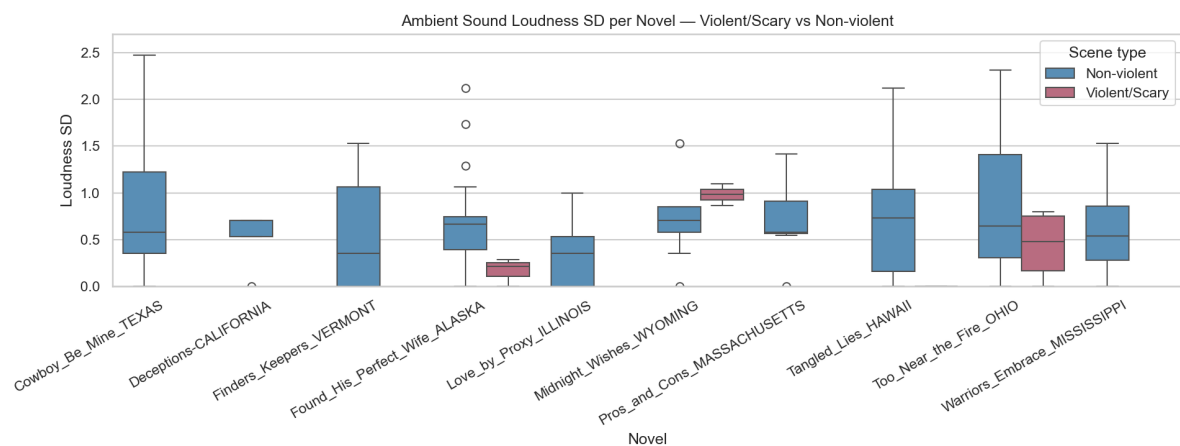


Figure 3: *Ambient sound* loudness SD per scene, classified in *violent/scary* vs. *non-violent* scenes of ten MMiA novels.

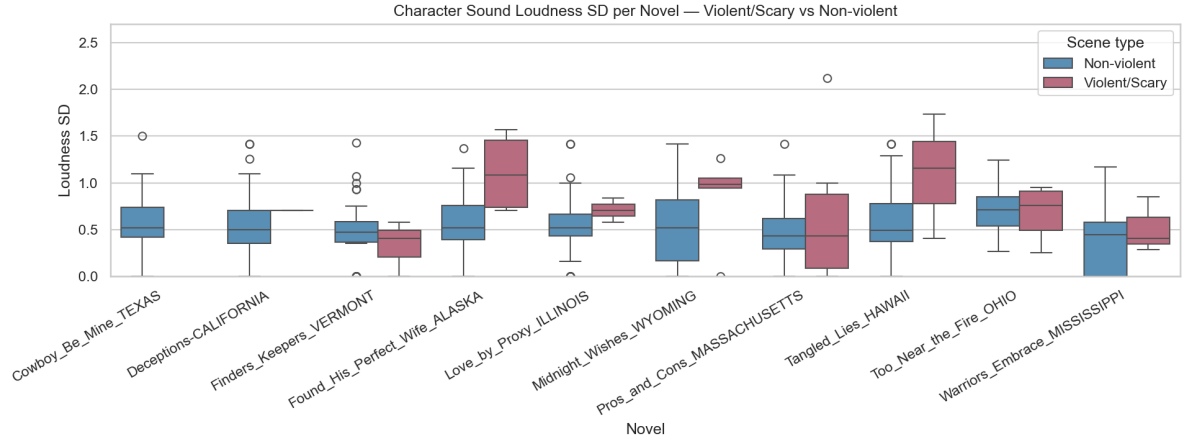


Figure 4: *Character sound* loudness SD per scene, classified in *violent/scary* vs. *non-violent* scenes of ten MMiA novels.

