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Exploring Age Differences in Absorption and Enjoyment during Story Listening

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Abstract: Using naturalistic spoken narratives to investigate speech processes and comprehension is becoming increasingly popular in experimental hearing research. Yet, little is known about how individuals engage with spoken story materials and how listening experiences change with age. We investigated absorption in the context of listening to spoken stories, explored predictive factors for engagement, and examined the utility of a scale developed for written narratives to assess absorption for auditory materials. Adults aged 20–78 years (N = 216) participated in an online experimental study. Participants listened to one of ten stories intended to be engaging to different degrees and rated the story in terms of absorption and enjoyment. Participants of different ages rated the stories similarly absorbing and enjoyable. Further, higher mood scores predicted higher absorption and enjoyment ratings. Factor analysis showed scale items approximately grouped according to the original scale dimensions, suggesting that absorption and enjoyment experiences may be similar for written and spoken stories, although certain items discriminated less effectively between stories intended to be more or less engaging. The present study provides novel insights into how adults of different ages engage in listening and supports using naturalistic speech stimuli in hearing research.

Keywords: spoken stories; listening experience; narrative absorption; enjoyment

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1. Introduction

Narratives are ubiquitous in everyday life and have, for millennia and amongst diverse peoples, served to transmit knowledge and culture from one generation to another [1]. As foundational communication forms that enable investment in daily conversations and leisure activities [2], literary research proposes that narratives are appealing in their capacity to facilitate immersion in a story world—a rich and complex experience influenced by our emotional and cognitive faculties [3,4].

Auditory cognitive neuroscience has recognized the significance of narrative discourse, such as everyday speech, for accurately studying spoken comprehension and listening effort [5–7]. Listening to acoustically degraded speech [8,9] may increase listening effort and fatigue, resulting in disengagement from conversation and withdrawal from social participation [10,11]. This effect is exacerbated among older adults, of whom approximately 40% experience some form of hearing loss past the age of 60 years [12,13]. Meanwhile, studies suggest that listeners motivated to understand what they are hearing are more likely to invest cognitive resources to overcome listening challenges and remain engaged in listening, reducing perceived effort [7]. To help older adults maintain social engagement

for longer, we need to understand how this population engages in listening tasks and what keeps them motivated to listen.

Naturalistic narratives offer a compelling approach to address this [5,6]. Some speech and hearing researchers are abandoning the use of uninteresting, disconnected sentences in favor of spoken, narrated materials [14,15]. Lines of research into the neural mechanisms underlying speech perception leverage such materials from audiobooks or story-telling podcasts [14,16]. Other studies investigate age-related changes in the neural encoding of the acoustic and linguistic features of spoken stories [16–19]. Research on speech-in-noise perception, comprehension, and hearing aid benefits in older adults increasingly employs spoken narratives [20,21]. Yet, the way in which individuals engage with naturalistic narrative speech and the impact of age-related hearing changes remain understudied.

Media, literary, and library research has extensively explored narrative engagement, and several metaphorical terms and theoretical concepts have been proposed to characterize the sensation of being "lost" in the world of a story [22], depending on the type of narrative materials encountered. These include "narrative engagement" in film [23], "absorption" [24] and "transportation" in textual narratives [3,25,26], and "immersion" [27] and "presence" [28] in video games and virtual reality. Encompassing multiple forms of experiences, narrative engagement can thus be understood as a psychological state in which an individual perceives "a story in an immediate, emotionally and cognitively intense fashion" [29].

Scale instruments to measure this unique, personal experience with narrative materials have been developed, among which the most rigorously tested and used is the Story World Absorption Scale [24], investigating the nature of the relationship between several of the concepts mentioned above. The Story World Absorption Scale (SWAS) is intended to be sensitive to various stimulus materials (e.g., different genres) and to predict the enjoyment outcomes of these. The SWAS comprises four main subscales: attentional focus (a feeling of deep concentration and focus), emotional engagement (feelings of sympathy and empathy and identification with characters), mental imagery of the story world (vivid, visual imagery that comes to mind and aids deeper immersion), and transportation (feelings of entering the story world while still being present in the actual world). The scale further includes an 'enjoyment' dimension, proposed as an outcome rather than an aspect of the absorption experience [24].

The SWAS has been used in several literary text studies [30,31], but few studies have examined narrative absorption in spoken stories. Herrmann and Johnsrude [6] demonstrated that the SWAS captured differences in absorption and enjoyment between intentionally engaging and sleep-facilitating stories as well as between stories that were easy to hear and those masked by multi-talker babble [6]. Lange et al. [32] explored predictors of absorption, measured using select SWAS items, in short (~one minute) audiobook excerpts, revealing that blink rate (eye tracking), articulation rate (narration tempo), and trait absorption (individual disposition for absorption) predicted absorption in the excerpts. However, beyond demonstrating various relationships among several physiological, acoustic, and self-report measures, this study did not explore the multifaceted, dimensional nature of listening absorption. Initially designed for written materials, the SWAS has only recently been applied to auditory narratives [6]. The sensitivity of individual scale items to spoken stories and the applicability of the four-dimensional structure to auditory content thus remains to be determined.

Older and younger adults are psychologically different and may respond to narratives differently. Neuroscientific literature suggests narrative comprehension involves cognitive processes integrating events, characters, relationships, etc., into a causally coherent structure [33]. Story processing activates several brain regions for sensory perception, memory retrieval, and encoding, as well as areas associated with attentional focus, reasoning, imagery, and inference [34]. Given well-documented age-related changes in cognitive and sensory function [35,36], engaging narratives for one age group may not be engaging

for another. It is, therefore, important to compare how different age groups respond to naturalistic narratives.

Additionally, stories are complex and can vary in their capacity to be engaging [37,38]. Prior studies have included a wide variety of story materials written and produced to facilitate different types of engagement and absorption across demographics. Specifically, episodes from the podcast series The Moth [39] have been used as examples of highly engaging materials [6,16]. The Moth podcast features spoken stories about human experiences and life events. Stories are intended to create "a unique, intimate, and often enlightening experience" for the listener [39]. Spoken versions of young adult fiction print books described as "high-interest, low-reading level" [40,41], using a simple vocabulary and linear plot lines, have been used as examples of moderately engaging stories [16].

In contrast, episodes from the Sleep With Me [42] podcast have been included as examples of disengaging story materials [6]. The series is described as "The podcast that puts you to sleep" [42], letting the listener "forget your problems and progressively gets more boring until you fall to sleep" [43]. Characterizing the experiences of people from different ages listening to stories may benefit from using stories associated with varying levels of engagement to increase external validity and limit concerns about generalizability due to single-stimulus sampling [44].

