

Affective Computing and Music

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CS 486/686 Affective Computing

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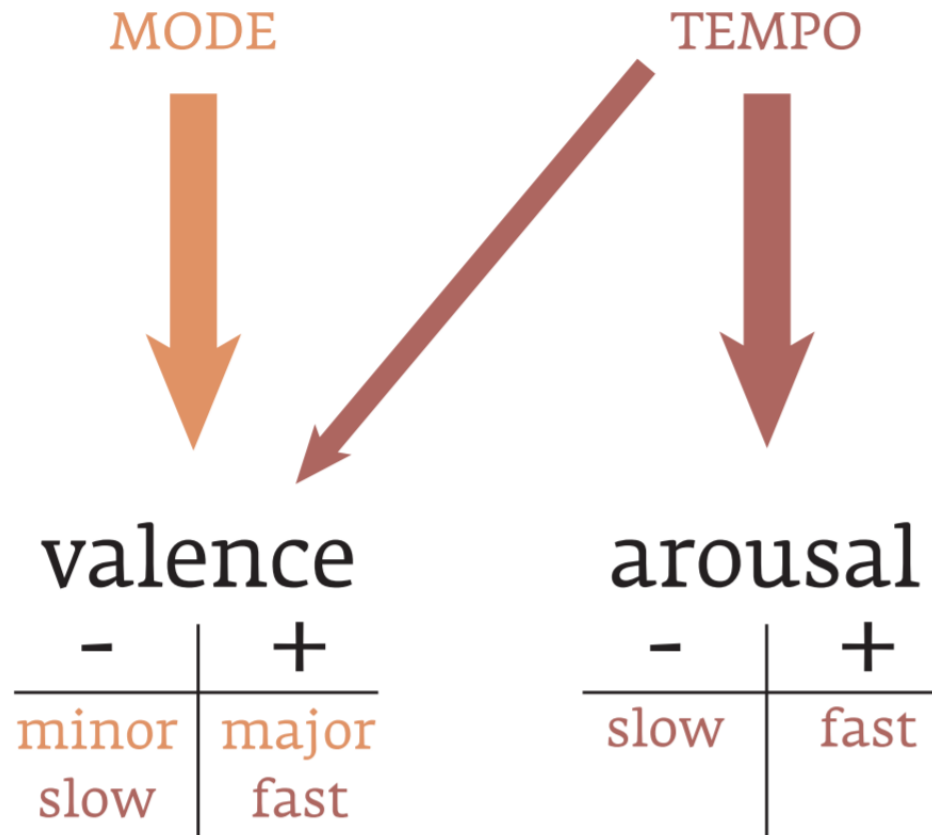


Fig. 1. The double effect of mode and tempo on valence and arousal.

Morreale, Fabio, and Antonella De Angeli. "Collaborating with an Autonomous Agent to Generate Affective Music." *Computers in Entertainment (CIE)* 14.3 (2016): 5.

Table I. Mapping Between Musical Structures and the Emotional Dimensions of Valence and Arousal

		Valence	Arousal
Mode	Major	Positive	
	Minor	Negative	
Tempo	Fast	Positive (less influential)	High
	Slow	Negative (less influential)	Low
Sound level	High		High
	Low		Low
Pitch contour	Ascending	Positive	
	Descending	Negative	
Pitch register	High	Positive	
	Low	Negative	
Dissonance		Negative	
Expectations	Fulfilment	Positive	
	Frustration	Negative	

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Musical characteristics and emotional expression of music
(adapted from Bruner II, 1990, p. 100)

musical element	Emotional Expression							
	Serious	Sad	Fear	Serene	Humorous	Happy	Exiting	Majestic
Mode	Major	Minor	Minor	Major	Major	Major	Major	Minor
Tempo	Slow	Slow	Slow	Slow	Fast	Fast	Fast	Medium
Pitch	Low	Low	Low	Medium	High	High	Medium	Medium
Rhythm	Firm	Firm	Low	Flowing	Flowing	Uneven	Firm	Firm
Harmony	Cons	Diss	Diss	Cons	Cons	Cons	Diss	Diss
Loudness	Medium	Varied	Soft	Soft	Medium	Medium	Loud	Loud

C Major vs C minor



Consonant vs Dissonant Music



Effects of Music on Angry Drivers

Simulating *real* emotion is hard.

What emotions do the following songs make you feel...?

Application areas – Effects of Music on Angry Drivers

Effects of happy, sad, and self-selected music on angry drivers in simulated driving.

Widely accepted in driving research that angry drivers make more driving errors than non-angry drivers.

