

How do angry drivers respond to emotional music?

A comprehensive perspective on assessing emotion

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Introduction

- ▷ Much research on aggressive driving
- ▷ Emotions are critical factor in driver distraction
- ▷ Music may add to the cognitive load, primary task difficulty
- ▷ Multiple Resources theory
- ▷ Appraisal-Tendency Framework (ATF)

Introduction

- ▷ Effect of music depends on type of music and primary task.
- ▷ Attention deployment – ignore the unnecessary
- ▷ Music impacts drivers differently

Hypotheses

- ▷ Angry drivers → worse driving performance than non-angry drivers
- ▷ Angry drivers (music) → better driving performance than angry drivers (no music)
- ▷ Angry drivers (music) will report less anger after than angry drivers (no music)

Hypotheses

- ▷ Angry drivers (music) different pattern of physio data than angry drivers (no music)
- ▷ Drivers with more anger-expression out and higher anger will show worse driving performance.

Methods

- ▷ Participants: 52 (43 M), Age: M= 21, SD 2.42
- ▷ Research credits
- ▷ Driving simulator: SimuRide, did not record data on driving performance, researcher recorded driver errors.



Methods

- ▷ Electrocardiogram (ECG): heart rate and HRV
- ▷ Functional near-infrared spectroscopy (fNIRS): changes in concentration of oxygenated and deoxygenated hemoglobin, degree of oxygenation of tissues using optical methods

Methods

- ▷ Differential emotions scale (DES): assess discrete emotional dimensions. 16 items, self-report
- ▷ Cognitive-affective response test-music (CART-M): measures formal-intellectual and emotional-expressive dimensions, self-report

Methods

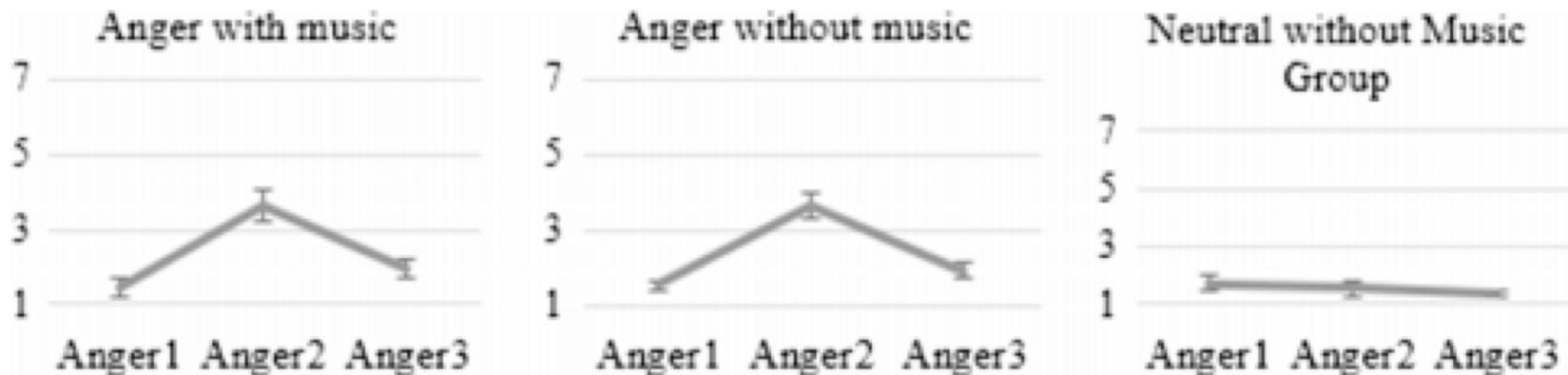
- ▷ Driving Anger scale: rate hypothetical anger-provoking driving scenarios, self-report 14 items
- ▷ State-trait anger expression inventory-2 (STAXI-2): 5 subscales, 57 items, self-report
 - State anger
 - Trait anger
 - *Anger expression-out*
 - Anger expression-out
 - Anger control

Methods

- ▶ 3 between-subject conditions:
 - Angry with music
 - Angry without music
 - Neutral drivers without music
- ▶ Drivers picked their own music (1 song played on repeat)
- ▶ Driving sessions were approximately 15 minutes

Results

- ▶ Results of a one-way ANOVA showed significant differences in anger without music ($F(2,15)=15, p=.000$) and anger with music ($F(2,16)=21, p=.000$) between the two groups. Pts. in neutral group did not report the same changes.