A one-tailed Mann-Whitney test¹⁰ confirmed a statistically significant difference in *character sound* SD ($U = 11,386.0$, $p = 0.0040$), supported by Spearman $\rho = 0.112$ ($p = 0.0063$) and AUC = 0.639,¹¹ meaning the *violent/scary* scene has the higher *character sound* SD in 63.8% of randomly drawn *violent/non-violent* pairs, compared to 50% under chance. A sensitivity check restricted to scenes with *strong* versus *absent* VIOLENCE & SCARINESS produced the largest effect (AUC = 0.756, $p = 0.0001$).

By contrast, *ambient sound* SD showed no meaningful difference between scene types (*non-violent*: $M = 0.712$; *violent*: $M = 0.682$), with all tests returning null results (Mann-Whitney $p = 0.661$; Spearman $\rho = -0.043$; AUC = 0.467). The corresponding sensitivity check (*strong* vs. *absent* VIOLENCE & SCARINESS) likewise found no significant effect (AUC = 0.376, $p = 0.915$).

This dissociation suggests that the romance novel writers of the corpus texts encode VIOLENCE & SCARINESS primarily through vocal behavior rather than through shifts in the surrounding soundscape. Within vocal behavior specifically, this effect is carried by loudness *variability* rather than by loudness *level*: *violent/scary* scenes are not objectively louder, but their *character sound* fluctuates more. One possible explanation is that *violent/scary* scenes foreground interpersonal conflict and emotional arousal, which are inherently tied to the voice, while the *ambient* soundscape may

be held constant, described independently of scene intensity, or not represented at all.

Both analyses are limited by pronounced class imbalance (32 *violent/scary* scenes out of 589 for *character sound*; 14 out of 138 for *ambient sound*), and the *ambient sound* null result in particular should be interpreted with caution given the small number of annotated *violent/scary* scenes; a larger corpus with denser *ambient sound* annotation would be required to rule out a genuine effect.

4.2 Loudness SD and SEX & NUDITY

In the second analysis, I tested whether *character sound* and *ambient sound* loudness SD are associated with *erotic* scenes, comparing within-scene loudness SD for both sound types against the SEX & NUDITY annotation.¹²

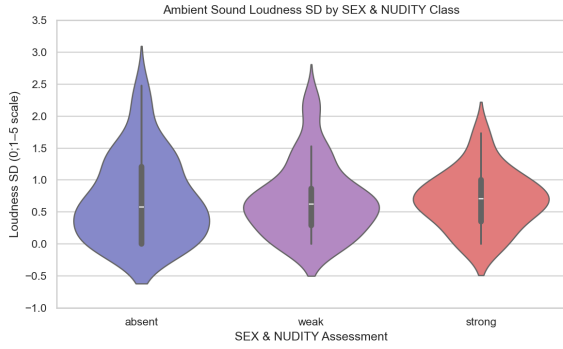
I found a small but statistically reliable positive relationship between *character sound* SD and SEX & NUDITY score: Spearman $\rho = 0.168$ ($p < 0.001$). Treating the score as binary (*erotic* vs. *non-erotic*),¹³ *character sound* SD discriminates

¹²Annotation of 815 scenes: 589 contained at least two *character sound* events (218 *non-erotic*, 371 *erotic*), and 146 contained at least two *ambient sound* events (52 *non-erotic*, 94 *erotic*); two sound events of the same category are the minimum required to compute SD.

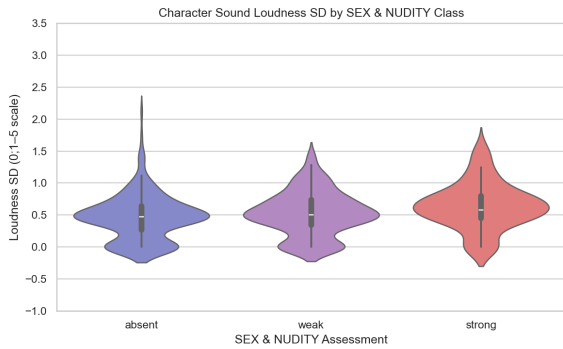
¹³The ternary SEX & NUDITY score (*absent* = 0, *weak* = 1, *strong* = 2) was binarized as *absent* (0) vs. *weak/strong* (1, 2) for the AUC calculation, treating any presence of *erotic* content as the positive class. Spearman ρ is reported for the full ternary score, as it uses all available data and respects the ordinal structure of the annotation scale without collapsing information. AUC is reported as the single effect size for binary discrimination, applied consistently in both the main analysis and the sensitivity analysis, since it has an intuitive probabilistic interpretation and is robust to the right-skewed distribution of SD values.

