Facing emotional vocalizations and instrumental sounds: The comparison of sighted and blind individuals

Kinga Wołoszyn[1,2*], Mateusz Hohol[2], Michał Kuniecki[2], Piotr Winkielman[3]

[1] Ignatianum University in Krakow, PL [2] Jagiellonian University, Krakow, PL [3] University of California San Diego, La Jolla, USA
* correspondence: kinga.b.woloszyn@gmail.com

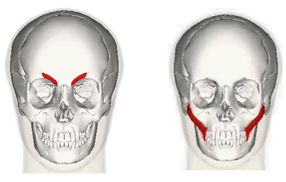
INTRODUCTION

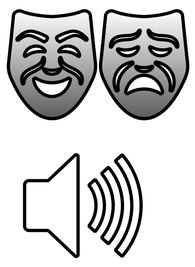
Facial mimicry of perceived facial displays has been shown in multiple studies (e.g., Dimberg et al., 2000; Kret et al., 2013; Olszanowski et al., 2020).
Here, we examined whether:
(1) Imitation of emotional displays goes beyond the visual modality - emotional auditory stimuli can trigger corresponding facial displays;
(2) Cross-channel imitation is specific to human vocal expressions of emotions or is a response to emotional stimuli in general;
(3) The auditory-motor association underlying cross-channel mimicry requires a visual experience.

METHODS

Participants
- **blind** participants (N = 18, M = 32,5 yo, 7F)
- **sighted** participants (N = 32, M = 31,3 yo, 17F)

Measurement
- Facial electromyography (**fEMG**)
  - *corrugator supercilii* (frowning)
  - *zygomaticus major* (smiling)





free listening paradigm

- 80 sounds: **nonverbal expressions of emotions** (fear, happiness, sadness) and neutral sounds (approx. 3 s)
- **Vocal** (e.g., crying, shouting) and **instrumental** (simple melodies)
- Source: Montreal Affective Voices (Belin et al., 2008) & Musical Emotional Bursts (Paquette et al., 2013)

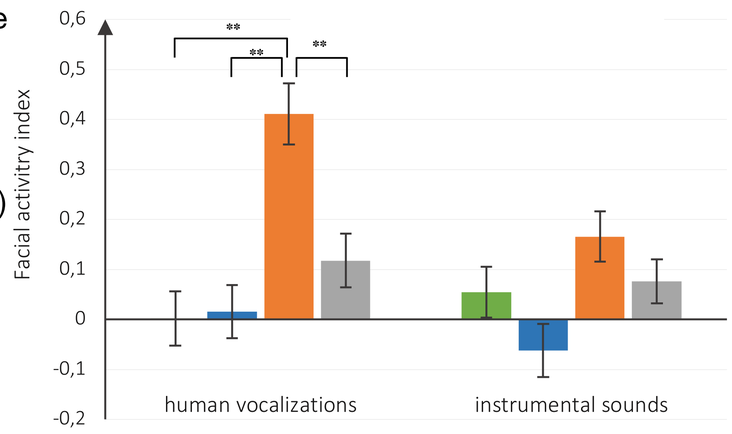
RESULTS

The **facial activity indexes** (*z*-scored mean activity of the *corrugator* minus *z*-scored activity of the *zygomaticus).*
The higher the index, the greater the *zygomaticus* activity relative to the *corrugator* activity.

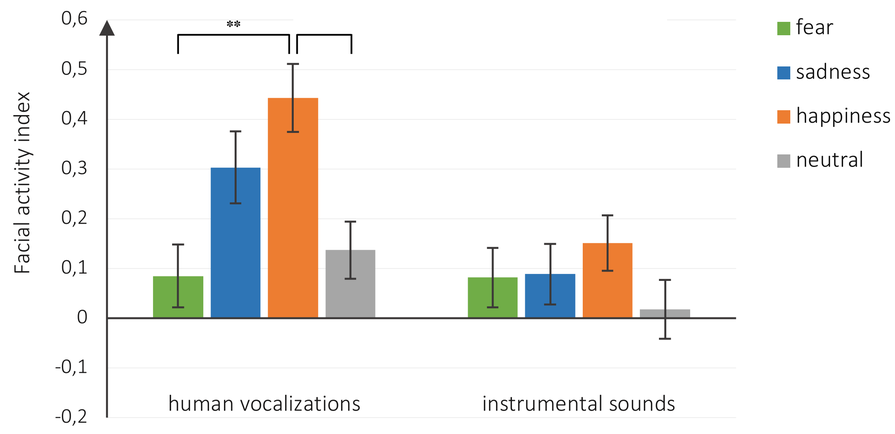
Emotion (sighted: $F(3, 2199) = 13.73$; $p < .001$; blind: $F(3, 903.1) = 5.45$; $p = .001$).
Sound type (sighted: $F(1, 2198) = 4.58$; $p = .032$; blind: ($F(1, 14.3) = 12.48$; $p = .003$).
Sound type x Emotion (only sighted: $F(3, 2199) = 2.82$; $p = .038$).