Research shows angry people tend to be more optimistic when negative outcomes are de-emphasized and blame other individuals more for negative outcomes => less careful on the road.

Effects of Music on Angry Drivers

The effects of music on driving task depend on the type of music and the demands of the primary task. With the low task demand, music can mitigate emotional driving by serving as a “positive” distractor, in which it occupies a small portion of cognitive resources.

If a driving task is very demanding, listening to music may deteriorate driving performance.

Effects of Music on Angry Drivers

Simulating *real* emotion is hard.

Inducing anger: spent twelve minutes writing about an angry experience they could vividly remember.

Happy songs: Monsieur Verdoux: Cancan a Paris Boulevard and

Op.77-3rd Movement: Vivace Non Troppo

Sad songs: Madeleine and Carlotta's Portrait and Brothers-Backdraft

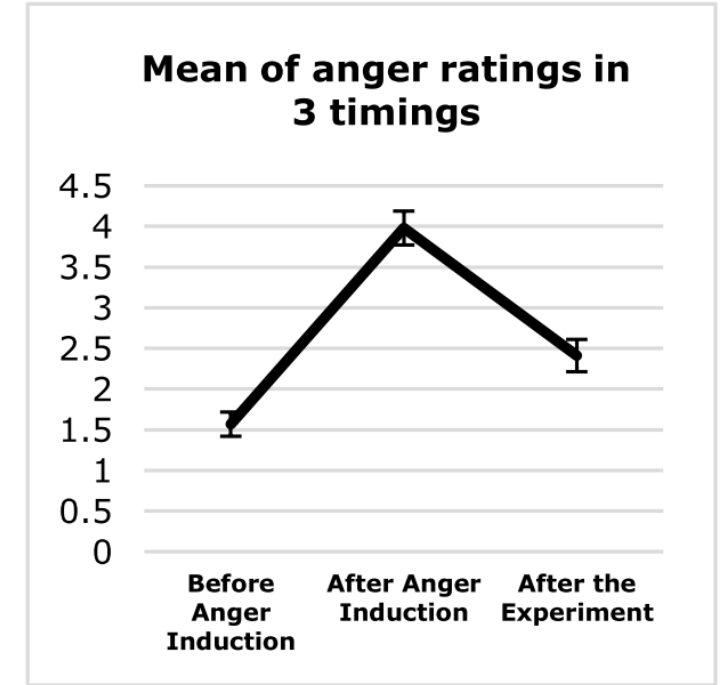


Figure 1 Mean of anger ratings in 3 timings. Error bars indicate standard error of the mean "conditions".

Fakhr Hosseini, Maryam, and Myounghoon Jeon. "The Effects of Various Music on Angry Drivers' Subjective, Behavioral, and Physiological States." In *Proceedings of the 8th International Conference on Automotive User Interfaces and Interactive Vehicular Applications Adjunct*, pp. 191-196. ACM, 2016.

Results of one-way ANOVA showed that aggressive driving behaviors were not different among groups in easy $F(4, 57) = .78, p > .05$ and medium $F(4, 57) = 1.79, p > .05$ conditions.

But in the *hard condition* $F(4, 57) = 5.28, p < .005$, there were significant differences. Tukey HSD tests showed that drivers who drove with self-selected music ($M = 2.69$) had significantly more errors than the groups who drove with sad music ($M = .66, p < .01$), happy music ($M = .83, p < .01$), and the control group ($M = .45, p < .01$) (Figure 2).