¹⁰A one-tailed test was used based on the directional hypothesis that *violent/scary* scenes show *higher* loudness variability than *non-violent* scenes.

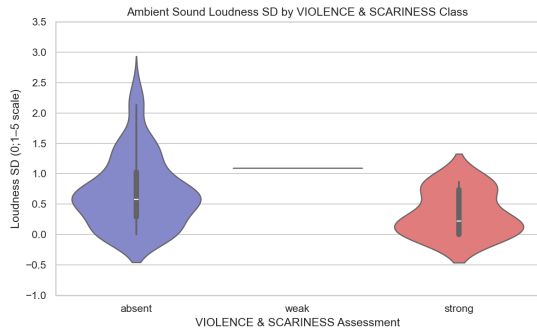
¹¹AUC treats *violent/scary* as the positive class.



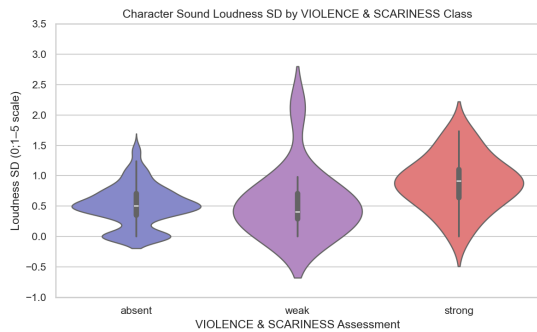
(a) Distribution of *ambient sound* loudness SD per scene across SEX & NUDITY assessment classes (*absent*, *weak*, *strong*).



(b) Distribution of *character sound* loudness SD per scene across SEX & NUDITY assessment classes (*absent*, *weak*, *strong*).



(c) Distribution of *ambient sound* loudness SD per scene across VIOLENCE & SCARINESS assessment classes (*absent*, *weak*, *strong*). Only 3 *weak* scenes contain at least two *ambient sound* events, too few to support a meaningful distributional comparison for this class.



(d) Distribution of *character sound* loudness SD per scene across VIOLENCE & SCARINESS assessment classes (*absent*, *weak*, *strong*).

the two groups at $AUC = 0.580$ ($p < 0.001$), meaning that in a randomly drawn pair of one *erotic* and one *non-erotic* scene, the *erotic* scene has the higher SD 58.0% of the time, compared to 50% under chance. A sensitivity analysis comparing only *strongly erotic* scenes (score 2, $n = 82$) against *non-erotic* scenes (score 0, $n = 218$) yielded a larger effect, $AUC = 0.658$ ($p < 0.001$), with mean SD rising from 0.467 to 0.644, a 37.9% increase. By contrast, no equivalent effect was found for the mean loudness of *character sound* (*erotic*: $M = 3.000$; *non-erotic*: $M = 3.096$) – if anything, *erotic* scenes were marginally quieter on average, reinforcing that the effect is carried by loudness variability rather than loudness level.

For *ambient sound* SD, no significant effect was found (Spearman $\rho = 0.067$, $p = 0.42$; $AUC = 0.539$). The corresponding sensitivity check (*strong* vs. *absent* SEX & NUDITY) likewise found no significant effect ($AUC = 0.548$, $p = 0.258$).