Difference between the groups in terms of the effect of emotions: $F(3, 3496) = 3.37$; $p = .018$.

SIGHTED INDIVIDUALS



BLIND INDIVIDUALS

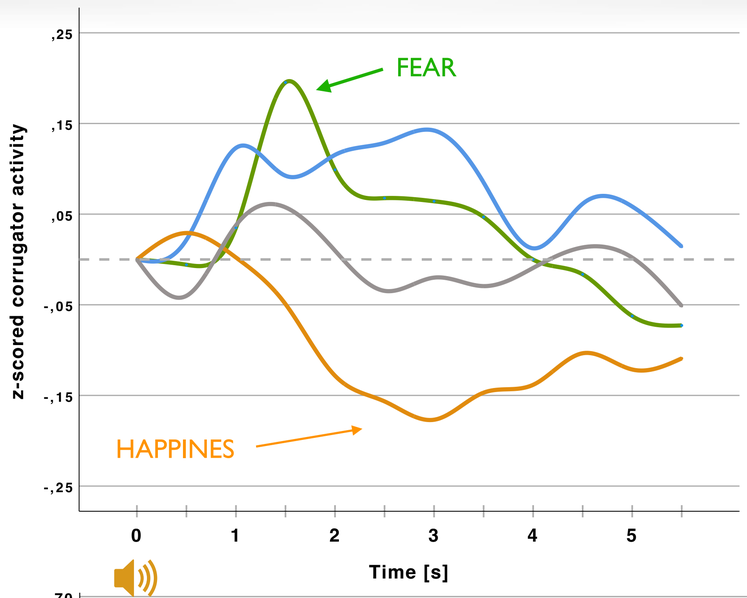


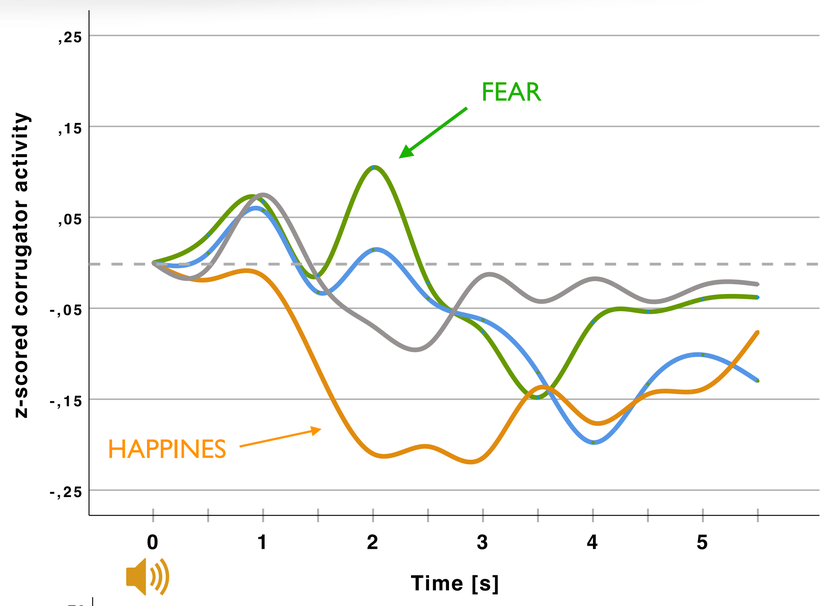
The time courses of the ***corrugator*** responses to sounds expressing **happiness**, **fear**, **sadness**, and **neutral** sounds (vocal and instrumental sounds together).

Sighted (left) and blind (right) participants.