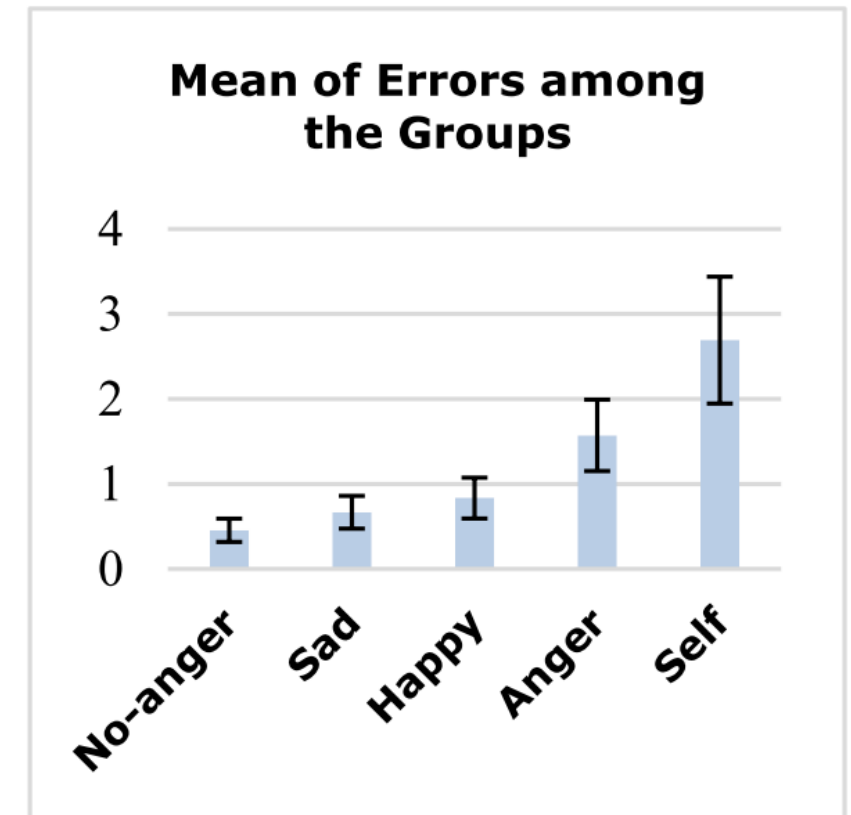


Figure 2 Mean of aggressive driving errors across conditions. Error bars indicate standard error of the mean.

So if you're driving angry and selecting your own music (as most people do when they're driving) you're more likely to make more mistakes on hard routes.

Whereas, if you listen to sad or happy music, safer driver.

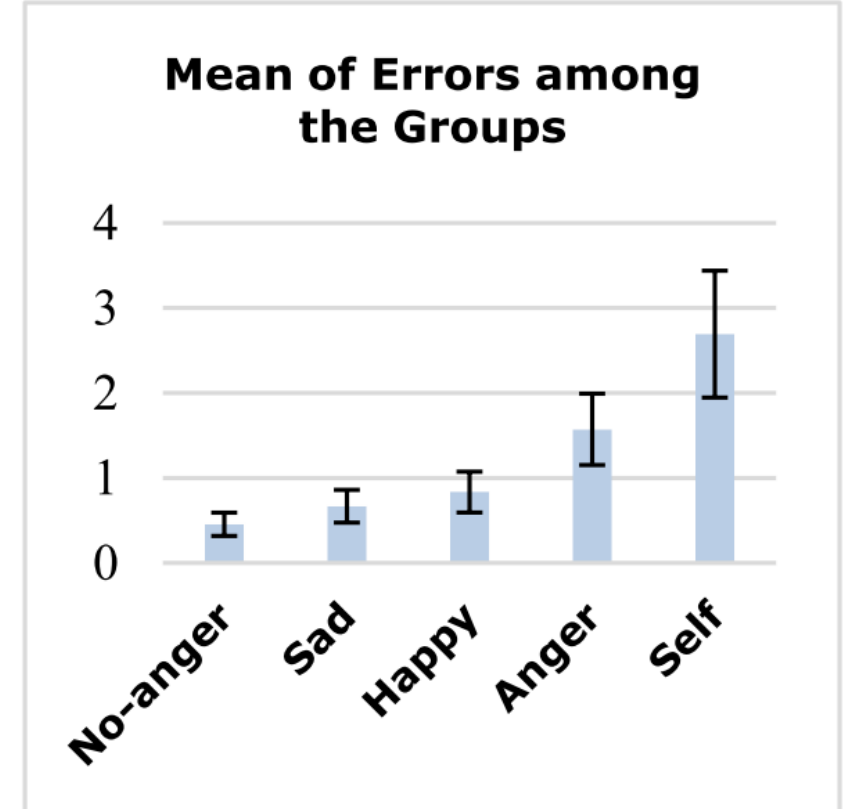


Figure 2 Mean of aggressive driving errors across conditions. Error bars indicate standard error of the mean.

Application – Generating Music Playlist for Mood of *Groups* of People

MoodMusic – created for mood of *groups* of people rather than mood of individual.

Real-time conversation analysis to determine mood of the group – looks at

intensity volume of signal – rolling average over 30 second-window

pitch height – average magnitude difference

Weighted these two parameters on...

Bauer, Jared S., Alex Jansen, and Jesse Cirimele. "MoodMusic: a method for cooperative, generative music playlist creation." In *Proceedings of the 24th annual ACM symposium adjunct on User interface software and technology*, pp. 85-86. ACM, 2011.

