The Brussels Mood Inductive Audio Stories (MIAS) database

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Abstract Through this study, we aimed to validate a new tool for inducing moods in experimental contexts. Five audio stories with sad, joyful, frightening, erotic, or neutral content were presented to 60 participants (33 women, 27 men) in a within-subjects design, each for about 10 min. Participants were asked (1) to report their moods before and after listening to each story, (2) to assess the emotional content of the excerpts on various emotional scales, and (3) to rate their level of projection into the stories. The results confirmed our a priori emotional classification. The emotional stories were effective in inducing the desired mood, with no difference found between male and female participants. These stories therefore constitute a valuable corpus for inducing moods in French-speaking participants, and they are made freely available for use in scientific research.

Keywords Mood Induction Procedure (MIP) · Audio stories database · Arousal · Valence · Basic Emotions · Projection

In everyday life, we repeatedly face events that influence our feelings, resulting in constant experiences of specific and changing moods. These moods can probably influence information processing, as has been suggested by various studies. Indeed, authors have reported an influence of mood on various cognitive processes, such as learning (e.g., Bertels, Demoulin, Franco, & Destrebecqz, 2013; Brand, Reimer, & Opwis,

2007), memory (Deliens, Gilson, Schmitz, & Peigneux, 2013; Drace, 2012), and executive functions (e.g., Mitchell & Phillips, 2007). Although mood is sometimes considered to be an intrinsic characteristic of a group of patients (e.g., depressed people, as in Ellwart, Rinck, & Becker, 2003), participants' moods are manipulated using mood induction procedures (MIPs) in most studies.

MIPs have developed in various forms, based on hypnosis, guided imagery, autobiographical recall, the Velten MIP (reading self-referent affirmations to progressively generate a particular mood, such as happiness or sadness; Velten, 1968), feedback, music, stories, films, pictures, real-life techniques, or combinations of two or more of these techniques at once. Among the aforementioned techniques, films and stories have turned out to be the most effective means to elicit emotional states (for reviews, see, e.g., Gerrards-Hesse, Spies, & Hesse, 1994; Gilet, 2008; Westermann, Spies, Stahl, & Hesse, 1996). Both are easy to implement in a laboratory, have high ecological validity, and can be presented individually or collectively. Furthermore, they may be selected because their emotional content is explicit from the beginning, and they can elicit a mood without directly asking participants to experience it.

In specific experimental contexts, the use of stories reveals several advantages over films. First, in contrast to films, which engage both the auditory and visual modalities, stories can be unimodal, either visual (plain texts) or auditory, opening up the possibility for the participant to perform a simultaneous task in the other modality[1] (see, e.g., Bertels et al., 2013). Although attempts have been made to overcome this

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[1] However, it should be borne in mind that the modality activated by the content of the story, which is not necessarily the same as the modality of the story (e.g., activation of mental imagery by an audio description of visual characteristics), could differentially interfere with the simultaneous task (Vermeulen, Corneille, & Niedenthal, 2008). Moreover, given that listening to stories requires a significant cognitive load, the simultaneous task should not be too demanding.

limitation by using nonauditory film clips (Carvalho, Leite, Galdo-Álvarez, & Gonçalves, 2012; Hewig, Hagemann, Seifert, Gollwitzer, Naumann, & Bartussek, 2005), this manipulation renders the material less emotional and less ecological. Second, the use of audio stories minimizes eye movements, which is crucial when using neuroimaging techniques such as magnetoencephalography (MEG) or electrophysiological measures such as facial electromyography (EMG). Finally, although emotional movie clips usually last less than a few minutes (Kaviani, Gray, Checkley, Kumari, & Wilson, 1999; Hewig et al., 2005; Schaefer, Nils, Sanchez, & Philippot, 2010; but see Hubert & de Jong-Meyer, 1990), audio stories may last longer, particularly since excerpts may be selected and concatenated at the researcher's choosing. By contrast, skipping nonemotional passages from films without interfering with the story's coherence is more difficult. However, when the selected narratives are intensely emotional throughout, using such longer stories would ensure that participants were in a specific mood for a long period (i.e., the duration of the story), with the induction probably getting stronger as participants went along.

From this perspective, the purpose of our study was to create a standardized database of emotional audio stories—a resource that is, to the best of our knowledge, currently missing. Audio, rather than written, texts were used for several reasons. First, it is well known that prosody plays an important role in emotional processes (Coutinho & Dibben, 2013). Second, using audio texts allows for greater standardization from one presentation to another in terms of duration and fluency. Third, the use of audio stories circumvents limitations or variability related to participants' literacy levels.

To maximize the length of the mood induction, we used stories having an approximate duration of 10 min and in which the emotional elements were present from the beginning. The stories were rearranged so that nonemotional passages were skipped in order to maximize emotional load from the beginning to the end of the story, so that participants were kept in a specific mood for 10 min.

