

Are We Better at Conveying and Perceiving Emotions Through Speech or Song?

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Introduction

- Emotional expression is an integral part of human interaction
- Evolutionary theories propose human music serves to regulate emotions in social settings [1]
- Song and speech have distinct production and processing advantages, explored using professional actor/singer recordings [2]
- We aim to understand emotional communication using a naturalistic method of spontaneous speech/song improvisation [3]

Predictions

- Ease of emotional improvisation in speech > song
- Accuracy of emotional perception in song > speech

Methods

Experiment 1 (Production) 🎤

- 15 participants (mean=21 years, SD=3.9, 7 males)
- Were asked to improvise 5 emotions (Happy, Peaceful, Neutral, Sad, and Afraid)
- In both modalities, improvisors rated the difficulty level of conveying emotion on a 5-point Likert scale (1 = not difficult at all, 5 = very difficult)
- Improvisations were recorded as stimuli for Experiment 2

Experiment 2 (Perception) 🗣️

- **Semantics (2a):** 52 participants (mean = 19.51 years, SD = 3.02, 10 males)
- **No Semantics (2b):** 54 participants (mean = 19.2 years, SD = 1.9, 10 males)
- For each stimulus, participants were asked to:
 - Identify the modality (speech or song)
 - Select the emotion expressed (Happy, Peaceful, Neutral, Sad & Afraid)
 - Rate confidence level for emotion selection (Likert scale 1-5; 1 = Not confident & 5 = very confident)

Analysis: Accuracy of correctly identifying modality/emotion was assessed. We then ran an ANOVA with repeated measures modality and emotion were ran for each dependent variables: modality accuracy, emotion accuracy, and confidence level rating.

Results

Experiment 1:

- Participants found it easier to convey emotions through speech than song ($p < .001$)

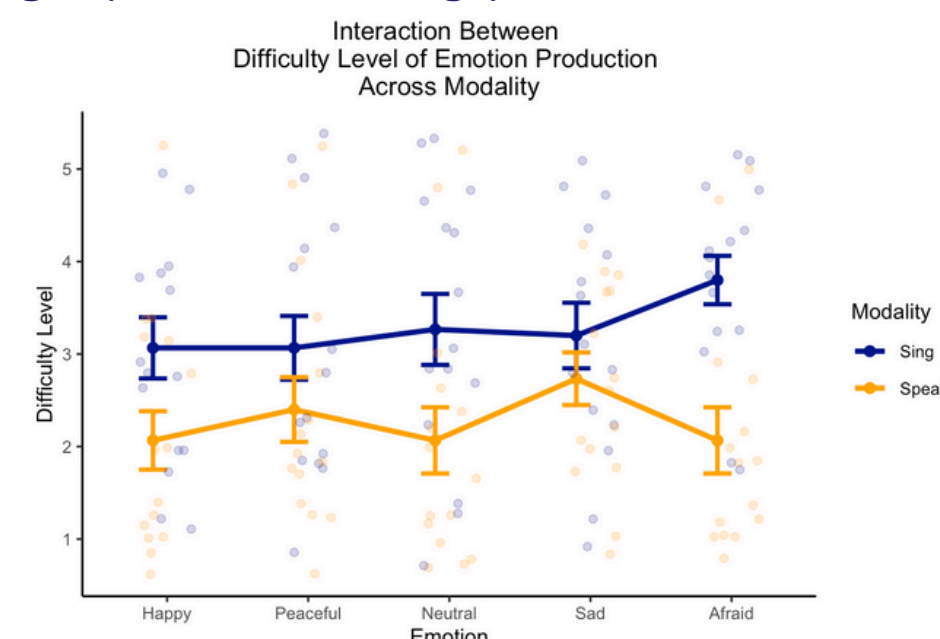


Figure 1. Difficulty level of emotional production for two modalities (song and speech)

Experiment 2a:

- Emotional accuracy was higher in speech than in song ($p < .001$)
- Higher confidence in speech > song ($p < .001$)

Experiment 2b:

- Emotional accuracy was higher in song than in speech ($p < .001$)
- Higher confidence in song > speech ($p < .001$)

