

# Can you feel the music or are you just listening?

## Differences in emotions induced by music as a function of musicality and engagement

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### Introduction

- Until today many questions regarding emotional aspects of music are left unanswered by research.
- Two possible underlying factors **musical education** and **musical engagement** present the focus of this research. Investigated was whether those two impact the way music induces emotions and how?
- The following **hypotheses** were tested:
  - Both musicians and non-musicians experience a stronger emotional response when singing along to music compared to just listening to music.**
  - Musicians have a stronger emotional response than non-musicians, both when listening to music and when singing along to music.**
  - The difference in emotional responses between musicians and non-musicians is greater when singing along to music than when just listening to music.**

### Methods

#### Random sample

- An a priori power analysis estimated a **sample size of 52** as sufficient for the planned repeated measures ANOVA with within-between-interaction with an effect sizes of  $f \geq 0.2$ .
- Overall inclusion criteria:** German language skills of at least C1, absence of hearing difficulties
- Inclusion criteria for musicians:** active participation in music at least once a month, at least five years of musical education
- Inclusion criterion for non-musicians:** no active participation in music for the last five years

### Design

#### Recruitment:

- A questionnaire based on the Goldsmith Musical Sophistication Index was used to assign the participants to the two groups (musicians; non-musicians).

#### Experiment:

- In the experiment participants underwent two conditions, in which the emotional state was captured while listening to (**1: listening**) or participating in music (**2: singing along**).
- The **conditions** were **randomized** in order, and both made up by the **same four songs**, each condition lasting exactly two minutes.



Graphic 1: Two songs that are well known in Germany were the same for each participant and determined beforehand. The other two songs were chosen by each individual participant.

#### Rating:

- After each musical stimulus, the participants **rated their emotional experience** during the previous condition on a 9-point-scale for **valence** (1 = very negative to 9 = very positive) and **arousal** (1 = very calm; 9 = very arousing).
- Furthermore, **familiarity** of the presented stimuli was registered on a binary scale.

### Results

#### Hypothesis 1

#### ANOVA

- The initial repeated measures ANOVA showed that Valence and arousal differed significantly as a function of engagement (valence:  $F(1,53) = 4.045$ ,  $p = 0.049$ ; arousal:  $F(1,53) = 2.939$ ,  $p = 0.092$ )

#### valence:

Effect		Value	F	Hypothesis df	Error df	Sig.
Engagement	Pillai's Trace	.071	4.045 <sup>b</sup>	1.000	53.000	.049
	Wilks' Lambda	.929	4.045 <sup>b</sup>	1.000	53.000	.049
	Hotelling's Trace	.076	4.045 <sup>b</sup>	1.000	53.000	.049
	Roy's Largest Root	.076	4.045 <sup>b</sup>	1.000	53.000	.049

Table 1: Results of repeated measures ANOVA to compare valence ratings showing significant effects with  $\eta^2 = .071$

#### arousal:

Effect		Value	F	Hypothesis df	Error df	Sig.
Engagement	Pillai's Trace	.305	23.279 <sup>b</sup>	1.000	53.000	<.001
	Wilks' Lambda	.695	23.279 <sup>b</sup>	1.000	53.000	<.001
	Hotelling's Trace	.439	23.279 <sup>b</sup>	1.000	53.000	<.001
	Roy's Largest Root	.439	23.279 <sup>b</sup>	1.000	53.000	<.001

Table 2: Results of repeated measures ANOVA to compare arousal ratings showing significant effects with  $\eta^2 = .305$

#### Post hoc testing

- Paired t-tests regarding a difference in **valence** between engagement conditions (singing; listening) among **non-musicians** resulted in **insignificance** ( $t(25) = 0.852$ ,  $p=0.201$ ).
- Similar t-tests concerning **arousal** instead of valence turned out **significant**.