Results

- ▶ To find which conditions drivers' anger increased more, they compared anger at time 2 and 3.
- ▶ Results from independent samples *t* test shows that the decrement in pts anger is not different between groups.

Table 1 Mean of self-report anger in each group

Groups	Anger 1	Anger 2	Anger 3
Neutral without music	1.7	1.52	1.35
Anger with music	1.44	3.66	1.94
Anger without music	1.52	3.64	1.94

Table 2 Paired samples *t* test of self-report anger scores of before and after emotion induction

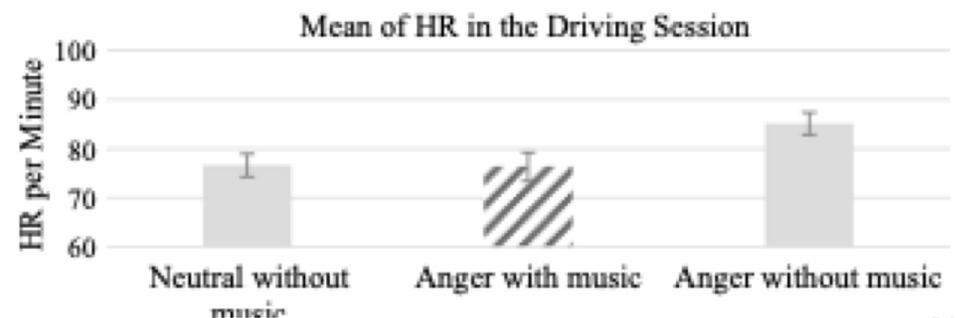
Groups	t value anger 1, 2	<i>p</i> value
Neutral without music	.71	> .05
Anger with music	- 5.71	< .05
Anger without music	- 5.26	< .05

Table 3 Paired samples *t* test of self-report anger scores of emotion induction and before leaving the lab

Groups	t value anger 2, 3	<i>p</i> value
Neutral without music	.67	> .05
Anger with music	6.51	< .05
Anger without music	5.39	< .05

Results between groups

- ▶ ECG data based on two caules: mean of hear rate (HR) and standard deviation of hear rate variability (HRV)
- ▶ HR: one-way ANOVAs → Mean of HR during driving are different between the groups ($F(2,47)=3.08, p=.04$).
- ▶ Angry drivers with no music had a higher HR than angry drivers with music and neutral drivers.
- ▶ ECG: HRV did not differ between groups



Results within groups

- ▷ Each person's ECG data was compared in different phases of the experiment.
- ▷ ECG (HR): Paired samples *t* test
 - Neutral group: HR higher in practice session ($t(12)=3.74, p<.05$)
 - Angry w/o music: HR higher in driving session ($t(17)=-3.94, p <.05$)
 - Angry w/ music: HR is not significantly different between practice and driving session ($t(15)=1.5, p>.05$)

Results within groups

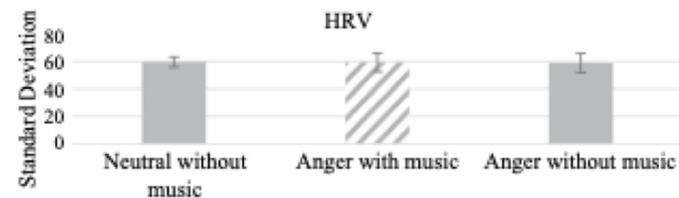
- ▷ Each person's ECG data was compared in different phases of the experiment.
- ▷ ECG (HRV): Paired samples *t* test
 - Neutral group: HRV no significant difference between practice and driving ($t(14)=.66, p>.05$)
 - Angry w/o music: HRV no significant difference in practice driving ($t(15)=-3.94, p >.05$)
 - Angry w/ music: HR is not significantly different between practice and driving session ($t(14)=.71, p>.05$)

Results fNIRS

- ▶ Based on the oxygenation (O₂Hb) of PFC from both hemispheres. Results did not show any patterns regarding deoxygenation (HHb) and asymmetrical patterns of hemispheres in positive and negative emotions.
- ▶ Hemodynamic changes of PFC during driving was tested using a one-way ANOVA to find differences among drivers with and without music.
- ▶ Found hemodynamic changes were not significantly different among groups.