This dissociation suggests that the romance novel writers of the corpus texts encode SEX & NUDITY primarily through vocal behavior rather than through shifts in the surrounding soundscape. Within vocal behavior specifically, this effect is carried by loudness *variability* rather than by loudness *level*: *erotic* scenes are not objectively louder, but their *character sound* fluctuates more. The null result for *ambient sound* is suggestive: it is not consistent with the possibility that *erotic* scenes are simply acoustically busier overall, supporting the interpretation that the increase in loudness variability reflects the dynamic vocal and physical expressiveness of the characters rather than a general inflation of acoustic activity in the scene.

5 Conclusion

This paper proposed and tested loudness SD as an acoustically grounded proxy for content advisory relevance in romance fiction. H2 is confirmed in its core prediction: *character sound* loudness SD is significantly elevated in scenes featuring explicit SEX & NUDITY relative to *neutral* scenes. However, H2's further prediction that this elevation would acoustically distinguish *erotic* scenes from *violent/scary* scenes specifically is not borne out: as the discussion below shows, *character sound* SD is likewise elevated in *violent/scary* scenes relative to *neutral* ones, so the two content categories are not acoustically distinguishable from one another

on this dimension alone. H1, by contrast, given the small number of detected relevant scenes containing sufficient *ambient sound* events ($n = 138$), could neither be confirmed nor reasonably falsified: the *ambient sound* analysis returned null results across all tests, but the limited data points preclude a definitive conclusion. More scenes providing *ambient sound* events would be needed. However, in general romance fiction tends to provide fewer *ambient sound* representations, while focusing on soundful character interaction.

Beyond the individual findings for each content category, a suggestive parallel emerges when comparing the two analyses: scenes flagged as explicit under either SEX & NUDITY or VIOLENCE & SCARINESS both show elevated *character sound* loudness SD relative to non-flagged scenes. Given that this pattern rests on only two content categories within a single ten-novel corpus, it should be read as a hypothesis-generating observation rather than an established finding. One plausible explanation, though not tested directly in this study, is that loudness variability tracks a shared underlying property of narratively significant scenes more broadly – for instance, a higher pace of events and their heightened importance for the plot — rather than indexing eroticism or violence specifically. This interpretation is consistent with prior work on sound word density in Gothic fiction (Guhr and Algee-Hewitt, 2024), which found that sound representation clusters at points where a scene departs from the narrative default, typically where the narrator seeks to intensify atmosphere. Sound in these moments works to stimulate the senses of characters, and such heightened sensory attention tends to coincide with states of suspense or anxiety, whether the underlying situation is erotic, violent, or otherwise fear-inducing. Loudness SD may therefore be tracking something broader than either content category alone: a marker of emotionally heightened, plot-relevant scenes more generally. Whether sound consistently points toward *suspenseful* scenes across a larger and more heterogeneous literary corpus remains an open question for future work, complicated by the fact that suspense itself is a notoriously difficult narrative phenomenon whose intersubjective operationalization remains an open desideratum in literary studies.

This shared acoustic signature across content categories, however, does not imply that the categories themselves are interchangeable at a finer grain. The SEX & NUDITY classifier achieved sur-

prisingly good results (macro F1 = 0.63 on the external test set) given the heuristic nature of the approach and its reliance on synthetically generated training data. This suggests that the category is sufficiently well operationalized to support automated detection, even under low-resource conditions, and has the potential to be further refined with more data. The VIOLENCE & SCARINESS classifier proved considerably harder to finetune and generalize (macro F1 = 0.30 on external test set), which can be attributed to the operationalization of the category itself. Following Tsai et al. (2024), the class bundles violence and scariness into a single label, yet the two phenomena are narratologically and acoustically distinct: scariness in particular is a broad and diffuse category whose textual and acoustic markers remain underspecified. The detection of scary scenes, therefore, remains an open desideratum, and a more fine-grained operationalization of VIOLENCE & SCARINESS will be part of future work. Beyond these specific findings, the study demonstrates the analytical value of scene segments as a structural unit for corpus-level content analysis. Applied to different editions or adaptations of the same text, loudness SD and content advisory annotation could be used to detect omissions, alterations, or tonal shifts with respect to explicit content across versions, a use case with practical relevance for editorial studies, content moderation, and computational literary studies more broadly.