	N	Correlation	Significance	
			One-Sided p	Two-Sided p
Pair 1 Mean_SV & Mean_LV	26	.190	.176	.352
Pair 2 Mean_SA & Mean_LA	26	.372	.031	.061

Table 3:

1<sup>st</sup> line: paired t-tests comparing the mean of the valence ratings in singing and listening condition für non musicians  
2<sup>nd</sup> line: paired t-tests comparing the mean of the arousal ratings in singing and listening condition für non musicians

- The paired t-test comparing the mean ratings of **valence/arousal** across the engagement conditions turned out **significant for musicians**.

	N	Correlation	Significance	
			One-Sided p	Two-Sided p
Pair 1 Mean_SV & Mean_LV	29	.691	<.001	<.001
Pair 2 Mean_SA & Mean_LA	29	.518	.002	.004

Table 4:

1<sup>st</sup> line: paired t-tests comparing the mean of the valence ratings in singing and listening condition für musicians  
2<sup>nd</sup> line: paired t-tests comparing the mean of the arousal ratings in singing and listening condition für musicians

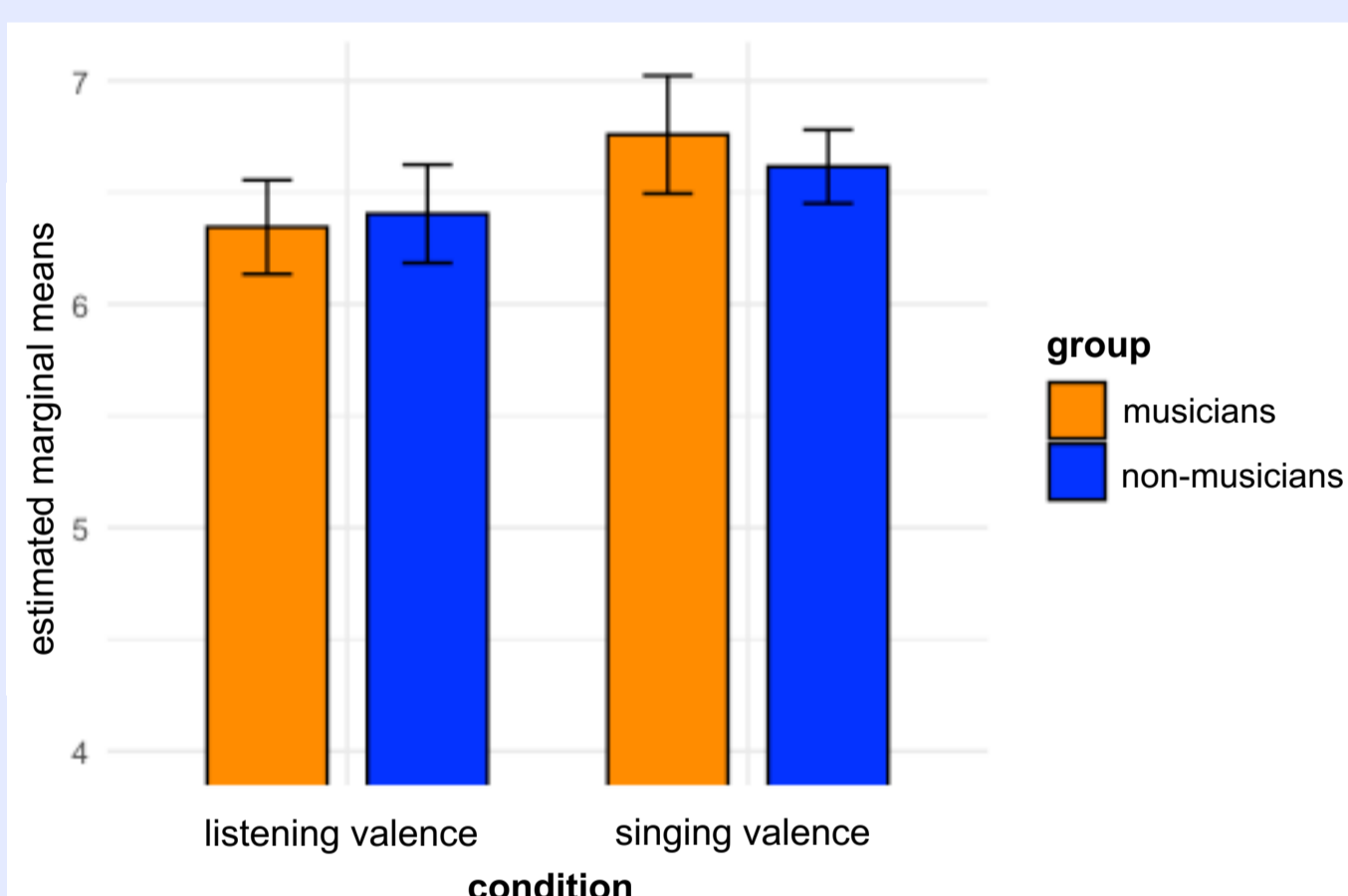


Figure 1: Results of repeated measures ANOVA to compare valence

