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Loneliness and the recognition of vocal socioemotional expressions in adolescence

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Supplemental Materials

1) Raw accuracy estimates

Table 1 below represents estimates of listeners' raw accuracy (i.e., hit rate) for each emotion type. Hit rate is computed as: (number of correct identifications of a stimulus type) / (number of presentations of a stimulus type). Values range from 0 to 1. Mean (*M*) and standard deviation (*SD*) values are given for each emotion type. Accuracy rates for each emotion are above chance level (i.e., 1/7, or 0.14).

Table 1

Listeners' emotion recognition accuracy (hit rate) by emotion

Emotion	<i>M</i> hit rate (<i>SD</i>)
Anger	0.62 (0.14)
Disgust	0.35 (0.14)
Fear	0.45 (0.16)
Friendliness	0.49 (0.15)
Happiness	0.33 (0.15)
Meanness	0.34 (0.14)
Sadness	0.61 (0.19)

2) Results without covarying for social anxiety

To establish robustness of our results to the inclusion/exclusion of a specific covariate, the general linear model presented in the manuscript was recomputed without social anxiety scores

entered as a predictor. Greenhouse-Geisser corrections were applied based on results of Mauchly's test of sphericity. All omnibus effects are identical to those presented in the main manuscript. Parameter estimates for the interaction of Emotion x Loneliness suggested that greater loneliness was associated with heightened recognition of friendliness, $\beta = .19$, $t(117) = 1.99$, $p = .049$, 95% CI [.001, .37]. The association with fear was not significant ($p = .38$). Parameter estimates for the interaction of Emotion x Age suggested that age was positively associated with the recognition of sadness, $\beta = .33$, $t(117) = 3.63$, $p < .001$, 95% CI [.15, .50], and fear, $\beta = .21$, $t(117) = 2.30$, $p = .02$, 95% CI [.03, .40].

Table 2

Full factorial general linear model results, without covarying for social anxiety

Effect	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Loneliness	(1, 118)	0.001	<.01	.98
Age	(1, 118)	1.52	.01	.22
Gender	(1, 118)	5.96	.05	.02
Emotion	(5.45, 643.33)	139.82	.54	<.001
Emotion x Loneliness	(5.45, 643.33)	2.92	.02	.01
Emotion x Age	(5.45, 643.33)	6.22	.05	<.001
Emotion x Gender	(5.45, 643.33)	1.54	.01	.17

Note. η^2 = partial eta squared.

3) Results accounting for speaker age

The vocal emotional stimuli used in the emotion recognition task were spoken by adolescent and adult actors. The general linear model presented in the manuscript was recomputed with the addition of Speaker Age as a within-subjects variable (2 levels: adolescent speaker, adult speaker) as a predictor. Greenhouse-Geisser corrections were applied based on results of Mauchly's test of sphericity. All omnibus effects presented in text remain significant in the

current model. In addition, there were a main effect of Speaker Age, $F(1, 115) = 73.85, p < .001, \eta^2 = .39$, and an interaction between Speaker Age and Emotion, $F(5.08, 584.59) = 27.25, p < .001, \eta^2 = .19$. Adult speakers were better recognized than adolescent speakers; pairwise comparisons revealed that this pattern was true for all emotions (anger: $p < .001$, fear: $p < .001$, friendliness: $p = .002$, happiness: $p = .001$, meanness: $p = .003$), except disgust ($p = .15$) and sadness ($p = .24$). This is consistent with previous work showing that adults' vocal expressions of emotion are better recognized than those of adolescents (Morningstar, Ly, Feldman, & Dirks, 2018).

Table 3
Full factorial general linear model results, accounting for speaker age

Effect	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Loneliness	(1, 115)	<0.01	<.01	.99
Age	(1, 115)	0.84	.01	.36
Social Anxiety	(1, 115)	0.24	<.01	.63
Gender	(1, 115)	4.95	.04	.03
Speaker Age	(1, 115)	73.85	.39	<.001
Speaker Age x Loneliness	(1, 115)	0.26	<.01	.61
Speaker Age x Age	(1, 115)	1.70	.02	.20
Speaker Age x Social Anxiety	(1, 115)	0.81	.01	.37
Speaker Age x Gender	(1, 115)	0.62	.01	.43
Emotion	(5.40, 621.16)	132.12	.54	<.001
Emotion x Loneliness	(5.40, 621.16)	4.21	.04	.001
Emotion x Age	(5.40, 621.16)	5.81	.05	<.001
Emotion x Social Anxiety	(5.40, 621.16)	2.46	.02	.03
Emotion x Gender	(5.40, 621.16)	1.10	.01	.36
Speaker Age x Emotion	(5.08, 584.59)	27.25	.19	<.001
Speaker Age x Emotion x Loneliness	(5.08, 621.16)	0.54	.01	.75

Speaker Age x Emotion x Age	(5.08, 621.16)	2.17	.02	.06
Speaker Age x Emotion x Social Anxiety	(5.08, 621.16)	0.80	.01	.56
Speaker Age x Emotion x Gender	(5.08, 621.16)	1.12	.01	.35

Note. η^2 = partial eta squared. Speaker Age represents the age group of the actor who produced the vocal stimuli (adolescent vs. adult). Age represents the listener's age in years (entered as a mean-centered continuous predictor).

4) Results using hit rate as the measure of listeners' performance

The general linear model presented in the manuscript was recomputed using listeners' hit rate (i.e., uncorrected raw accuracy; see Table 1 of the Supplemental Materials) as the dependent variable. Mauchly's test of sphericity indicated that sphericity should be assumed ($p > .05$).

Results are identical to those presented in the main text. Parameter estimates for the interaction of Emotion x Loneliness suggested that greater loneliness was associated with heightened recognition of friendliness, $\beta = .31$, $t(116) = 2.64$, $p = .009$, 95% CI [.08, .54], and of fear, $\beta = -.26$, $t(116) = -2.25$, $p = .03$, 95% CI [-.49, -.03]. Parameter estimates for the interaction of Emotion x Age suggested that age was positively associated with the recognition of sadness, $\beta = .33$, $t(116) = 3.61$, $p < .001$, 95% CI [.15, .50]. Age was not associated with the recognition of fear ($p = .26$) in this model.

Table 4

Full factorial general linear model results for hit rate

Effect	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Loneliness	(1, 115)	0.03	<.01	.87
Age	(1, 115)	1.53	.01	.22
Social Anxiety	(1, 115)	0.28	<.01	.60
Gender	(1, 115)	4.67	.04	.03

Emotion	(6, 690)	100.00	.47	<.001
Emotion x Loneliness	(6, 690)	3.23	.03	.004
Emotion x Age	(6, 690)	4.20	.04	<.001
Emotion x Social Anxiety	(6, 690)	1.89	.02	.08
Emotion x Gender	(6, 690)	1.80	.02	.10
