

## **Supplementary Information for**

Culture Shapes Emotion Perception from Faces and Voices: Changes Over  
Development

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Supplementary text

Tables S1 to S3

## Supplementary Information Text

### **The average fundamental frequency (f0) of Japanese and Dutch speakers' vocal stimuli**

We examined whether there were differences in the vocal and facial stimuli between Japanese and Dutch speakers. For vocal stimuli, we calculated the average fundamental frequency (f0) for each vocal stimulus and compared it between Japanese and Dutch speakers (Table S1). A difference was observed for the happy voice stimuli showing that f0 was higher in Japanese speakers than in Dutch speakers ( $z=-3.36$ ,  $p<.001$ ), but not for the angry voice stimuli.

### **The results of analyses that include the factor of the culture of stimuli in Study 1**

In our article, we did not consider the culture of stimuli in our analysis of cultural and developmental differences in multisensory emotion perception. However, it may be informative to exploratorily consider the factor of the culture of stimuli in multisensory emotion perception. Percentage of VC for incongruent stimuli in all multisensory sessions is shown in Table S2. To examine whether the developmental changes of vocal superiority in each Perceiver Group are different by the Culture of model, we ran a GLMM with Perceiver Group (East Asians and Westerners), Age Group (5-6 years, 11-12 years, and adult), and Culture of model (East Asian stimuli and Western stimuli) as fixed factors, and participant as a crossed random factor. As in Experiment 1, the binomial family call function was used because responses were coded in a binary fashion as VC or face choice (i.e., 1 or 0). There were significant main effects of Age Group ( $p<.001$ ,  $z=-5802.4$ ), Perceiver Group ( $p<.001$ ,  $z=6469.7$ ), and Culture of model ( $p<.001$ ,  $z=362.1$ ). Moreover, the interaction between Age Group and Culture of model ( $p<.001$ ,  $z=-766.4$ ), Age Group and Perceiver Group ( $p<.001$ ,  $z=-3328.7$ ), as well as Perceiver Group and Culture of model ( $p<.001$ ,  $z=-3428.3$ ) were significant. The second-order interaction was also significant ( $p<.001$ ,  $z=-174.1$ ).

To examine whether the developmental changes of vocal superiority in each Perceiver Group would be different for each Culture of model, we ran a GLMM separately for each Culture of model. We treated the Age Group and Perceiver Group as fixed factors, and participant as a crossed random factor. In the Eastern model, there was significant main effects of Age ( $p < .001$ ,  $z = 4.55$ ). The interaction was also significant ( $p < .001$ ,  $z = -3.33$ ) and developmental changes were observed in East Asian participants ( $p < .001$ ,  $z = 0.16$ ), but not in Western participants ( $p = .94$ ,  $z = 0.08$ ). In the analysis of responses with the Western model, however, neither the main effect of Perceiver Group ( $p = .26$ ,  $z = -1.12$ ) and Age ( $p = .67$ ,  $z = -0.43$ ) nor the interaction ( $p = .14$ ,  $z = .14$ ) were significant. These results suggest that, although we had not hypothesized it, the culture of model may have an impact on multisensory emotion perception.

### **The results of analyses that include the factor of participant and stimuli as crossed random factors in Study 1**

In our article, we treated participant as a random factor. However, it is possible to include stimuli as crossed random factor and so we conducted an additional analysis. We ran a GLMM with the Perceiver Group (East Asians and Westerners) and Age Group (5-6 years, 11-12 years, or adults) as fixed factors, and participant and stimuli as crossed random factors (Table S3). The model including the Perceiver Group, Age Group, as well as the interaction of the Perceiver Group and Age Group was selected as the best (AIC=4432.5), and was superior to the models that included only the Perceiver Group (AIC=4447.7) or only the Age Group (AIC=4444.4).

**Table S1.** The average fundamental frequency (f0) of Japanese and Dutch speakers' voice.

	angry voice	happy voice
Japanese speaker	242.8	335.9
Dutch speaker	233.1	261.4

(Hz)

**Table S2.** VC (%) of Eastern and Western stimuli.

		Eastern participants	Western participants
5-6 y.o.	Eastern model	12.9	10.1
	Western model	5.7	7.1
11-12 y.o.	Eastern model	25.4	6.7
	Western model	4.1	8.3
adults	Eastern model	33.9	10.9
	Western model	5.7	11.0

(%)

**Table S3.** The comparison among three models.

	estimate				AIC	BIC
	(Intercept)	Age Group	Perceiver Group	Age Group×Perceiver Group		
model 1	-5.52 ( $p < .001$ )	0.41 ( $p < .001$ )	—	—	4444	4472
model 2	-1.87 ( $p < .001$ )	—	-0.62 ( $p < .01$ )	—	4448	4475
model 3	-3.81 ( $p < .001$ )	0.98 ( $p < .001$ )	-0.13 ( $p = .79$ )	-0.42 ( $p = .067$ )	4433	4474