Finally, it is well known that mood states and emotions influence motivation and cognition [45] and affect the experience of narrative fiction, including the extent to which one feels involved in the story world and comprehends the text [46–48]. Mood and emotional influences on motivation and task disengagement have also received theoretical emphasis in the context of listening engagement [6,10]. However, whether mood affects enjoyment with and absorption by spoken stories has not been explored.

The current study has two specific aims: First, we investigate whether story absorption and enjoyment for spoken stories change with demographic variables such as age and mood state. Second, we examine which items of the SWAS best discriminate between different types of stories and explore whether the four dimensions of the SWAS that were developed for written narratives also capture experiences with spoken stories.

Given the research discussed above, the current study explores the following hypothesizes:

H1: *Individual differences (age, gender, mood) affect absorption and enjoyment ratings of spoken stories.*

H2: *SWAS items will distinguish four dimensions if absorption for spoken narratives is equivalent to absorption for written narratives.*

2. Methods

2.1. Participants

Two hundred and sixteen individuals aged 20 to 78 years (M = 49.9, SD = 15) took part in an online experimental study. Of those 216 participants, 108 identified as female, 104 as male, and four identified with a different gender (not further specified). Participants' age information and distribution across experimental conditions are displayed in Figure 1. Participants were recruited from the Amazon Mechanical Turk participant pool via CloudResearch (https://www.cloudresearch.com, accessed on 10 June 2024), an online crowdsourcing platform (previously TurkPrime [49,50]). All participants gave informed consent before participation and received USD 7 in remuneration after completing the study. The study was conducted according to the guidelines of the Declaration of Helsinki and the Canadian Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans and was approved by the Research Ethics Board at the Baycrest Centre for Geriatric Care.

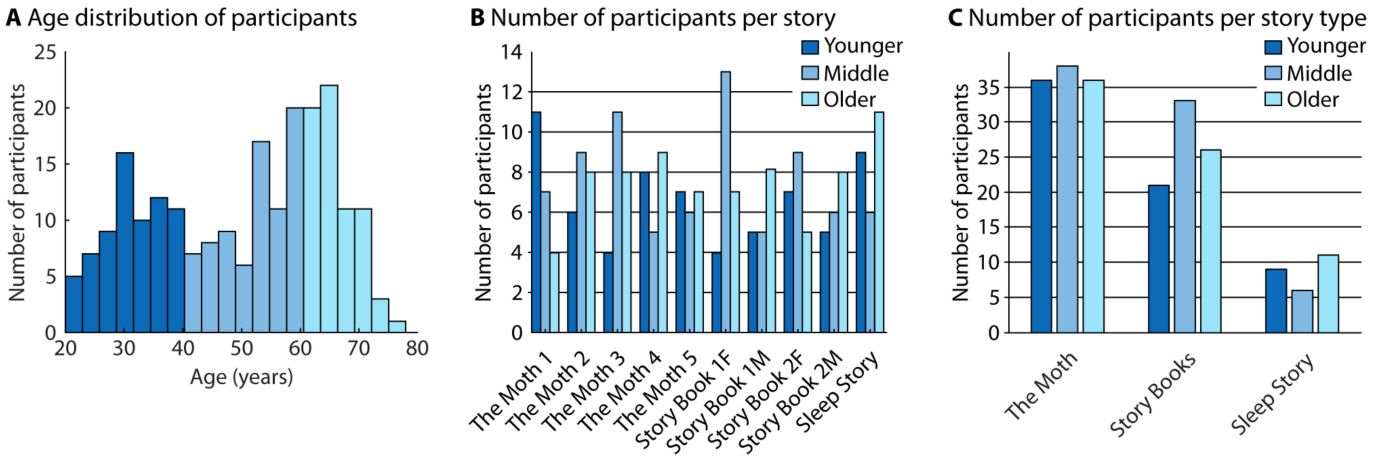

Figure 1. Age information of participants and distribution across stories. (**A**) Histogram displaying the age distribution of participants in the current study. (**B**) Number of participants for each story. (**C**) Number of participants for each of the three-story types: The Moth, Story Books, and Sleep Story.

Previous research suggests that data obtained through online experiments can be vulnerable to factors such as random and/or fraudulent respondents and lack of response reliability compared to laboratory research, resulting in low data quality [51–53]. However, appropriate quality checks can mitigate the low data quality issues such that data recorded online compared to in-lab yield similar results [54–58]. Several data quality measures and conservative exclusion criteria (e.g., attention checks and low performance on tasks) were implemented in our experimental procedures, previously used in Herrmann [59] and Irsik et al. [16]. Data from 82 additional individuals were recorded (i.e., in addition to the 216 useable datasets) but excluded from analysis for failing to meet one or more rejection criteria. Specifically, exclusions occurred when participants scored lower than 80% in an attention-check procedure during story listening (N = 40), correctly answered fewer than 70% of subsequent story-comprehension questions (N = 20), or reported that they were distracted during story listening (N = 5) (procedures are described in more detail below). Furthermore, five participants reported a history of a neurological disease, one participant reported being a non-native English speaker, six participants obtained an unexpectedly high digits-in-noise threshold (>5 dB SNR), and two participants failed to complete the digits-in-noise perception task altogether.

2.2. Materials and Procedures

2.2.1. Story Selection

A set of ten stories (~10 min each) of different types were selected for the current study. Recognizing that different stories may appeal to different people, we sampled stories from various genres and themes to ensure a broad representation of narrative experiences. All stories have been used in previous studies [6,16,60]. Five stories from the storytelling podcast The Moth (https://themoth.org, accessed on 10 June 2024) were chosen for high engagement: The Bounds of Comedy by Colm O'Regan (The Moth 1), Swimming with Astronauts by Michael Massimino (The Moth 2), Nacho Challenge by Omar Qureshi (The Moth 3), Alone Across the Arctic by Pam Flowers (The Moth 4), and Discussing Family Trees in School Can Be Dangerous by Paul Nurse (The Moth 5). Two stories adapted from print books were included as samples of moderately engaging stories: Wave by D.M. Ouellet (Story Book 1F and 1M) and Alibi by Kristin Butcher (Story Book 2F and 2M). Two versions for each of the two stories were recorded in-lab, one by a female and one by a male native English speaker (different female and male speakers for the two stories), resulting in four Story Book stories used in the current study. Finally, a 10 min excerpt from the Sleep With Me podcast (http://www.sleepwithmepodcast.com, accessed on 10 June 2024) was included to represent a highly disengaging story [6,42]. For data analysis, the

ten individual stories were grouped based on their hypothesized levels of engagement as described in [6], that is, The Moth (highly engaging), Story Books (moderately engaging), and Sleep Story (disengaging).