Our corpus covers different emotions by including sad, amusing, frightening, and erotic texts. Crucially, a fifth, neutral text was also used as a baseline condition. Although this might appear trivial, some authors have actually assessed MIPs' effectiveness by only comparing negative and positive conditions (e.g., Davydov, Zech, & Luminet, 2011; Göritz & Moser, 2006; Hubert & de Jong-Meyer, 1990), which does not ascertain whether both were actually effective. Also, we wanted to assess whether the procedure as such (in this case, listening to stories) influences mood. This factor is generally overlooked, since mood ratings are only taken after the MIP in most studies, but not before (Carvalho et al., 2012; Gross & Levenson, 1995; Hagemann et al., 1999; Hewig et al., 2005; Schaefer, Nils, Sanchez, & Philippot, 2010). Additionally, in studies using MIPs to investigate the effects of mood on

cognitive processes, such neutral text would serve as a control condition involving task demands and a fatigue effect similar to those in the emotional conditions.

Given that experiencing emotions when listening to a story might be at least partly dissociated from one's appraisal of its content, the assessment of each story was twofold. Using visual analogic scales and adjectives ratings, participants had to judge the emotionality of the content, as well as to report their own mood before and after listening to each story. Comparing both periods of assessment was crucial in order to assess the effectiveness of the stories in inducing moods. Additionally, we investigated the extent to which participants projected themselves into the different stories by asking them to rate their projection level on a visual analog scale, since several language and literature experts have already highlighted the importance of self-projection in what they call "emotional contagion," a concept close to mood induction (Davis, 1983; Ekman, 2003). Given that personality factors may influence the effectiveness of a laboratory MIP (e.g., Petrides & Furnham, 2003), the five stories were randomly presented to each participant, enabling us to undertake within-subjects comparisons and to attenuate the impact of interindividual differences.

We expected the content of the sad and frightening stories to be judged more negatively than the neutral narrative, and the content of the amusing and erotic stories to be judged more positively. We also expected the amusing, erotic, and frightening stories to be judged as being more arousing than the neutral and sad stories. In terms of their influences on participants' moods, we expected the sad story to create a negative mood and the amusing one to generate a positive mood. That is, (1) after having listened to the sad and amusing stories, participants would be in a more negative and a more positive mood, respectively, than after having listened to the neutral story, and (2) the absolute value of the difference between the post- and pre-story mood valence measures would be greater for negative (sad) and positive (amusing) MIPs than for the neutral MIP (assuming that listening to a neutral story might affect participants' mood). We also expected the amusing, erotic, and frightening stories to arouse participants, as compared to the neutral and sad stories. That is, (1) after having listened to the amusing, erotic, and frightening stories, participants would report that they felt more excited than after having listened to the neutral and sad stories, and (2) the absolute value of the difference between the post- and prestory mood arousal measures would be greater for the arousing (i.e., amusing, erotic, and frightening) MIPs than for the nonarousing (neutral and sad) ones.

A complementary aim of our study was to examine gender differences in the processing of emotional stories. Indeed, although a widespread stereotype exists that women are "more emotional" than men (Fischer & Manstead, 2000), studies aimed at validating emotional stimulus databases have not

always taken this factor into account (Davydov et al., 2011; Göritz & Moser, 2006; Hewig et al., 2005; Verheyen & Göritz, 2009). Moreover, gender effects are controversial, since some studies have reported differences between men and women (Schaefer et al., 2010), whereas others have not (Carvalho et al., 2012). Our study was undertaken using a well-balanced number of male and female participants, allowing us to test for gender-related differences in judging the emotional content of the stories, the self-reported effectiveness of the MIP, and participants' projection into the stories.

Method

Participants

A group of 60 French-speaking volunteers (33 women, 27 men; 27 students; mean age = 26.03, SD = 4.96, range 18–40) listened to five stories in a random order. The data from one participant (a woman) were discarded from the analyses because her story valence and arousal data were systematically missing. All analyses were conducted on the remaining 59 participants.

All of the participants reported that they had no hearing impairments or speech disorders, psychiatric or neurological illnesses, or substance abuse.

Material

Stories Five texts were chosen on the basis of their a priori emotional categories: (1) the neutral text consisted of a description of a giraffe (*Giraffa camelopardalis*) and its natural environment (http://fr.wikipedia.org/wiki/Girafe); (2) the sad story was an excerpt of a novel by Henry Bauchau (*Le boulevard périphérique*, 2008) and was about a young mother in the terminal phase of cancer; (3) the amusing text was an excerpt from the soundtrack of a show by Florence Foresti, a famous French humorist (*Mother fucker*; Petit, Rozon, & Berthon [Producers], Petit & Marouani [Directors], 2010) and was about the setbacks of motherhood; (4) the frightening excerpt was taken from a novel by Stephen King (*The Shining*, 1977/1998) that told the story of a woman pursued by her mad husband; and (5) the erotic text was a compilation of various excerpts from Emmanuèle Bernheim (*Vendredi soir*, 1998), Tahar Ben Jelloun (*Le premier amour est toujours le dernier*, 1995), and Michel Houellebecq (*Les particules élémentaires*, 1998) describing courtship displays that led to sexual intercourse.