Limitations

Some limitations should be noted: (1) The statistical analyses rest on a subcorpus of 10 novels, yielding small sample sizes, particularly for *violent/scary* scenes (32 scenes with *character sound* events, 14 with *ambient sound* events), which means that the null result for H1 cannot be interpreted as a definitive falsification. (2) The VIOLENCE & SCARINESS category additionally bundles two narratologically distinct phenomena: scariness, encompassing psychological tension, suspense, and atmosphere, does not map cleanly onto the acoustic features examined here, and its conflation with physical violence likely contributes to the poor classifier generalization (macro F1 = 0.30). A more fine-grained operationalization separating the two is needed before definitive conclusions can be drawn. (3) Finally, the study is restricted to a single novel series, and the generalizability of the

identified acoustic signals to other series or literary traditions remains open for future research.

Code & Data

Code is available in the GitHub repository on https://github.com/SvenjaGuhr/Explicit_Content_Detection. Due to copyright restrictions, the 20th-century romance novels used in this study cannot be redistributed. However, the LLM-generated scenes are included in the repository, and the codebase is designed to be reusable for application to other datasets. The code and data is released under the GNU GPL v3.0 license. The author does not permit the use of the code or accompanying data in support of censorship, surveillance, or book-banning initiatives.

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Content Rating	Explanation	Sample Passage
SEX & NUDITY <i>absent</i>	No sexual or intimate content is present: the scene contains no physical intimacy, no expression of desire or arousal, and no implied or explicit sexual activity. Longing or emotional attachment may be present but is not rendered in physical or sensory terms.	<i>Tangled Lies</i> : Rachel, however, wasn't quite so fortunate. For a long time she lay in her bed, staring out her window, her mouth still tingling with a forbidden longing. And when she fell asleep this time, she was crying.
SEX & NUDITY <i>weak</i>	Sexual or intimate content is present but encoded implicitly through literary devices: metaphor, euphemism, physical suggestion, or narrative indirection. Desire or arousal is described, physical intimacy is initiated or implied, but the sexual encounter is not rendered explicitly on the page. The scene gestures toward sexuality through creative or literary means rather than depicting it directly.	<i>Love by Proxy</i> : Apparently there was a small conference going on. [...] "Yes?" the big man asked coldly, looking up with eyes that were every bit as dark as the straight black hair that fell forward onto a broad forehead. Amelia smiled wickedly. "Message for you, sir," she said. And she let the coat drop. The two men grouped around the desk stared, gaping, with appreciative smiles and big eyes. The bigger man stood erect and looked angry. Amelia had a passable voice no threat to the Met, of course, put passable. She began to gyrate in her outlandish belly dancer's costume to the tune of the birthday song, inching slowly closer to the big, dark man. He didn't look very receptive. In fact, he looked as if he'd like to pitch her out the window. That was even better. She laughed huskily as she went closer, her hips twitching, her skirts flying, her arms uplifted with the small cymbals on her fingers to show the high, soft curve of her breasts in their metallic casings. "Happy birthday, honey," she added at the end, and just for pure spite, she went on tip-toe to kiss him full on his hard, chiseled mouth with as much enthusiasm as she could muster.
SEX & NUDITY <i>strong</i>	Sexual activity is rendered explicitly as the primary event of the scene: a consummated sexual encounter is described in physical and sensory detail, with direct depiction of bodily response and intimacy. The scene leaves nothing to literary imagination; explicitness rather than suggestion is the dominant representational mode.	<i>Midnight Wishes</i> : By the time his fingers slid down to encounter the barrier of her panties, she wanted him more than she'd ever wanted anything in her life. With his gaze locked with hers, he slowly, sensually, pulled her panties off. When he touched her at the center of her being, tears of pleasure blurred her vision. He shifted positions and hovered over her for a moment, then slowly entered her. As their bodies joined, she continued to look into his eyes. In their dark depths, she saw not only passion, but caring, tenderness... emotions that stirred her more deeply than any physical act could accomplish alone. He moved, stroking urgency and need within her. As each thrust went deeper, became more powerful, she closed her eyes and gave herself completely to him.