Based on Robert Thayer's model
of 2 dimensions:

Energetic or tired

Tense or calm

(weighted by volume and pitch
intensity)

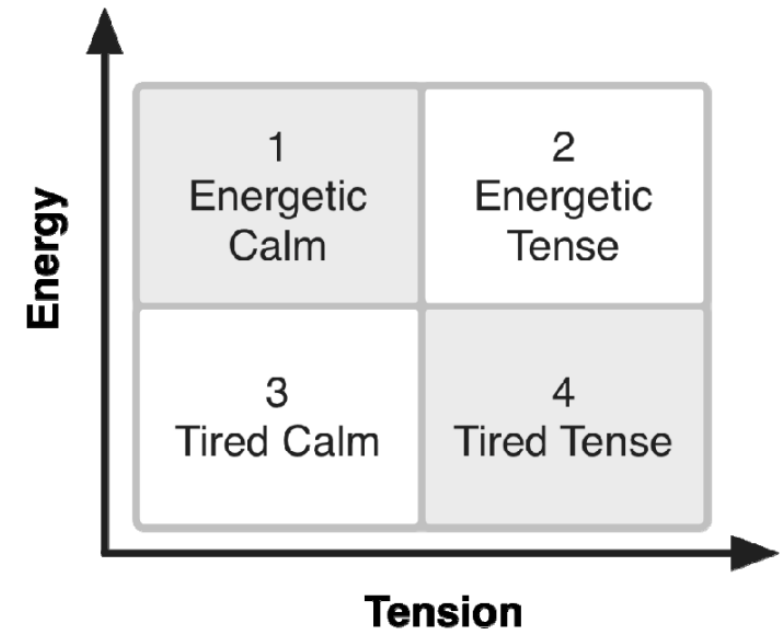


Figure 1: Thayer's mood model. Based on this model, the group's moods can be in one of four quadrants: energetic calm, energetic tense, tired calm and tired tense.

Based on Robert Thayer's model
of 2 dimensions:

Energetic or tired

Tense or calm

(weighted by volume and pitch
intensity)

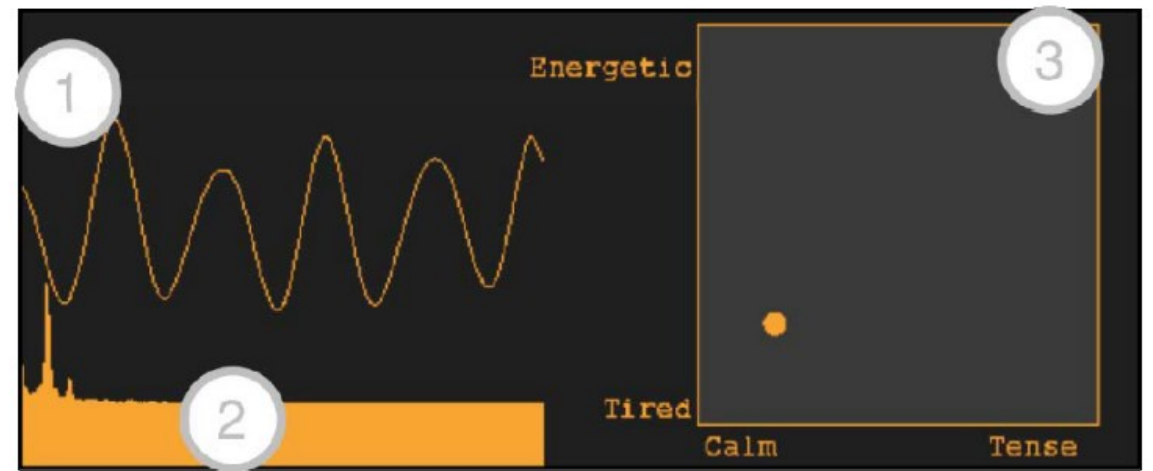


Figure 2: MoodMusic's interface displays three pieces of information: 1) audio as a sound wave, 2) a spectrum, and 3) the current energy and tension detected.

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Generating Music Playlist for Mood of *Groups* of People

Recommender system – only works with Last.fm which has library of user's preferences that can be tagged by users.

MoodMusic accesses Last.fm's API by intersecting top tags from each person's music library and it's mood's tag using a similarity index from Thayer's *Activation-Deactivation Adjective Check List*.

Therefore resulting playlist represents the intersection of preferred music between the group members for the determined mood.

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Other Application Areas

Therapeutic – e.g. mental health, physical health (e.g., stroke rehabilitation), exercise related

Video games

Learning

Others?