All of the book excerpts were extracted from texts initially written in French, excluding the frightening text, which was obtained from a French translation of the American book. For the emotional excerpts, each text was rearranged so that nonemotional passages were skipped, in order to maximize emotional load without harming the story's coherence. The

duration of each story ranged from 10 min 36 s to 12 min 1 s. A native French-speaking professional actress (age 30) told the sad, frightening, and erotic stories, and a native French-speaking amateur actress (age 30) told the neutral story. The original speaker was used for the amusing story. Each narrative was recorded several times in order to select the best version. The sad story was digitally recorded on a Sony Mini Disc at a 44.1-kHz sampling rate and 32-bit resolution. The audio recordings were edited using the Soundtool/Digidesign 6.2.2. software. The neutral, frightening, and erotic stories were digitally recorded on a Sony linear PCM recorder (PCM-D50) and edited using Audacity software.

The audio stories and the written texts are provided as supplemental materials.

Questionnaires Questionnaires were presented in a paper-and-pencil format. Immediately before and after having listened to each story, participants were asked to draw a mark on a visual analog scale (VAS)—namely, a 10-cm continuous (or "analog") line between two end points—at the point that they believed best represented their current state. The first VAS (the "mood valence VAS") referred to how negative or positive they felt: The words "negative" and "positive" were written at the left and right ends of the line, respectively (i.e., lower VAS valence ratings corresponded to greater negativity). The second VAS (the "mood arousal VAS") referred to how aroused they felt: the words "calm, asleep" and "excited, awake" were written at the left and right ends of the line (i.e., lower VAS arousal ratings correspond to lower arousal). After having listened to each story, participants were also asked to draw a mark on a VAS that best fitted their level of projection onto the story—namely, to what extent they identified with one of the characters of the story. The words "not at all" and "absolutely" were written at the left and right ends of the line.

Participants also had to rate, on 7-point scales ranging from (1) *not at all* to (7) *absolutely*, the extents to which six adjectives depicting the basic emotions identified by Ekman, Friesen, and Ellsworth (1982; *irritating* for anger, *surprising* for surprise, *disgusting* for disgust, *frightening* for fear, *joyful* for joy, and *sad* for sadness) described the story that they had just listened to. Finally, they were asked to draw a mark on the two lines that best corresponded to their view of the narrative's content, independent of their personal feelings and emotions. These lines referred to how negative/positive and how calming/arousing they found the story to be (hereafter referred to as the "story valence and arousal" VASs, respectively). All VASs were 10 cm long, allowing for easy scoring on a continuous scale from 0 to 10.

Procedure

Participants were tested individually or simultaneously, with one participant in each experimental booth. Each participant

sat in front of a computer screen wearing headphones. The stimuli were presented at a loud, but comfortable, volume (about 65 dB). Stories were played using Windows Media Player software. Before beginning the five sessions of the study, participants were told that during each session they would have to listen to a story that might have emotional content; that they would be asked to fill in questionnaires regarding how they felt before and after the story; and that they should judge the emotional content of the story. In order to minimize demand effects, participants were reminded that personal, subjective ratings were required, and as such, that there were no correct or incorrect responses.

For each session, participants filled in the mood valence and arousal VASs twice: first before listening to the story, and once again after having listened to it. After listening, they also responded to the projection line, the 7-point scales for the six adjectives, and the story valence and arousal VASs. No time limit was imposed. Each session lasted less than 15 min. A delay of at least 2 h was required between listening to any two stories, so that several days were needed to present all of the stories to the participants.

Results

In this section, we first present results regarding (1) the judgment of the content of the stories and (2) their effectiveness in inducing moods. Indeed, checking that the selected stories corresponded to the desired emotions was a prerequisite, if we were to assess their influence on participants' mood. We then assessed (3) how the judgments of the content of the stories and their effectiveness in inducing moods were related. Finally, (4) we measured to what extent participants projected themselves into the stories.

Judgments about the emotional content of the stories

Interparticipant reliability in ratings on all scales assessing the emotional content of the stories was very high (Cronbach's α = .993), indicating that these stories produced reliable judgments across our sample.[2]

First, two mixed analyses of variance (ANOVAs) were conducted on participants' scores for (1) the story valence VAS and (2) the story arousal VAS, with Story as a within-subjects factor (five levels: neutral, sad, amusing, frightening, erotic) and Gender as a between-subjects factor. Table 1 displays the average raw scores for each story. All of the

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[2] Considering each scale separately, the interparticipant reliabilities for ratings on the story valence and arousal scales were very high (Cronbach's α = .991 and .971), as were the interparticipant reliabilities for the adjective ratings (Cronbach's α = .843, .958, .972, .993, .994, and .994 for the angry, surprise, disgust, fear, joy, and sadness scales, respectively).

following pairwise comparisons are Bonferroni corrected for multiple comparisons.