2.2.2. Story Listening Procedure and Experience Assessment

Participants used an internet browser on a computer or laptop to perform the experimental procedures. Participants were asked to use headphones during the study and completed a volume calibration by adjusting their device volume to a comfortable level while listening to pink noise. Each participant was randomly assigned to one of the ten spoken stories and was instructed to listen carefully and understand it as best as possible. After listening to each story, participants rated the 23 items of the SWAS [6,24]. All item statements are listed in Table 1. The statements were presented to each participant in randomized order, and they rated each on a 7-point scale anchored on 1 (strongly disagree) and 7 (strongly agree).

Table 1. Items of the Story World Absorption Scale (SWAS) capturing four dimensions and enjoyment.

Dimension	Item ID	Question
Attention	A1	When I finished listening I was surprised to see that time had gone by so fast.
Attention	A2	When I was listening I was focused on what happened in the story.
Attention	A3	I felt absorbed in the story.
Attention	A4	The story gripped me in such a way that I could close myself off from things that were happening around me.
Attention	A5	I was listening in such a concentrated way that I had forgotten the world around me.
Emotional engagement	EE1	When listening to the story I could imagine what it must be like to be in the shoes of the main character(s).
Emotional engagement	EE2	I felt sympathy for the main character(s).
Emotional engagement	EE3	I felt connected to the character(s) of the story.
Emotional engagement	EE4	I felt how the main character(s) was/were feeling.
Emotional engagement	EE5	I felt for what happened in the story.
Mental imagery	MS1	When I was listening to the story I had an image of the main character(s)in mind.
Mental imagery	MS2	When I was listening to the story I could see the situations happening in the story being played out before my eyes.
Mental imagery	MS3	I could imagine what the world in which the story took place looked like.
Transportation	T1	When I was listening to the story it sometimes seemed as if I were in the story world too.
Transportation	T2	When listening to the story there were moments in which I felt that the story world overlapped with my own world.
Transportation	T3	The world of the story sometimes felt closer to me than the world around me.
Transportation	T4	When I was finished with listening to the story it felt like I had taken a trip to the world of the story.
Transportation	T5	Because all of my attention went into the story, I sometimes felt as if I could not exist separately from the story.
Enjoyment	E1	I thought it was an exciting story.
Enjoyment	E6	I thought it was an enthralling story.
Enjoyment	E7	I listened to the story with great interest.
Enjoyment	E8	I thought the story was beautiful.
Enjoyment	E10	I thought the story was presented well.

To identify individuals who might have been engaged in other activities during the experiment, additional attention tasks were administered. During story listening, a number between 0 and 9 appeared in the center of the screen approximately every 15 s (randomly selected ranging from 11 to 19 s). The number stayed on the screen for 2.2 s. Participants were instructed to press the corresponding number key on their keyboard as quickly as possible. Only responses within 2.2 s and of the correct number key were considered correct responses. Participants who missed or incorrectly responded to 20% or more of visual numbers were assumed not to be paying attention to the experimental procedures, and their data were excluded from the analysis ($N = 40$). After listening to the story, participants were asked ten multiple-choice, plot-specific questions with four answer options each to

assess their general comprehension of the narrative (chance rate 25%). Participants who correctly answered fewer than seven of the ten comprehension questions were assumed not to be paying attention to the experimental procedures, and their data were excluded from the analysis (N = 20). Moreover, participants were explicitly asked if they were doing something else while listening to the story, such as checking their phone, opening other browser tabs, etc. Participants who indicated 'yes' to this question were excluded from the analysis (N = 5).

The experimental procedures were implemented using JavaScript/HTML scripts with jsPsych JavaScript libraries (v6.1.0; [61]). Experiment code and stimuli were stored at an online Gitlab repository and hosted via Pavlovia (https://pavlovia.org, accessed on 10 June 2024).

2.2.3. Hearing Assessment

Participants' subjective ratings of their general hearing abilities and problems were assessed on an 11-point rating scale in response to the question "How would you rate your general hearing abilities?" anchored on 0 (very poor) and 10 (very good) and the statement "I often experience hearing problems" anchored on 0 (strongly disagree) and 10 (strongly agree). The effect of age on subjective hearing reports was assessed using Spearman's correlation separately for general hearing abilities and hearing problems.

Participants' objective hearing abilities were assessed using an adapted version of the digits-in-noise (DIN) test [62,63]. The DIN test has been used and validated for testing both in-lab [63–65] and remotely [62,66–69], and DIN thresholds correlate reliably with pure-tone audiological examinations performed in person (0.5–4 kHz; r > 0.7; [64–66]). Participants listened to digit triplets masked with 12-talker babble noise [70,71], after which they typed the digits they heard in the order they had been presented. The signal-to-noise ratio (SNR) was manipulated by varying the spoken digits relative to the level of the babble noise. Twenty-six randomly generated digit triplets from 1–9 (onset-to-onset interval: 0.85 s) were presented at 26 SNRs (range: −15 dB to +15 dB; step size: 1.2 dB). The babble masker lasted 3 s, and the sequence of digits started 0.5 s after babble onset. Each participant completed two practice trials with high SNRs, followed by the 26 test trials [59]. A trial was considered correct if all three digits were typed in the order they were presented.

2.2.4. Mood Assessment

To evaluate participants' mood and its relation to story absorption and enjoyment, five positive ("contented", "pleased", "joyful", "cheerful", and "happy") and five negative ("dissatisfied", "sad", "frustrated", "low-spirited", and "depressed") adjectives were adapted from the "Hedonic Tone" factor of the UWIST Mood Adjective Checklist (UMACL) [72]. Each scale item/adjective was rated in terms of how much it reflected the current feelings of the participants on an 11-point scale ranging from 0 (not at all) to 10 (very much).

2.3. Analyses

Data analyses were conducted using MATLAB (MathWorks) and JASP [73] version 0.16.4 software. Significant main effects in ANOVAs were followed up by post hoc comparisons using the Holm procedure [74]. Effect sizes for ANOVAs and t-tests are reported using omega squared (ω^2) and Cohen's d (d), respectively.

Age was treated continuously in most statistical analyses, but three age-group categories were used for an intuitive assessment of effects and visualizations: younger adults with a mean age of 30.7 years (age range 20–39), middle-aged adults with a mean age of 51.3 years (age range 40–59), and older adults with a mean age of 65.7 years (age range 60–78).