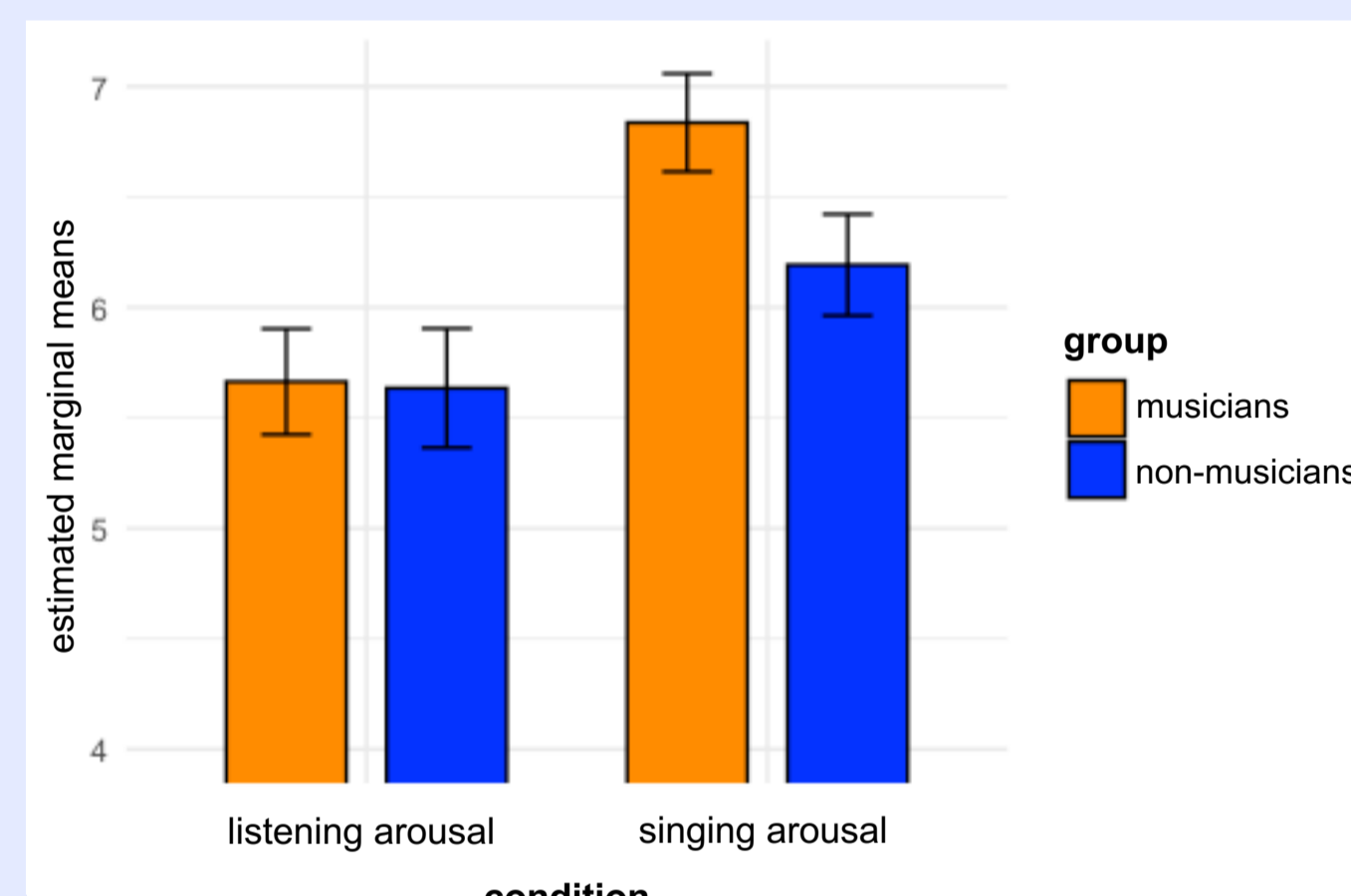


Figure 2: Results of repeated measures ANOVA to compare arousal

#### Hypothesis 2

- A repeated measures ANOVA revealed no statistically significant main effects. Neither for valence nor for arousal.
- Independent sample t-tests revealed a significant difference in arousal between musicians and non-musicians in the singing condition.

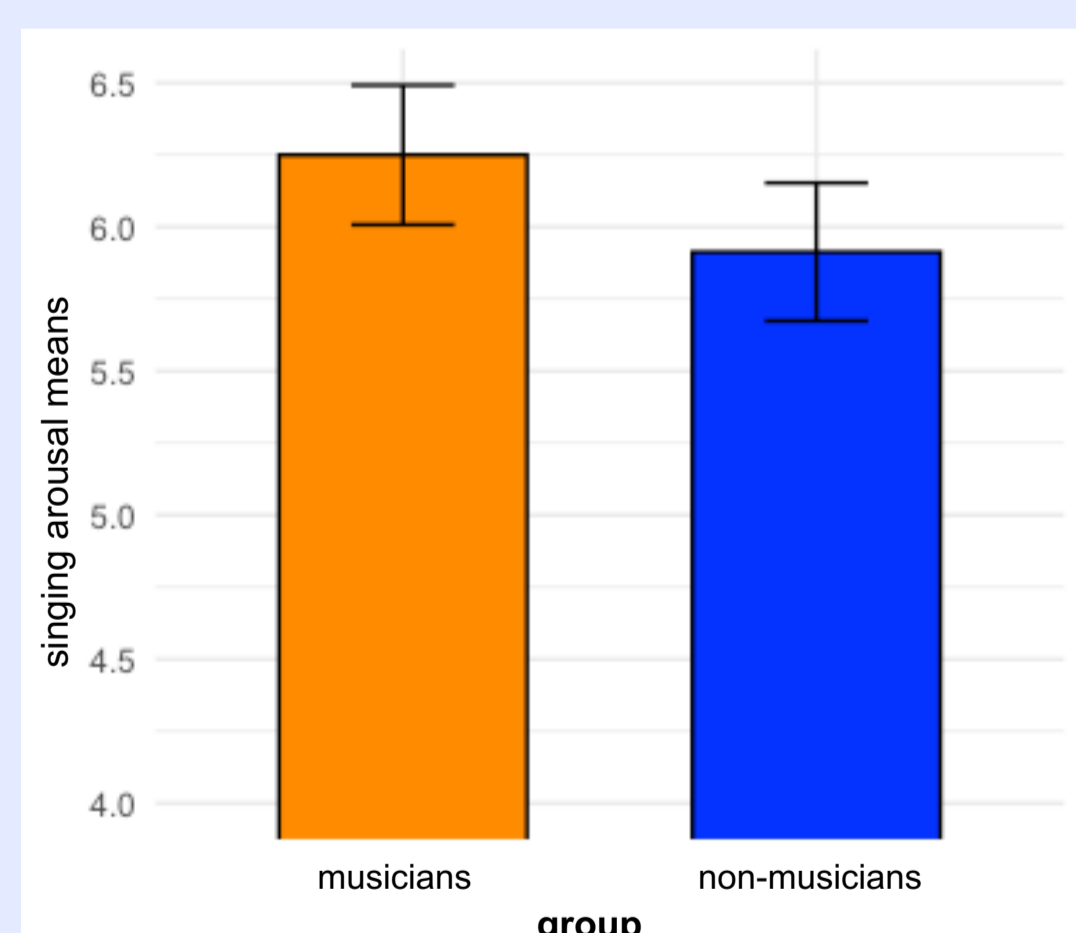


Figure 3: Depiction of the insignificant findings of the ANOVA regarding differences in the arousal group means (musicians; non-musicians)