The ANOVA conducted on valence VAS scores disclosed a significant effect of story, $F(4, 228) = 106.145, p < .001, \eta_p^2 = .651$. The effect of gender and the Story × Gender interaction were not significant, both $Fs \leq 1$. Post-hoc comparisons revealed that the sad and frightening stories were judged as being more negative than the neutral, amusing, and erotic ones, and the amusing and erotic stories were judged as being more positive than the neutral one, all $ps < .001$. The sad and frightening stories, on the one hand, and amusing and erotic stories, on the other, did not differ from each other, both $Fs < 1$. Table 2 summarizes the results from these pairwise comparisons.

The ANOVA conducted on the arousal VAS scores also revealed a significant effect of story, $F(4, 228) = 34.189, p < .001, \eta_p^2 = .375$. The effect of gender and the Story × Gender interaction were not significant, $F(1, 57) = 2.578, p = .114, \eta_p^2 = .043$, and $F < 1$. Post-hoc comparisons revealed that the neutral and sad stories were less arousing than the three other stories, all $ps < .001$. The neutral and sad stories, on the one hand, and the amusing, frightening, and erotic stories, on the other hand, did not differ from each other, all $Fs < 1$. Table 3 summarizes the results from these pairwise comparisons.

Second, an ANOVA was computed on the participants' scores on the 7-point scales for the six adjectives, with Story (five levels) and Basic Emotion (six levels: joy, sadness, disgust, surprise, anger, fear) as within-subjects factors, and Gender as a between-subjects factor. The main effects of story and basic emotion were significant, $F(4, 228) = 33.692, p < .001, \eta_p^2 = .371$, and $F(5, 285) = 59.292, p < .001, \eta_p^2 = .510$. The Story × Basic Emotion interaction was also significant, $F(20, 1140) = 103.532, p < .001, \eta_p^2 = .645$. Neither the effect of gender nor its interaction with any of the other factors was significant, all $ps > .170$. Planned comparisons contrasting ratings on the intended scale with ratings on the other five scales revealed that the ratings of the sad story were higher on the sad scale than on the other scales, $p < .001$. The same was true regarding the amusing and erotic stories' scores on the joy scale, and for the frightening story on the fear scale, all $ps < .001$ (see Table 1).

MIP effectiveness

Two mixed ANOVAs were conducted on participants' scores for (1) the mood valence VAS and (2) the mood arousal VAS, with Story (five levels) and Moment of Assessment (two levels: pre-MIP, post-MIP) as within-subjects factors, and Gender as a between-subjects factor. Table 4 displays the average raw scores by story and moment of assessment.

The ANOVA conducted on the mood valence VAS scores revealed significant effects of story, $F(4, 228) = 11.070, p < .001, \eta_p^2 = .163$, and moment, $F(1, 57) = 43.162, p < .001, \eta_p^2 = .431$.

Table 1 Average raw scores on the story valence and arousal VAS, on the projection VAS and on the 7-point scales for the six adjectives

Story	VAS (0–10)			Seven-point scales					
	Story valence	Story arousal	Projection	Anger	Surprise	Disgust	Fear	Joy	Sadness
Neutral	5.88 (0.18)	5.09 (0.26)	1.77 (0.25)	1.62 (0.12)	3.99 (0.19)	1.12 (0.05)	1.20 (0.09)	2.72 (0.16)	1.60 (0.17)
Sad	2.19 (0.26)	4.72 (0.20)	5.62 (0.32)	1.84 (0.17)	1.79 (0.14)	1.72 (0.16)	3.84 (0.25)	1.10 (0.05)	5.73 (0.17)
Amusing	7.03 (0.29)	7.36 (0.21)	5.02 (0.32)	1.41 (0.11)	2.90 (0.19)	1.09 (0.09)	1.24 (0.10)	5.73 (0.19)	1.27 (0.13)
Scary	2.12 (0.25)	7.36 (0.20)	4.52 (0.38)	2.35 (0.20)	3.29 (0.19)	3.00 (0.22)	5.06 (0.190)	1.26 (0.11)	3.16 (0.22)
Erotic	6.95 (0.27)	7.27 (0.26)	5.51 (0.30)	2.09 (0.20)	3.38 (0.23)	1.61 (0.13)	1.35 (0.09)	3.92 (0.22)	1.18 (0.08)

Standard errors are in parentheses.

The Story × Moment interaction was also significant, $F(4, 228) = 39.908$, $p < .001$, $\eta_p^2 = .412$. Neither the effect of gender nor any interaction including this factor was significant, all $Fs \leq 1$.