Table 7: Operationalization of the retained PG-story content advisory category SEX & NUDITY (Tsai et al., 2024) on a ternary scale (*absent*, *weak*, *strong*), with sample passages drawn from the *Men Made in America* corpus. The scale distinguishes between the absence of category-relevant content, its implicit representation through literary devices such as metaphor, euphemism, or narrative suggestion (*weak*), and its explicit rendering as the primary event of the scene (*strong*).

Content Rating	Explanation	Sample Passage
VIOLENCE & SCARINESS <i>absent</i>	No category-relevant content is present: the scene contains no weapons, no physical threat, no fear-inducing situation, and no dangerous activity. Interpersonal tension or conflict may be present but is not rendered in terms of physical danger or threat to bodily integrity.	<i>Deceptions:</i> Adele rose gracefully from her chair and quietly approached Lisa. “The producer wants both of you, Lisa. That’s what I’ve been trying to tell you. These period movies are chancy at best, and they need bankable stars to ensure the public will at least turn out — even if it’s only to see the two of you on screen together again.” She waited for the diminutive actress to absorb the information she was hearing. Lisa’s black, almond-shaped eyes stared at her, the pain within them causing Adele to suffer a twinge of guilt until she recalled what she was trying to accomplish. “There is no way I can work with Drew again. Please don’t ask that of me.” Adele studied her for a moment in silence. Lisa’s midnight black hair tumbled around her face and over her shoulders, almost touching her waist. The woman was beautiful - and fiery — and a damned good actress.
VIOLENCE & SCARINESS <i>weak</i>	Violence or threat is present but encoded implicitly through atmosphere, anticipation, or narrative suggestion: a weapon appears as a prop, danger is sensed or anticipated, or fear is the dominant emotional register of the scene. Physical harm is not depicted on the page; the scene gestures toward violence or scariness through literary and atmospheric means rather than rendering it directly.	<i>Finders Keepers:</i> Holly Wingate Paynter leaned her crowbar against the paint-chipped doorjamb and warily eyed the floor of the cold, dark master bedroom. A leaky ceiling and years of abandonment and neglect had left their mark. It didn’t look good. Holly considered skipping the bedroom, but she’d prowled through every other room in the woefully dilapidated Danvers House, soaking up its creepy atmosphere. She scanned the room with her powerful flashlight and frowned as she considered possible routes. She wasn’t particularly worried, just didn’t want to accidentally leave her footprints in the rotten wood. Being a Wingate, she wasn’t exactly at the Danvers House by invitation. Best to avoid any careless mistakes.
VIOLENCE & SCARINESS <i>strong</i>	Violence, captivity, or intense terror is rendered explicitly as the primary event of the scene: physical harm, serious injury, or sustained life-threatening threat is described in direct sensory and physical detail. The scene leaves nothing to literary imagination; explicitness rather than suggestion or atmosphere is the dominant representational mode, and a reader would identify its defining content as an act of violence or a life-threatening situation.	<i>Midnight Wishes:</i> An involuntary scream erupted from her raw throat as the curtains caught fire, the flames licking up toward the ceiling. Terror screamed inside her as she felt the hot breath of death surrounding her.

Table 8: Operationalization of the retained PG-story content advisory category VIOLENCE & SCARINESS (Tsai et al., 2024) on a ternary scale (*absent*, *weak*, *strong*), with sample passages drawn from the *Men Made in America* corpus. The scale distinguishes between the absence of category-relevant content, its implicit representation through literary atmosphere, anticipation, or suggestion (*weak*), and its explicit rendering as the primary event of the scene (*strong*).