2.3.1. Story Listening and Experience

Rating scores on the 23 items of the SWAS were linearly re-scaled to range from 0 to 1, facilitating interpretation. For each participant, ratings were separately averaged across absorption and enjoyment items. To assess the overall influence of story type and age on

absorption and enjoyment, we first conducted two-way analyses of variance (ANOVAs), separately for absorption and enjoyment ratings, using story type (three levels: Sleep Story, Story Book, and The Moth) and age group (three levels: younger, middle-aged, and older) as between-participants factors.

Separate linear regressions were calculated to analyze the effect of age as a continuous variable and to identify the factors that predicted absorption and enjoyment. Explanatory variables included story type, age, gender, DIN threshold, and mood. Gender was included because differences in narrative engagement between men and women have been reported previously [75]. The DIN threshold was included to examine whether hearing abilities affect story-listening experiences. Finally, mood was included as a predictor to investigate whether mood effects previously observed for engagement and story involvement for written materials [46,47] could be extended to auditory materials.

2.3.2. Hearing

A logistic function was fit to the DIN data, and the resulting 50% threshold was used as a dependent measure. The relationship between age and the DIN threshold was investigated using the Pearson correlation. We investigated whether age was related to subjective hearing reports using the Spearman correlation.

2.3.3. Mood

For each participant, mood scores were averaged across items, separately for positive and negative mood items. An overall mood score was calculated by subtracting the mean rating of negative items from the mean rating of the positive items (i.e., a high overall mood score resulted from a high positive mood rating and a low negative mood rating).

2.3.4. Identification of Most Discriminatory SWAS Items

To explore which items of the SWAS discriminate best between stories designed to be engaging and those designed to be disengaging, responses for individual items of the SWAS (including enjoyment) were averaged across participants, separately for each story type. Averages for individual story types were overlaid to visualize the degree to which each item contributed to the experiences with the stories. To investigate the sensitivity of individual items further, we calculated, within item, the mean differences between The Moth and Sleep With Me and the Story Book and Sleep With Me story types. We sorted items by the magnitude of the difference from the Sleep With Me story.

2.3.5. Factor Analysis

Factor analyses were conducted to investigate whether the four SWAS dimensions can be observed for listening experiences. Procedures closely followed those described previously [24]. Factor analyses focused on data from the engaging stories, that is, The Moth stories and Story Book stories (overall N = 190 participants/datasets). Principal components analyses were calculated using oblique rotation (Promax) and maximum likelihood estimation with all items of the SWAS (excluding enjoyment items since they are not part of the four-dimensional SWAS). The overall Measure of Sampling Adequacy derived from the Kaiser–Meyer–Olkin test was 0.936, and Bartlett's test was significant ($p < 0.001$), indicating that the data were adequate for factor analyses [76–78]. The internal consistency of the SWAS items was acceptable (Cronbach $\alpha = 0.95$).

First, an exploratory factor analysis was calculated using the eigenvalue criterion 1 to determine the number of factors [79,80]. A second exploratory factor analysis was calculated with a predetermined factor number of 4, reflecting the number of dimensions of the original SWAS [24]. This second analysis examined whether individual items load with the original dimensions. The item selection criterion was a primary loading greater than 0.45 [24].

3. Results

3.1. Subjective and Objective Hearing

Age was positively correlated with subjective ratings of hearing problems ($r = 0.19$, $p = 0.005$) but was not significantly associated with self-rated general hearing abilities ($r = -0.11$, $p = 0.096$; Figure 2A). We further observed a positive correlation between age and digits-in-noise thresholds ($r_{214} = 0.38$ $p = 6.05 \times 10^{-9}$), with higher (i.e., worse) digits-in-noise thresholds for older participants (Figure 2B), as expected [16,59].

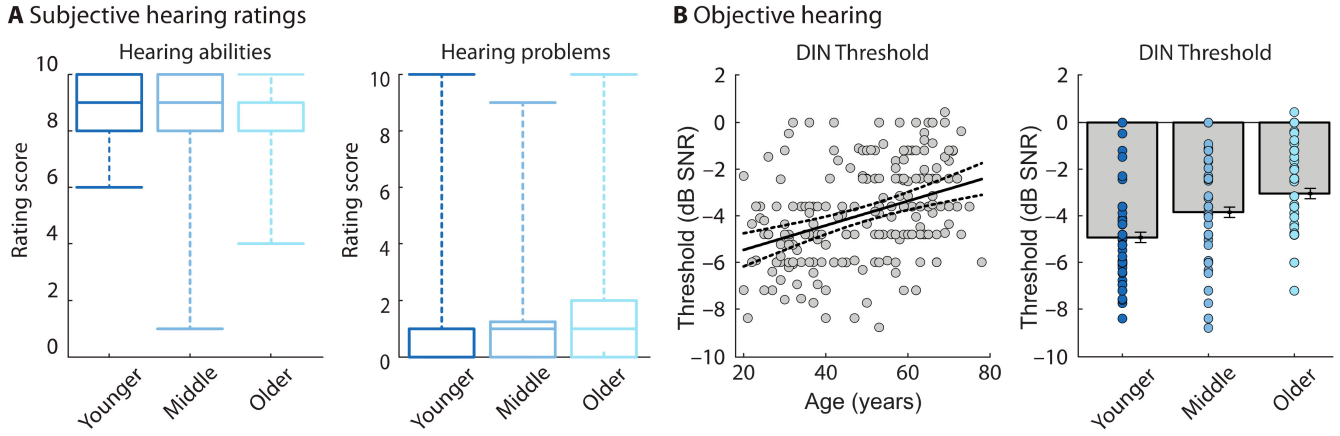

Figure 2. Subjective and objective hearing. (**A**) Subjective hearing per age group. Left: General hearing ability. Right: Hearing problems. (**B**) Digits-in-noise thresholds. Left: Correlation between age and DIN threshold. Right: Mean DIN threshold per age group.

3.2. Absorption and Enjoyment

Absorption and enjoyment ratings for each story type are shown in Figure 3A,B. Figure 3C,D show mean absorption and enjoyment ratings for each unique story. The ANOVA investigating absorption across age groups revealed a difference between story types (main effect of story type: $F_{2,207} = 67.86$, $p = 2.17 \times 10^{-23}$, $\omega^2 = 0.38$). Absorption ratings were higher for The Moth stories compared to the Story Book stories ($t_{188} = 2.42$, $p_{holm} = 0.016$, $d = 0.36$) and the Sleep Story ($t_{134} = 11.62$, $p_{holm} = 6.89 \times 10^{-24}$, $d = 2.60$), and for Story Book stories compared to the Sleep Story ($t_{104} = 9.65$, $p_{holm} = 3.89 \times 10^{-18}$, $d = 2.24$). There were no age-group differences (main effect of age group: $F_{2,207} = 2.96$, $p = 0.054$, $\omega^2 = 0.01$), nor was there a story type × age group interaction ($F_{4,207} = 1.2$, $p = 0.31$, $\omega^2 = 0.002$), suggesting that people across ages find the stories similarly absorbing.