Considering each moment of assessment separately, we found the effect of story to be significant in the post-MIP condition, $F(4, 228) = 33.929$, $p < .001$, $\eta_p^2 = .373$, but not in the pre-MIP condition, $F(4, 228) = 1.505$, $p = .202$, $\eta_p^2 = .026$. After having listened to the sad story, participants reported that they felt more negative than after hearing the frightening, neutral, erotic, and amusing stories. On the contrary, after having listened to the amusing excerpt, participants reported that they felt more positive than after any of the other stories. No difference was observed post-MIP between the neutral and frightening stories, $p = .249$, and between the neutral and erotic stories, $p = .240$, whereas participants reported that they felt more positive after the erotic than after the frightening story, $p = .001$. Table 5 summarizes the results from these pairwise comparisons.
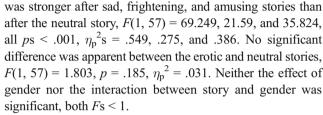
MIP indexes consisting in the difference between the post- and pre-MIP valence ratings were computed for each story (Table 4). One-sample t tests revealed that these indexes differed significantly from zero for the neutral, $t(58) = -2.085$, $p = .041$, sad, $t(58) = -9.477$, $p < .001$, amusing, $t(58) = 6.496$, $p < .001$, and frightening, $t(58) = -6.963$ $p < .001$, stories, but not for the erotic one, $t < 1$.

The ANOVA conducted on these indexes revealed a significant effect of story, $F(4, 228) = 39.908$, $p < .001$, $\eta_p^2 = .412$. Planned comparisons revealed that the mood induction

was stronger after sad, frightening, and amusing stories than after the neutral story, $F(1, 57) = 69.249$, 21.59, and 35.824, all $ps < .001$, $\eta_p^2s = .549$, .275, and .386. No significant difference was apparent between the erotic and neutral stories, $F(1, 57) = 1.803$, $p = .185$, $\eta_p^2 = .031$. Neither the effect of gender nor the interaction between story and gender was significant, both $Fs < 1$.

The ANOVA conducted on the mood arousal VAS scores revealed a significant effect of story, $F(4, 228) = 6.779$, $p < .001$, $\eta_p^2 = .106$, but no significant effect of moment, $F(1, 57) = 1.100$, $p = .299$, $\eta_p^2 = .019$. The Story × Moment interaction was significant, $F(4, 228) = 10.957$, $p < .001$, $\eta_p^2 = .161$. Neither the effect of gender nor any interaction including this factor was significant, all $ps > .280$, with the exception of the interaction between story and gender, $F(4, 228) = 3.181$, $p = .014$, $\eta_p^2 = .053$.

Considering each moment of assessment separately, we found a significant effect of story in the post-MIP but not in the pre-MIP condition, $F(4, 228) = 15.919$, $p < .001$, $\eta_p^2 = .218$, and $F < 1$. After having listened to the amusing, frightening, and erotic stories, participants reported being more aroused than after the neutral and sad stories, all $ps < .005$. No difference was observed post-MIP between the neutral and sad excerpts, on the one hand, $F < 1$, and between the amusing, frightening, and erotic excerpts, on the other hand, all $ps > .350$. Table 6 summarizes the results from these pairwise comparisons.

MIP indexes consisting in the difference between the post- and pre-MIP arousal ratings were computed for each story

Table 2 Values from the paired-samples t tests regarding the story valence VAS

	Neutral	Sad	Amusing	Scary	Erotic
Neutral	–				
Sad	14.2***	–			
Amusing	–3.55*	–13.17***	–		
Scary	13.19***	0.26	13.61***	–	
Erotic	–3.15*	–11.51***	0.194	–12.18***	–

*** $p < .001$. * $p < .05$. (Bonferroni corrected)

Table 3 Values from the paired-samples t tests regarding the story arousal VAS

	Neutral	Sad	Amusing	Scary	Erotic
Neutral	–				
Sad	1.24	–			
Amusing	–6.27***	–9.18***	–		
Scary	–6.83***	–9.16***	0.011	–	
Erotic	–5.44***	–8.03***	0.236	0.282	–

*** $p < .001$. (Bonferroni corrected)

Table 4 Average raw scores on the mood valence and the mood arousal VAS, by story and moment of assessment

	Mood valence VAS			Mood arousal VAS		
	Pre-MIP	Post-MIP	MIP Index (Post – Pre)	Pre-MIP	Post-MIP	MIP Index (Post – Pre)
Neutral	6.38 (0.20)	6.12 (0.19)	–0.25 (0.12)	5.52 (0.24)	4.94 (0.24)	–0.57 (0.18)
Sad	6.52 (0.19)	4.65 (0.23)	–1.88 (0.20)	5.71 (0.23)	5.06 (0.20)	–0.66 (0.23)
Amusing	6.26 (0.20)	7.49 (0.16)	1.23 (0.19)	5.78 (0.27)	6.76 (0.21)	0.98 (0.17)
Scary	6.77 (0.21)	5.53 (0.21)	–1.24 (0.18)	5.81 (0.21)	6.12 (0.23)	0.31 (0.26)
Erotic	6.69 (0.17)	6.75 (0.21)	0.05 (0.20)	5.97 (0.23)	6.43 (0.24)	0.44 (0.21)

Standard errors are in parentheses.