The *corrugator* activity differed depending on the emotion category:
- sighted $F(33, 1023) = 2.89$; $p < .001$; partial $eta^2 = 0.085$
- blind $F(33, 561) = 1.49$; $p = .040$; partial $eta^2 = 0.08$)

No difference between the groups ($p = .414$)



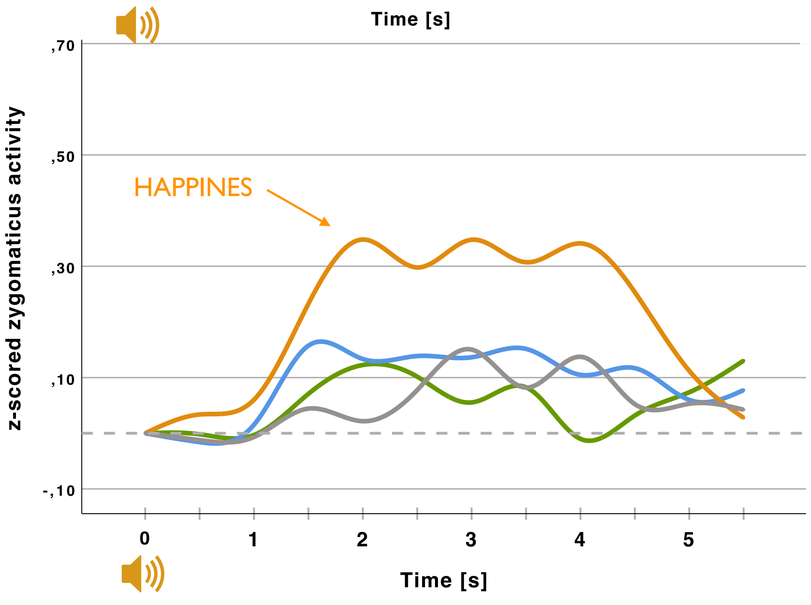


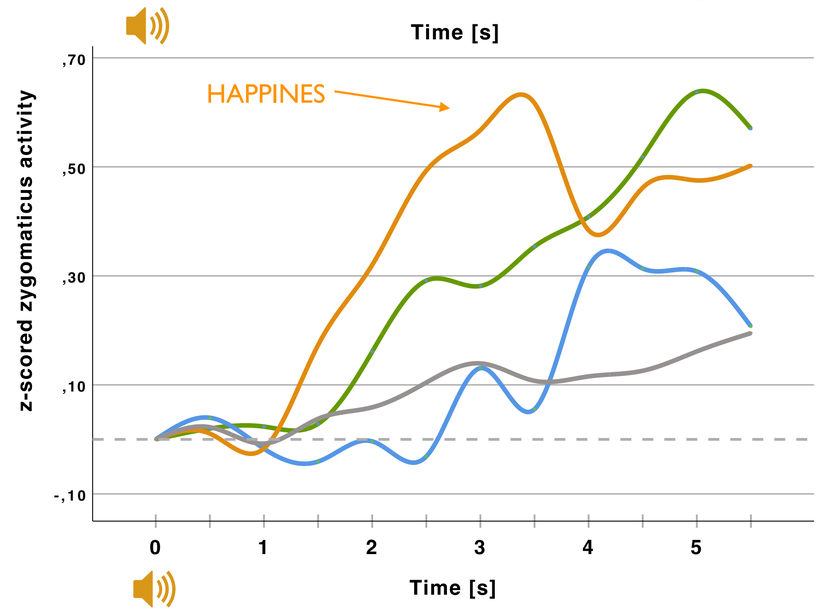
The time course of the ***zygomaticus*** responses to HUMAN VOCALIZATIONS expressing **happiness**, **fear**, **sadness**, and **neutral** sounds.

Sighted (left) and blind (right) participants.

The *zygomaticus* activity differed depending on the emotion category:
- sighted: $F(33, 1023) = 2.76$; $p < .001$; partial $eta^2 = 0.08$
- blind: $F(33, 561) = 1.78$; $p < .005$; partial $eta^2 = 0.10$

Difference between the groups:
- $F(33, 1584) = 2.01$; $p = .006$; partial $eta^2 = .04$





SUMMARY

- *Zygomaticus* and *corrugator* selectively responded to nonverbal emotional sounds.
- The effect was characteristic of human vocalizations.
- Blind participants showed an analogous pattern of activity to the sighted, but their facial responses were less differentiated (see response to sad voc.).
- The dynamics of the *zygomaticus* differed between the groups.

CONCLUSIONS

- Facial imitation goes beyond visual modality.
- Visual experience seems to be unnecessary for cross-channel facial mimicry, but visual feedback may shape more subtle emotional differentiation.
- The physiological measurement of facial movements, along with the analyses of the temporal dynamics of muscular activity, allow for detecting between-group differences that may not be visible otherwise.

SCAN ME

This work was supported by the National Science Center, Poland (2017/25/N/HS6/01052)