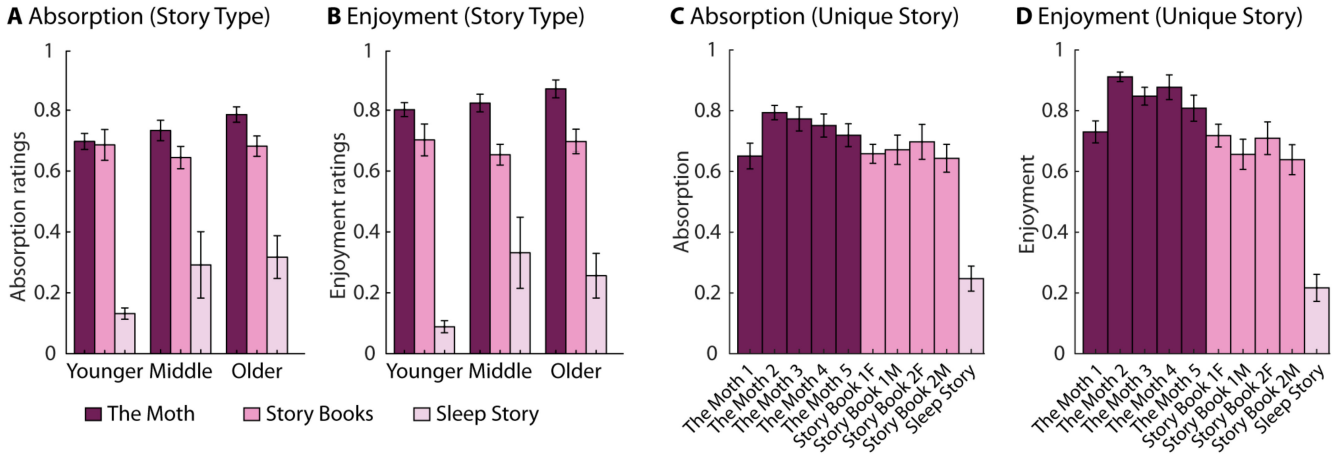

Figure 3. Story listening experience. (**A**,**B**) Absorption and enjoyment ratings by age group and story type. (**C**,**D**) Absorption and enjoyment ratings for each unique story.

Similar to absorption ratings, the ANOVA for enjoyment revealed differences between story types (main effect of Story Type: $F_{2,207} = 103.67$, $p = 6.42 \times 10^{-32}$, $\omega^2 = 0.48$). Enjoyment was higher for The Moth stories compared to Story Book stories ($t_{188} = 5.25$, $p_{holm} = 3.81 \times 10^{-7}$, $d = 0.78$) and the Sleep Story ($t_{134} = 14.33$, $p_{holm} = 3.21 \times 10^{-32}$, $d = 3.21$), and for Story Book stories compared to the Sleep Story ($t_{104} = 10.46$, $p_{holm} = 1.59 \times 10^{-20}$, $d = 2.43$). There were no age-group differences (main effect of age group: $F_{2,207} = 2.54$, $p = 0.081$, $\omega^2 = 0.01$), nor a story type × age group interaction ($F_{4,207} = 1.76$, $p = 0.14$, $\omega^2 = 0.007$), suggesting that people across ages find the stories similarly enjoyable.

3.3. Predictors of Absorption and Enjoyment

The linear regression analysis predicting absorption was significant ($R^2 = 0.363$, $F_{5,206} = 23.45$, $p = 1.26 \times 10^{-18}$), explaining 36% of the variance. Specifically, story type predicted absorption ($t_{210} = 9.69$, $p = 1.59 \times 10^{-18}$), as expected based on the ANOVA reported above. Mood also predicted absorption ($t_{210} = 3.86$, $p = 1.52 \times 10^{-4}$), such that higher mood ratings were associated with higher absorption ratings (Figure 4A). Age, gender, and digits-in-noise thresholds did not predict absorption ($ps > 0.21$).