(see Table 4). One-sample t tests revealed that these indexes differed significantly from zero for the neutral, $t(58) = 3.081$, $p = .003$, sad, $t(58) = 2.959$, $p = .004$, amusing, $t(58) = 5.837$, $p < .001$, and erotic stories, $t(58) = 2.178$, $p = .033$, but not for the frightening one, $t(58) = 1.337$, $p = .186$.

The ANOVA conducted on these indexes revealed a significant effect of story, $F(4, 228) = 10.957$, $p < .001$, $\eta_p^2 = .161$. Planned comparisons revealed that the mood induction was stronger after the amusing, frightening, and erotic stories than after the neutral story, $Fs(1, 57) = 34.054, 6.945$, and 13.038, $p < .001$, $p = .011$, and $p = .001$. We observed no significant difference between the sad and neutral stories, $F < 1$. Neither the effect of gender nor the interaction between story and gender was significant, $F(1, 57) = 1.165$, $p = .285$, $\eta_p^2 = .02$, and $F(4, 228) = 1.277$, $p = .28$, $\eta_p^2 = .022$.

Relation between judgment of the content of the stories and their effectiveness in inducing moods

Regarding the valence dimension, correlational analyses revealed that the more the participants judged the sad and frightening stories as being negative, the stronger was the negative mood induction (i.e., the more negative they reported feeling after vs. before hearing the story), $r = .285$, $p = .029$, and $r = .353$, $p = .006$. This was also the case for the neutral story, $r = .260$, $p = .046$. Also, the more the participants judged the erotic story as being positive, the stronger was the positive mood

induction (i.e., the more positive they reported feeling after vs. before hearing the story), $r = .479$, $p < .001$. Surprisingly, this was not the case for the amusing story, $r = -.205$, $p = .12$.

Regarding the arousal dimension, correlational analyses revealed that the more the participants judged the frightening and erotic stories as being arousing, the stronger was the arousal induction (i.e., the more aroused they reported feeling after vs. before the story), $rs = .477$ and $.591$, both $ps < .001$. This was also the case for the sad story, $r = .350$, $p = .007$, but not for the neutral and amusing stories, $r = .253$, $p = .053$, and $r = -.159$, $p = .228$.

Assessment of projection level into the stories

An ANOVA conducted on projection scores, with Story and Gender as within- and between-subjects factors, revealed a significant effect of story, $F(4, 228) = 30.701$, $p < .001$, $\eta_p^2 = .350$. The effect of gender and the Gender × Story interaction were not significant, both $Fs < 1$. Participants projected themselves less into the neutral story than into the other four stories, all $ps < .001$, which did not differ from each other, all $ps > .180$ (see Table 1).

Correlations were computed for each story between projection and the differences between the post- and pre-MIP conditions for each story on (1) the mood valence scores, on the one hand, and (2) the arousal scores, on the other hand. Regarding the mood valence scores, these analyses disclosed

Table 5 Values from the paired-samples t tests regarding the post-MIP valence VAS

	Neutral	Sad	Amusing	Scary	Erotic
Neutral	–				
Sad	4.81***	–			
Amusing	–7.14***	–10.03***	–		
Scary	2.41	–3.42*	8.42***	–	
Erotic	–2.21	–7.04***	3.28*	–4.28**	–

*** $p < .001$. ** $p < .01$. * $p < .05$. (Bonferroni corrected)

Table 6 Values from the paired-samples t tests regarding the post-MIP arousal VAS

	Neutral	Sad	Amusing	Scary	Erotic
Neutral	–				
Sad	–0.31	–			
Amusing	–5.96**	–7.04**	–		
Scary	–3.77**	–3.82**	2.23	–	
Erotic	–3.92**	–4.86**	1.6	–0.85	–

** $p < .01$. (Bonferroni corrected)

significant negative correlations for the sad and frightening stories, $r = -.425$, $p = .001$, and $r = -.368$, $p = .004$, revealing that the more that participants projected themselves into these stories, the more negative was the difference between the post- and pre-MIP conditions (i.e., the more efficient the MIP was in inducing a negative mood). Significant positive correlations were observed for the amusing and erotic stories, $r = .276$, $p = .034$, and $r = .297$, $p = .022$, showing that the more that participants projected themselves into these stories, the more positive was the difference between the post- and pre-MIP conditions (i.e., the more efficient the MIP was in inducing a positive mood). No significant correlation was found for the neutral story, $r = .099$, $p = .453$.

Considering the arousal scores, analyses disclosed significant positive correlations for the sad, frightening, and erotic stories, rs = .352, .512, and .420, $p = .006$, $p < .001$, and $p = .001$, but not for the neutral and amusing ones, $r = .120$, $p = .773$, and $r = .116$, $p = .381$. These correlations revealed that the more that participants projected themselves into the sad story, the greater was the difference between the post- and pre-MIP conditions (i.e., the less efficient the MIP was in calming participants). Also, the more that participants projected themselves into the frightening and erotic stories, the more positive was the difference between the post- and pre-MIP conditions (i.e., the more efficient the MIP was in arousing/exciting participants).