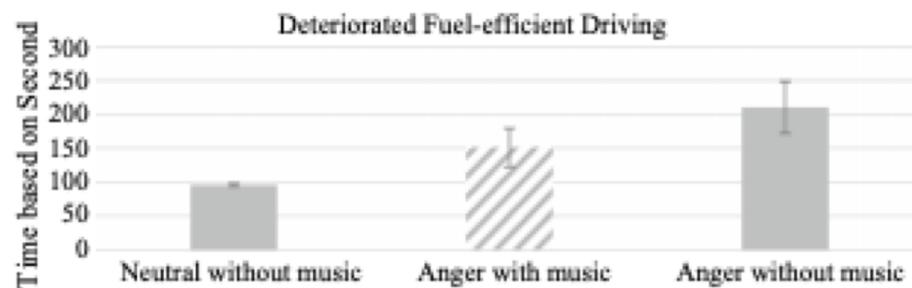
Results within groups

- ▷ Looking at hemodynamic changes in PFC during practice and driving in all conditions.
- ▷ Paired samples *t* test
 - Neutral group average O2HB significantly increased from practice to driving ($t(16)=2.19, p<.05$)
 - Angry w/o music: no changes from practice to driving ($t(14)=-.43, p >.05$)
 - Angry w/ music: O2HB significantly increase between practice and driving session ($t(14)=3.17, p<.05$)



Results Behavioral data

- ▶ Lane departure, speeding, fuel-efficient driving, number of crashes, passing red-light, and passing stop signs were observed and recorded. Fuel-efficient driving was the only one different among groups.
- ▶ One-way ANOVA, groups were significantly different ($F(2,47)=3.94, p < .05$). Anger w/ music higher than neutral.



Results Questionnaires

- ▷ Finding out how much music and add or reduce drivers' workload was tested. Several one-way ANOVAS were performed to locate differences in the groups.
- ▷ Workload-perform ($F(2,43)=6.15, p<.05$) and workload-effort ($F(2,46)=4.48, p<.05$) are significantly different.
- ▷ Post hoc LSD on workload-perform showed angry drivers without music rated their performance significantly worse than angry with music and the neutral group.
- ▷ Post hoc LSD showed angry drivers with music claimed significantly less workload-effort than the other two groups.

Results Questionnaires

- ▷ DAS and CBQ showed no correlation with driving errors.
- ▷ Anger expression-out were correlated with less fuel-efficient driving ($r=.3, p<.05$)

Discussion

- ▷ Angry drivers → worse driving performance than non-angry drivers - **difference with fuel-efficient driving**
- ▷ Angry drivers (music) → better driving performance than angry drivers (no music) - **Reject, no significant diff.**
- ▷ Angry drivers (music) will report less anger after than angry drivers (no music) - **no difference among drivers.**

Discussion

- ▷ Angry drivers (music) different pattern of physio data than angry drivers (no music)
 - ▷ -yes, angry w/o music had higher HR than other two groups.
 - ▷ -no, no significant differences in oxygenation and deoxygenation of PFC
- ▷ Drivers with more anger-expression out and higher anger will show worse driving performance. -yes and no, no correlation between DAS and driving errors, but anger expression-out was correlated with fuel-efficient driving.

Class Discussion

- ▷ Sample
 - ▷ Rural vs. urban
 - ▷ Highly male sample

Class Discussion

- ▷ Methods:
 - ▷ Self-selected music
 - ▷ on repeat
 - ▷ Podcasts
 - ▷ Singing to the music

Class Discussion

- ▷ Methods:
 - ▷ Rater bias
 - ▷ Driving simulator
 - ▷ Screen for stress?
 - ▷ No neutral with music