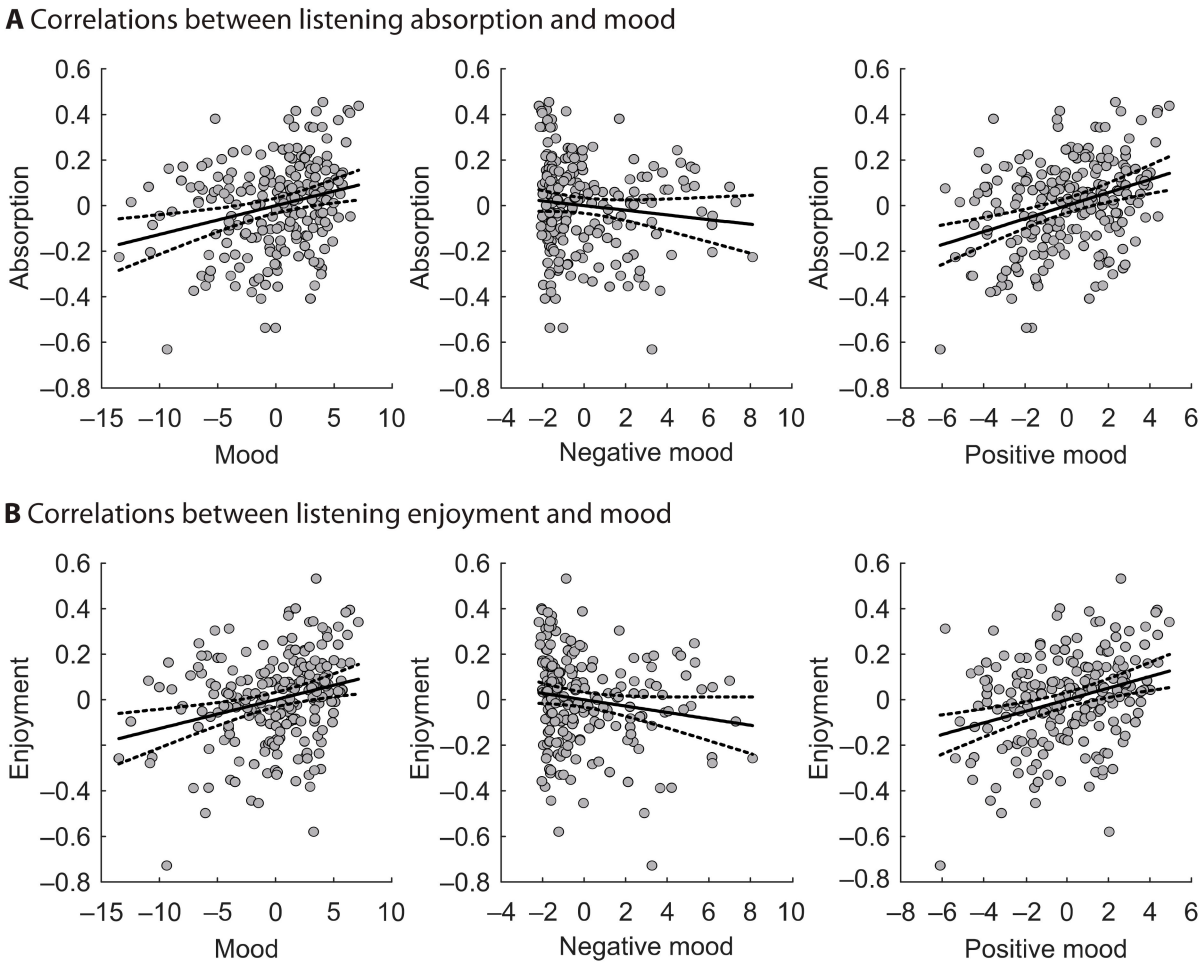

Figure 4. Relation between mood and absorption and enjoyment. (**A**) Correlations between absorption and mood. (**B**) Correlations between enjoyment and mood. The three plots show correlations for overall mood, negative mood, and positive mood. Data reflect the residuals after regressing out story type, age group, DIN threshold, and gender.

The regression predicting enjoyment was also significant ($R^2 = 0.502$, $F_{5,206} = 41.48$, $p = 2.01 \times 10^{-29}$), accounting for 50% of the variance. Story type predicted enjoyment ($t_{210} = 13.37$, $p = 9.08 \times 10^{-30}$), again corresponding to the results of the ANOVA reported

above. Mood also predicted enjoyment ($t_{210} = 3.94$, $p = 1.13 \times 10^{-4}$), such that higher mood ratings were associated with higher enjoyment ratings (Figure 4B). Moreover, gender had a small effect ($t_{210} = 2.24$, $p = 0.026$), indicating that women enjoyed the stories more than men. As was the case for absorption, age and digits-in-noise thresholds did not predict enjoyment ($ps > 0.44$).

3.4. Mood and Listening Experience

To follow up on the significant effect of mood, we explored whether a positive or negative mood underlies the relationship between mood and absorption/enjoyment. To this end, the same regression analyses reported in the previous section were calculated again, but positive and negative mood scores replaced the overall mood score in separate analyses. The analyses for absorption revealed a significant relation with positive ($t_{210} = 5.22$, $p = 4.44 \times 10^{-7}$) but not with negative mood ratings ($t_{210} = -1.64$, $p = 0.104$), showing that people with more positive mood ratings also rated the story to be more absorbing (Figure 4A). The analyses for enjoyment likewise showed a significant relation with positive ($t_{210} = 4.67$, $p = 5.47 \times 10^{-6}$), as well as with negative mood ratings ($t_{210} = -2.28$, $p = 0.023$), such that individuals who showed higher positive and lower negative mood ratings also rated the story as more enjoyable (Figure 4B).

3.5. Identification of SWAS Items That Discriminate between Stories

Figure 5 shows the rating scores for each item of the SWAS (including enjoyment) averaged across participants. Figure 5A shows absorption and enjoyment ratings for The Moth stories relative to the Sleep With Me story, and Figure 5B shows Story Book stories relative to the Sleep With Me story. The plots indicate that items A2, T5, A5, T2, MS1, and E7 appear to produce a small difference between The Moth and Story Book stories relative to the Sleep With Me story, suggesting that they may not be effective for discriminating between materials with different engagement levels. Specifically, items A2, MS1, and E7 obtained relatively high scores across all story types, including Sleep With Me. In contrast, low discriminability for items T2 and T5 was due to the relatively low ratings for The Moth and Story Book stories. A5 appears somewhat in between.