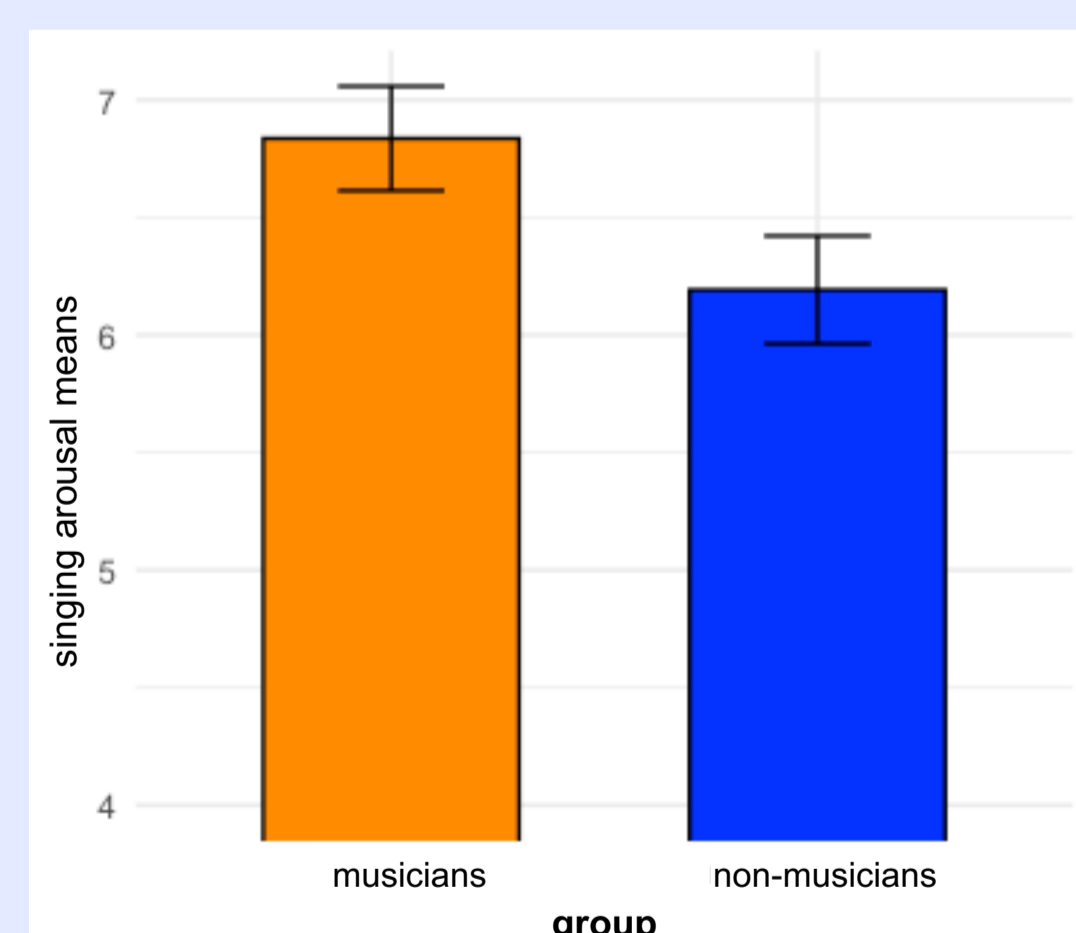


Figure 4: Diagram displaying the results of the independent t-test comparing group means (musicians; non-musicians) of arousal in the singing condition revealing a significant effect

- Still the data presented in a way that suggested a tendency towards our hypothesis. Therefore post hoc tests were used to investigate further.