For the five stories, we also made a correlational analysis between projection and the absolute value of the difference between the neutral valence value on the VAS scale (i.e., 5) and the story valence reported by each participant. These analyses revealed a positive correlation between the two ratings, $r = .364$, $p < .001$: The more that participants judged the stories as being emotional (whether negative or positive), the more they projected themselves into the stories, or conversely. A similar positive correlation was observed between projection and the absolute value of the difference between the neutral arousal value on the VAS scale (i.e., 5) and the story arousal reported by each participant, $r = .241$, $p < .001$.

Discussion

In the present study, we have provided a validated set of four emotional (sad, amusing, frightening, and erotic) and one neutral audio stories designed to induce moods. All five of the stories were presented to 33 women and 27 men in a within-subjects design, in order to minimize the influence of interindividual variability. Participants rated the content of each story regarding its valence and arousal, and in terms of the basic emotions (anger, fear, sadness, joy, surprise, and disgust) evoked by the story. Crucially, they also had to rate their own mood before and after listening to each story. This allowed us to assess the effectiveness of the MIP by comparing (1) the ratings

obtained for each story before and after the MIP and (2) the post-MIP ratings between the different stories.

As expected, the sad and frightening stories were judged more negatively than the neutral story, whereas the amusing and erotic stories were judged more positively. The amusing, frightening, and erotic stories were considered more arousing than the sad and neutral stories, which did not differ from each other. Regarding the basic emotions scales, all stories were rated higher on the intended than on the nonintended scales; that is, both the amusing and erotic stories were considered mainly joyful, the sad story was considered mainly sad, and the frightening story was mainly considered harrowing. These results confirmed that the a priori classification of the stories was appropriate.

Importantly, our set of stories showed themselves to be a valid tool to induce specific moods. Indeed, although participants' moods did not differ before listening to each story, the results showed that after having listened to the amusing story, participants reported feeling more positive than after hearing the four other stories. After the sad story, participants felt more negative than after hearing the other four stories. Moreover, as intended, listening to the amusing, frightening, and erotic excerpts made the participants feel more aroused than did listening to the neutral and frightening stories.

Although measuring the effectiveness of a MIP by comparing mood ratings reported after each MIP is the most common procedure (e.g., Carvalho et al., 2012; Gross & Levenson, 1995; Hagemann et al., 1999; Hewig et al., 2005; Schaefer et al., 2010), this does not take into account participants' moods before the MIP. Yet, mood differences before listening to each story should not be excluded, and could bias the comparisons between post-MIP mood ratings. Moreover, in the absence of a comparison between pre- and post-MIP moods, a potential and nonspecific effect on mood of merely listening to the stories cannot be ruled out. To the best of our knowledge, this is the first study that has investigated the impact of a neutral MIP by comparing mood valence and arousal ratings before and after listening.

This analysis allowed us to highlight the observation that listening to a neutral story induces a moderate decrease in mood arousal and valence levels. However, the content of this story may be considered to be neutral, since it was judged to be less negative than the content of the negative (frightening and scary) stories, less positive than the positive (amusing and erotic) stories, and less exciting than the arousing (amusing, erotic, and frightening) stories. Crucially for the validity of our set of stories, this decrease was significantly smaller than the one induced by the sad and frightening stories regarding mood valence, and similar to the one created by the sad story regarding mood arousal. Most probably, this calming effect resulted from the descriptive and nonaffective nature of the neutral story rather than from its content.

When we analyzed mood differences before and after listening to the emotional stories, the results showed that, as expected, participants felt more negative after than before having listened to the sad and frightening stories, and more positive after than before the amusing story. This difference was not significant for the erotic story, which may seem surprising. However, as we mentioned in the introduction, the first aim of the erotic story was to influence participants' mood arousal, not valence. Regarding mood valence, we expected that the erotic and frightening stories would differ from each other, and this was indeed the case. Moreover, listening to an erotic story in a laboratory might cause feelings of embarrassment that could potentially neutralize the positive induction of this kind of story.

Regarding arousal, participants felt less aroused after than before hearing the sad story, and more aroused after than before hearing the amusing and erotic stories. This was also the case for the frightening excerpt, although this difference was not significant. However, this finding alone does not disprove the effectiveness of the frightening story. Indeed, post-MIP arousal did not differ after having listened to the frightening, erotic, and amusing stories, and was significantly higher after having listened to the frightening than to the neutral and sad stories. Moreover, considering that listening to a (neutral) story decreases mood arousal levels, comparing this decrease with the (nonsignificant) increase in mood arousal levels due to the frightening story revealed a significant difference between the two effects. Taken together, these findings support the assumption that participants were aroused by the frightening story.