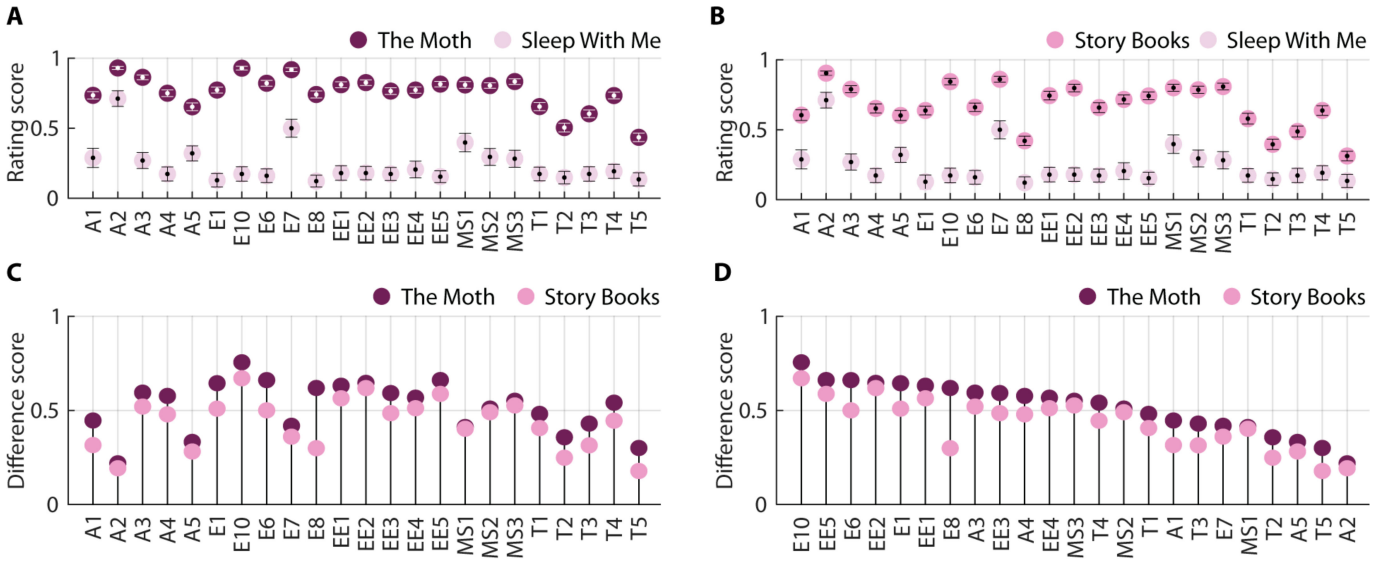

Figure 5. Rating scores for SWAS items. (**A**) The Moth ratings relative to Sleep With Me ratings. (**B**) Story Book ratings relative to Sleep With Me ratings. (**C**) Mean difference between The Moth and Story Book stories relative to the Sleep With Me story. (**D**) Sorted mean difference by magnitude between The Moth and Story Book stories relative to the Sleep With Me story (same data as in panel **C**). Error bars in panels **A** and **B** reflect the standard error of the mean.

We also calculated the mean difference between The Moth and Story Book stories relative to the Sleep With Me story. Figure 5C shows the mean difference ratings sorted by sub-scales of the SWAS, and Figure 5D shows the mean difference ratings sorted by the magnitude of the difference. These plots indicate that items of emotional engagement and enjoyment appear to discriminate particularly well, whereas items pertaining to attention and transportation discriminate less effectively between the less engaging (Sleep With Me) and more engaging (The Moth, Story Book) stories.

These descriptive analyses highlight that emotional engagement and enjoyment are most sensitive to naturalistic spoken stories. In contrast, attention and transportation appear less discriminative for the ~10-min spoken stories used here.

3.6. Analysis of the Dimensional Structure of the SWAS for Spoken Stories

We calculated factor analyses to examine the dimensional structure of the SWAS for spoken stories. First, we calculated an exploratory factor analysis using the eigenvalue criterion to determine the number of factors. The analyses revealed three unique factors. Factor loadings are provided in Table 2, and correlations between factors are shown in Table 3. While the Transportation (Factor 1) and Attention (Factor 3) factors were mainly retained as compared to the four-factor solution of the original SWAS dimensions [24], the Mental Imagery and Emotional Engagement were jointly captured in Factor 2. The correlation between the Emotional Engagement items and the factor was low compared to the other items. The three factors explained 62.1% of the variance.

Table 2. Factor loadings for three-factor solution.

Item	Factor 1	Factor 2	Factor 3
T3	0.999		
T5	0.927		
T2	0.826		
T1	0.719		
A5	0.704		
T4	0.519		
MS2		0.933	
MS1		0.879	
MS3		0.878	
EE1		0.615	
EE4		0.542	
A3			0.792
A2			0.652
A4			0.569
EE5			0.454
A1			
EE2			
EE3			

Table 3. Correlation between factors for three-factor solution.

	Factor 1	Factor 2	Factor 3
Factor 1	1.000		
Factor 2	0.663	1.000	
Factor 3	0.660	0.715	1.000

We also calculated an exploratory factor analysis with four pre-determined factors since the original SWAS consists of four dimensions [24]. Factor loadings are provided in Table 4, and correlations between factors are shown in Table 5. The analysis indicates that for story listening, individual scale items are approximately grouped into the four factors identified by the original SWAS for written narratives. Item A5 appears to be an

exception, loading on Transportation (Factor 1) rather than Attention (Factor 4). The four factors explained 65.4% of the variance, similar to the original work [24].

Table 4. Factor loadings for four-factor solution.

Item	Factor 1	Factor 2	Factor 3	Factor 4
T3	0.980			
T5	0.905			
T2	0.784			
A5	0.742			
T1	0.663			
T4	0.545			
MS2		1.002		
MS1		0.826		
MS3		0.780		
EE3			0.857	
EE2			0.733	
EE5			0.621	
A3				0.658
A2				0.614
A4				0.532
A1				
EE1				
EE4				

Table 5. Correlation between factors for four-factor solution.

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1.000			
Factor 2	0.610	1.000		
Factor 3	0.669	0.754	1.000	0.620
Factor 4	0.591	0.628	0.620	1.000

4. Discussion

While naturalistic speech stimuli have gained popularity for studying speech processing and hearing challenges, little research has explored age-related differences in experiences with such materials. This study examined whether a scale measure of absorption for written narratives could be extended to story listening and whether age-related factors influenced these experiences. We show that older adults enjoy and feel absorbed in spoken stories as much as younger adults do and that being in a positive mood facilitates enjoyment and absorption. We further showed that the four dimensions of the original absorption scale also captured distinct aspects of experience during story listening.

4.1. Absorption and Enjoyment of Spoken Narratives

We operationalized listening experiences using the concepts of absorption and enjoyment from the Story World Absorption Scale [24]. Listening experiences varied across the different story types, such that the stories we expected to be more engaging (i.e., The Moth) gave rise to higher absorption and enjoyment ratings than other story types. These findings corroborate the SWAS's ability to discriminate between different types of materials as described in the original work [24] and extend these observations to the auditory modality (see also [6]) and to older adults.

Interestingly, despite expected increased digits-in-noise thresholds for our older participants (indicative of subclinical hearing loss), story-listening experiences remained unaffected. The stories were presented without background noise, and older people commonly experience few comprehension challenges when listening to a single talker at a comfortable, audible level, even when they have subclinical hearing loss typical for their age [7]. Our

results thus suggest that spoken stories are similarly enjoyable and absorbing in individuals of different ages.

To ensure the generalizability of our findings to a wide range of narrative characteristics and to account for the diverse ways in which individuals may engage with narratives, we employed various story types and multiple examples per type, except for the Sleep With Me story. Findings showed The Moth and Story Book stories to be generally captivating and pleasurable, with The Moth being more absorbing and enjoyable. While Story Book stories were well-articulated, easily comprehensible, and aimed at a younger audience, their recorded narration might appear monotonous, lacking everyday speech elements. In contrast, live-recorded Moth stories featured natural language elements like filler words and pauses, mirroring everyday communication patterns [81,82]. The dynamic, engaging nature of The Moth stories thus renders them particularly suitable for investigating speech perception.

Growing interest exists in using spoken narratives to explore neural and behavioral memory signatures [5,83–85] and neural speech processes in diverse age groups [18,86–89]. Our study found high ratings of absorption and enjoyment for the stories, with minor variations reflecting individual preferences. This supports using spoken narratives for research on hearing health across lifespans. Additionally, our findings hold promise for investigating cognitive aging benefits through narrative absorption, particularly in populations with limited print access due to age-related vision loss.