#### Hypothesis 3

- The ANOVA revealed no significant effects for the interaction between the participant groups (musicality) and the level of engagement neither for valence ( $F(1,53) = 0.423$ ,  $p = 0.518$ ), nor for arousal ( $F(1,53) = 2.939$ ,  $p = 0.092$ ).

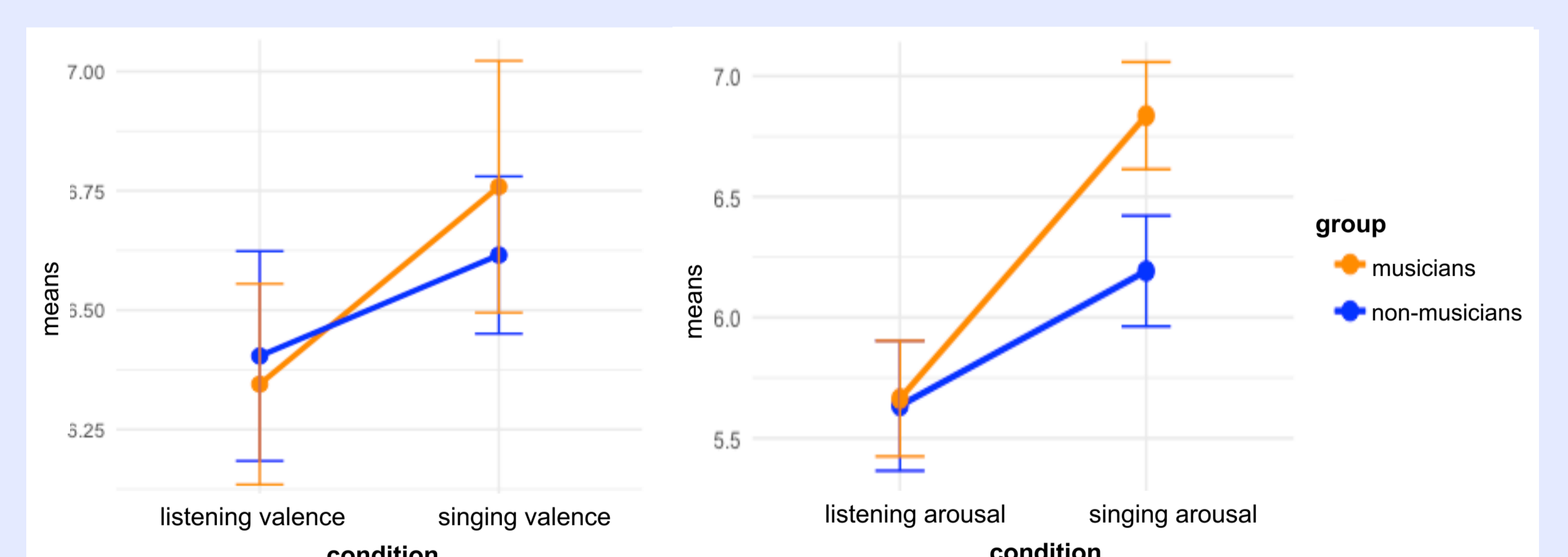


Figure 5: Depiction of insignificant interaction regarding valence and arousal

### Discussion

- Hypothesis 1 could be retained** but hypothesis 2 and 3 could not be confirmed.
- Results indicate that especially **musical engagement amplifies the emotional experience**.
- Insignificant but still clear trends of higher ratings in musicians compared to non-musicians indicate further research. Choosing **stricter criteria** to differentiate the groups (e.g. professional musicians) or a **better fit between musical education an stimuli** (e.g. classical music) may lead to significant effects.
- It might be interesting to investigate **whether musicians or non-musicians deviate further from a third reference group** of participants **with medium musical levels** via regression analysis.
- Further research** in this area is **recommended** to ensure that the found effects exist in reality.

### References

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