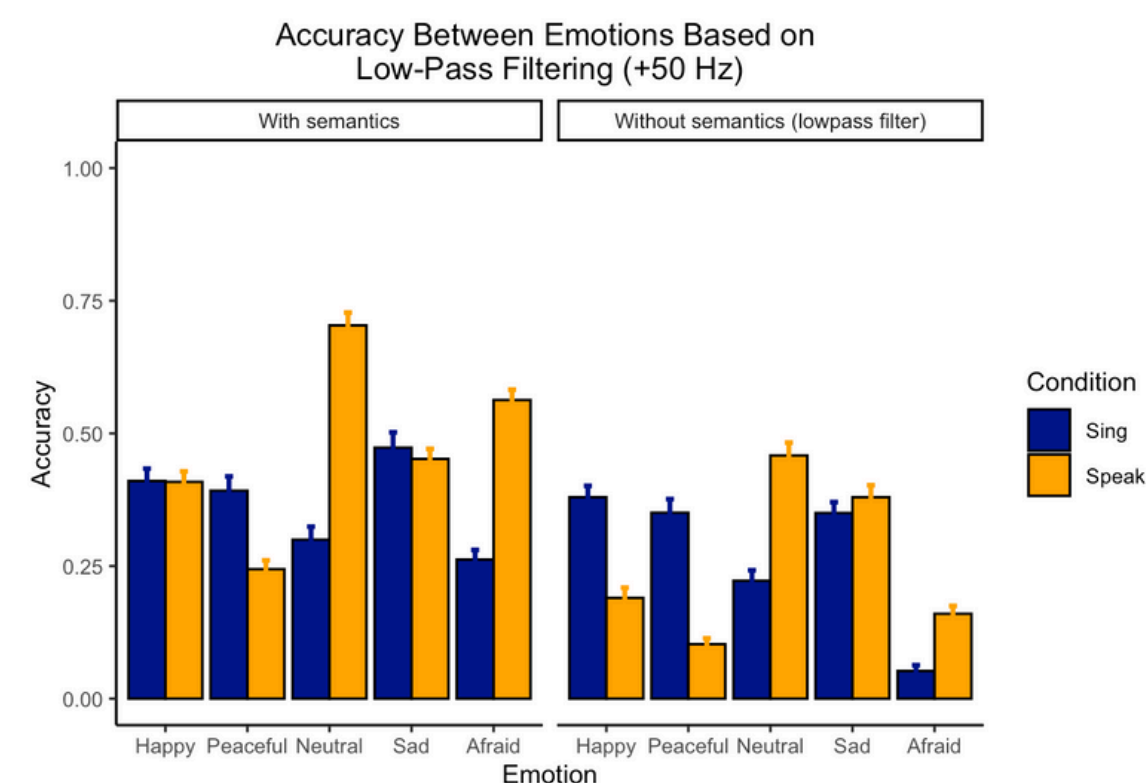


Figure 2. Emotion accuracy across speech and song in both filtering conditions

Results (Continued)

Confusion Matrix (With Semantics)

		Intended Emotion				
		Happy	Peaceful	Neutral	Sad	Afraid
Predicted Emotion	Happy	40.946%	19.712%	25.881%	8.173%	5.288%
	Peaceful	7.840%	31.805%	35.947%	16.938%	7.470%
	Neutral	9.936%	16.266%	50.160%	15.545%	8.093%
	Sad	2.212%	11.635%	30.481%	46.250%	9.423%
	Afraid	10.140%	9.790%	23.776%	15.035%	41.259%

Figure 3. Confusion Matrix (2a), X axis ('Intended Emotion') is the emotion that the rater perceived, and Y axis ('Predicted Emotion') is the emotion that was improvised

Confusion Matrix (Without Semantics)

		Intended Emotion				
		Happy	Peaceful	Neutral	Sad	Afraid
Predicted Emotion	Happy	28.472%	22.068%	24.537%	15.586%	9.336%
	Peaceful	9.473%	22.650%	29.416%	31.624%	6.838%
	Neutral	12.809%	20.525%	34.028%	28.549%	4.090%
	Sad	6.296%	19.722%	30.093%	36.481%	7.407%
	Afraid	15.741%	20.202%	29.040%	24.411%	10.606%

Figure 4. Confusion Matrix (2b), X axis ('Intended Emotion') is the emotion that the rater perceived, and Y axis ('Predicted Emotion') is the emotion that was improvised

Conclusion

- Semantics are key in making speech a primary communication tool.
- Music conveys emotions effectively through acoustics, especially without semantics.
- Future research should explore facial expressions, musical training, and cultural differences

References

- [1] Savage, P. E., Loui, P., Tarr, B., Schachner, A., Glowacki, L., Mithen, S., & Fitch, W. T. (2020). *Behavioral and Brain Sciences*, 44.
- [2] Van Besouw, R. M., Howard, D. M., & Ternström, S. (2005). *Logopedics Phoniatrics Vocology*, 30(3-4), 129-135.
- [3] Weiss, M. W., & Peretz, I. (2022). *Scientific Reports*, 12(1).