4.2. Predictors of Absorption and Enjoyment

Aside from age and hearing ability, our study explored other individual factors impacting the absorption and enjoyment of spoken stories. Consistent with existing literature on mood effects in several cognitive domains [90], our study demonstrated that positive mood ratings predicted higher story absorption and enjoyment.

Mood appears to influence narrative processing diversely. For example, congruence between mood and narrative (written) content enhances integration [91], while positive and negative mood induction influences text comprehension and memory recall [46]. Moreover, positive affective dispositions towards characters during film viewing increase narrative engagement and enjoyment [4]. Although the effects of mood on engagement and performance appear to hinge on context [92], negative emotions (e.g., anger and confusion) have been found to impede intrinsic motivation in educational environments, reducing students' learning interests and enjoyment [93]. Our findings contribute to this body of literature by linking positive mood to enhanced narrative absorption and enjoyment, possibly due to increased intrinsic motivation to engage in listening. Our data do not speak to how mood states relate to specific features of the narrative (e.g., feelings for and with characters) or how mood is altered by listening and how this affects absorption and enjoyment. Nevertheless, our study indicates the possible effects of mood on narrative speech processing and experience.

4.3. Item Discrimination and Factor Structure of Story Absorption Scale

We assessed the SWAS items' ability to discriminate between story types and the factorial structure of the SWAS for spoken stories. Consistent with findings for written narratives [24], scale items distinguished between different intended absorption levels in spoken stories. Enjoyment, Emotional Engagement, and Mental Imagery items were particularly sensitive, while Transportation and Attention subscales showed less clear discrimination. Hence, using all scale items is relevant for research questions about specific mental processes during narrative listening. At the same time, a more general absorption measure may be obtained using only Enjoyment, Emotional Engagement, and Mental Imagery subscales.

Factor analyses indicated that the SWAS items for auditory materials aligned with the original written narrative dimensions when a pre-determined four-factor structure was applied [24]. This implies shared mental processes during written and auditory story

absorption. In an unrestricted factor analysis solution, story absorption appeared to be captured by three factors, largely overlapping with the four-factor solution, with the exception that "Mental Imagery" and "Emotional Engagement" items tended to load on one rather than two factors (Table 4). This could indicate a subtle absorption difference attributed to the specific medium of spoken stories, such that Mental Imagery and Emotional Engagement dimensions only capture subtle differences in listening experiences. Future studies are needed for clarification.

While the SWAS effectively measures auditory narrative absorption, it lacks scales representing medium-specific auditory factors influencing absorption. Limited research on absorption by spoken narratives exists, though the study by Lange et al. [32] suggests acoustic features like narration tempo and pitch may impact audiobook listening. Including alternative subscales accounting for such medium-specific characteristics could enhance the scale's sensitivity.

4.4. Limitations and Future Directions

The findings of the present study should be interpreted in light of certain limitations. First, conducting the study online introduces potential variability in participants' listening environments, which we attempted to control through exclusion criteria and attention checks described earlier. However, we cannot entirely rule out the impact of uncontrolled environmental factors on participants' absorption and enjoyment, and our results may not be equivalent to those obtained through in-person testing.

Moreover, it should be mentioned that all stories used in this study were presented in clear speech, without noise masking. Speech listening under ideal conditions is relatively effortless across ages, and previous research has demonstrated that, among healthy, younger adults, engagement in story listening appears to be unaffected by masking conditions such as multi-talker babble [6,16,60]. However, it is uncertain whether older adults with hearing loss appropriate for their age perceive and rate absorption and enjoyment similarly when masked by, e.g., multi-talker babble. Examining the effects of different listening conditions, such as varying levels of background noise and the use of different narrative delivery methods, would provide deeper insights into the engagement processes across different demographics, especially older adults.

While our study primarily focused on how mood affects absorption, it was beyond the scope of our research to investigate whether this relationship is bidirectional, i.e., whether engaging deeply with a narrative can improve mood. Understanding this dynamic can help in designing more effective therapeutic interventions, educational tools, and engaging content that leverages the power of storytelling to enhance emotional well-being and should be explored.

Self-reported absorption through a scale measurement tool may not accurately reflect actual cognitive and emotional engagement. A recent study by Richardson et al. [94] comparing self-report and physiological measures of narrative engagement in spoken stories and movie clips found that self-reported engagement was higher for movie watching, compared to listening to spoken versions of the same stories, whereas physiological measures of engagement (heart rate, temperature, and electrodermal activity) showed the opposite, i.e., increased engagement during listening [94]. This suggests that while self-reported scales like the SWAS are useful, they should perhaps be complemented with physiological data. Future studies should consider incorporating both subjective self-report measures and objective physiological measures to capture a comprehensive picture of narrative engagement.

Although our four-factor analysis showed approximate convergence with the findings by Kuijpers et al. [24], we should highlight that our study was not originally designed with factor analysis as a primary objective. While we achieved a reasonably large sample size, the distribution of participants across different story types and demographic groups was not optimized for factor analysis. Ideally, future factor analyses would ensure a more balanced and targeted sampling strategy to enhance the robustness of the findings.

Additional research is, therefore, required, including larger and more diverse populations and materials spanning more genres and narrative styles.

5. Conclusions

This study aimed to explore how individuals of different ages experience absorption in and enjoyment of a variety of spoken stories and to assess the ability of the Story World Absorption Scale to capture such experiences. Our study demonstrates that listening to spoken stories produces analogous absorption and enjoyment experiences to those observed for narrative reading along the scale dimensions of Attention, Mental Imagery, Transportation, and Emotional Engagement and that people across ages engage with and experience such materials in similar ways. We further showed that a positive mood predicts the degree to which a person feels absorbed by and enjoys a spoken story. The findings suggest that age-related hearing changes do not necessarily diminish the capacity to engage with and enjoy narrative content. For older adults, particularly those experiencing hearing loss, engaging with well-produced spoken narratives can be an effective way to maintain cognitive stimulation and social engagement. We encourage future research to identify the specific auditory features, such as narrative style, vocal delivery, and story content, that will maximize listener engagement. Such insights could be applied in therapeutic settings, including using engaging audiobooks or storytelling sessions to improve mood and mental well-being among older adults and those in care settings. Finally, the study provides a foundation for using spoken narratives in hearing research. Naturalistic speech stimuli, such as those used in this study, offer a realistic and effective means of studying speech perception and comprehension across different age groups. Researchers can build on these findings to explore how narrative engagement varies with different hearing conditions and interventions.

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