Interestingly, the more the participants reported that they projected themselves into the sad and frightening stories, the more they reported feeling negative afterward. Conversely, the more they reported projecting themselves into the amusing and erotic stories, the more they reported feeling positive afterward. Furthermore, the more the participants projected themselves into the sad, frightening, and erotic stories, the more they reported feelings of arousal afterward. Undoubtedly, the characteristics of the neutral story (i.e., its descriptive and nonaffective nature) were also responsible for participants reporting that they projected themselves less into this story than into the emotional ones. Coherently, higher projection levels were associated with greater differences between a "neutral" story valence and the valence that participants attributed to each story. Hence, projection seems to be a crucial aspect when one attempts to induce moods. Still, to the best of our knowledge, our study has been the first to measure this factor through post-MIP questionnaires (but see Ellard, Farchione, & Barlow, 2012, for an assessment of personal relevance in a clinical population). Nevertheless, several language and literature experts have already highlighted the importance of self-projection in what they call "emotional contagion," a concept close to mood induction. For instance,

Davis (1983) stated that the ability to project oneself into either a real or a fictional character is the keystone of empathy, which is known to be a trigger of emotional reactions (Ekman, 2003). Yet, it has also been suggested that fiction leads to more empathic emotional reactions than do real facts, since fiction momentarily disarms receptors (here, the listeners) of some of the defense mechanisms that may inhibit empathy in the real world (Keen, 2006). This would explain why, in our study, fictional emotional stories led to stronger levels of self-projection, empathy, and consequently to more effective mood induction than did a neutral, descriptive text. From this point of view, MIPs using fictional material (audio stories, plain texts, and films) could be even more efficient than real-life techniques such as inducing fear by setting up blood tests or asking participants to improvise a public speech (Stemmler, Heldmann, Pauls, & Scherer, 2001), although further studies will be needed to confirm this assumption.

Another aim of our study was to investigate gender differences when judging the emotionality of stories, in self-reported effectiveness ratings of the MIP, and in projection into the stories. Strikingly, we did not observe any effects of gender in our analyses. Still, following Karama, Lecours, Leroux, Bourgouin, Beaudoin, Joubert, and Beauregard (2002), one might have expected to find a gender difference at least for arousal levels after hearing the erotic story. However, no gender effect was observed, even for this story. As a whole, these results strongly suggest that our stories are a useful tool to induce different moods in both men and women, without eliciting significant gender differences. These findings may result from the fact that our stories were presented in the auditory modality. Indeed, previous studies have reported no gender effect in the recognition of emotions in the auditory modality, particularly in emotional speech (e.g., Lima, Castro, & Scott, 2013; Paulmann, Pell, & Kotz, 2008).

Related to these gender issues, it is worth noting that a female speaker narrated all of the stories. In this way, we aimed to avoid any interference of the speaker's gender with the mood inductions. However, the exclusive use of a female voice is not without its limitations. For example, it has been shown that listeners attribute higher arousal ratings to erotic prosody expressed by speakers of the opposite rather than the same gender (Ethofer et al., 2007). However, as we mentioned above, no gender differences in the participants' subjective ratings were observed in our study, either for the erotic story or for the others. The apparent discrepancy between these two studies might be explained by the material used: Whereas the stories in the present study were narrated with the corresponding emotional prosody, in Ethofer et al.'s study, participants rated emotionally neutral low-arousal nouns and adjectives uttered in five emotional tones (neutral, angry, fearful, happy, and erotic). Further studies should specifically address whether a speaker's gender influences mood induction effectiveness, by comparing male and female speakers for each emotional type of story.

This database will be a useful tool in emotional research in nonclinical populations, but it might also be of interest in clinical populations. For example, alexithymia is characterized by difficulties in identifying, differentiating, and describing feelings, and is encountered in psychosomatic diseases and addiction, as well as in eating, panic, somatoform, and posttraumatic stress disorders (Leweke, Leichsenring, Kruse, & Hermes, 2012). Ratings of our stories by these clinical and subclinical alexithymia populations, coupled with electrophysiological responses while listening to the stories, may help us to better understand emotional processing in alexithymia. Moreover, it has been shown that congruent emotional cuing during the encoding of emotional information helps to reduce the deficit in recognition memory for emotional stimuli in high alexithymia scorers (Vermeulen, Toussaint, & Luminet, 2010). From this perspective, our audio database could be used by researchers or clinicians to support their alexithymic participants or patients in improving their recognition abilities for emotional events.

In summary, this study has demonstrated the effectiveness of audio stories in eliciting specific moods in both men and women, and consequently, it may constitute a helpful tool for studies involving mood induction. Nevertheless, several questions need to be addressed in further studies, such as the influence of the gender of the speaker (eventually combined with the gender of the listener) or the effectiveness of the stories in inducing moods in clinical populations. Moreover, further studies should assess the persistence of the moods induced. Indeed, although our primary aim was to use long stories to ensure that participants were in a specific mood for a long period (during which they could perform a simultaneous task, such as in Bertels et al., 2013), one might want to assess the persistence of the induced mood in order to study its influence on a subsequent task. Finally, the Brussels MIAS database is the first audio-story database that is freely available on the Internet for use in scientific research. Currently, it is only available in French, and further studies should aim at validating these stories for use in different languages.

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