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Emotional and Autonomic Responding to Auditory Stimuli

Background

The autonomic nervous system (ANS) is a complex physiological system comprised of two branches: the parasympathetic (PNS) and sympathetic (SNS). Together these systems regulate the body's arousal; processes that includes the interpretation of, and response to emotionally-evocative stimuli (Kreibig, 2010). This kind of stimuli often manifests in an auditory modality, in which sounds carry emotional information. While the human voice is an effective means of conveying such emotions, music is another medium that excels in eliciting emotional states in its listeners (Juslin & Sloboda, 2011). Music has also been found to differentially activate the branches of the ANS (Etzel et al., 2006). However, relatively little work however has been done examining the distinct differences in autonomic responsiveness between auditory emotional stimuli that is social in nature (e.g., voices) versus emotional evocative music.

Study Aims

The aims of this study were to explore the responsiveness of the autonomic nervous system to emotionally-evocative sounds (happy, sad, angry) and compare responsiveness patterns between its modality (i.e., voices vs. music).

Methods

Fifty participants (28 female, 22 male) were recruited from the University of New Orleans and completed a task (Figure 1) in which they listened to emotionally evocative sounds (happy, sad, angry) while seated. The task was comprised of two blocks comparing social vs non-social sounds. Each block (social/non-social) was comprised of four 150 second segments (baseline, happy, sad, angry), which exposed the participant to emotionally-salient sounds lasting for 15 seconds with 10 seconds of silence in between. The sounds in the social block were nonverbal vocalizations (laughing, crying yelling) and the sounds in the non-social block were clips of instrumental music, composed by Eerola & Vuoskoski (2010). Throughout this experiment, participants were hooked up to an ambulatory electrocardiograph from Mindware Technologies™ that measured heart rate (HR), respiratory sinus arrhythmia (RSA), pre-ejection period (PEP), and galvanic skin conductance (GSC).

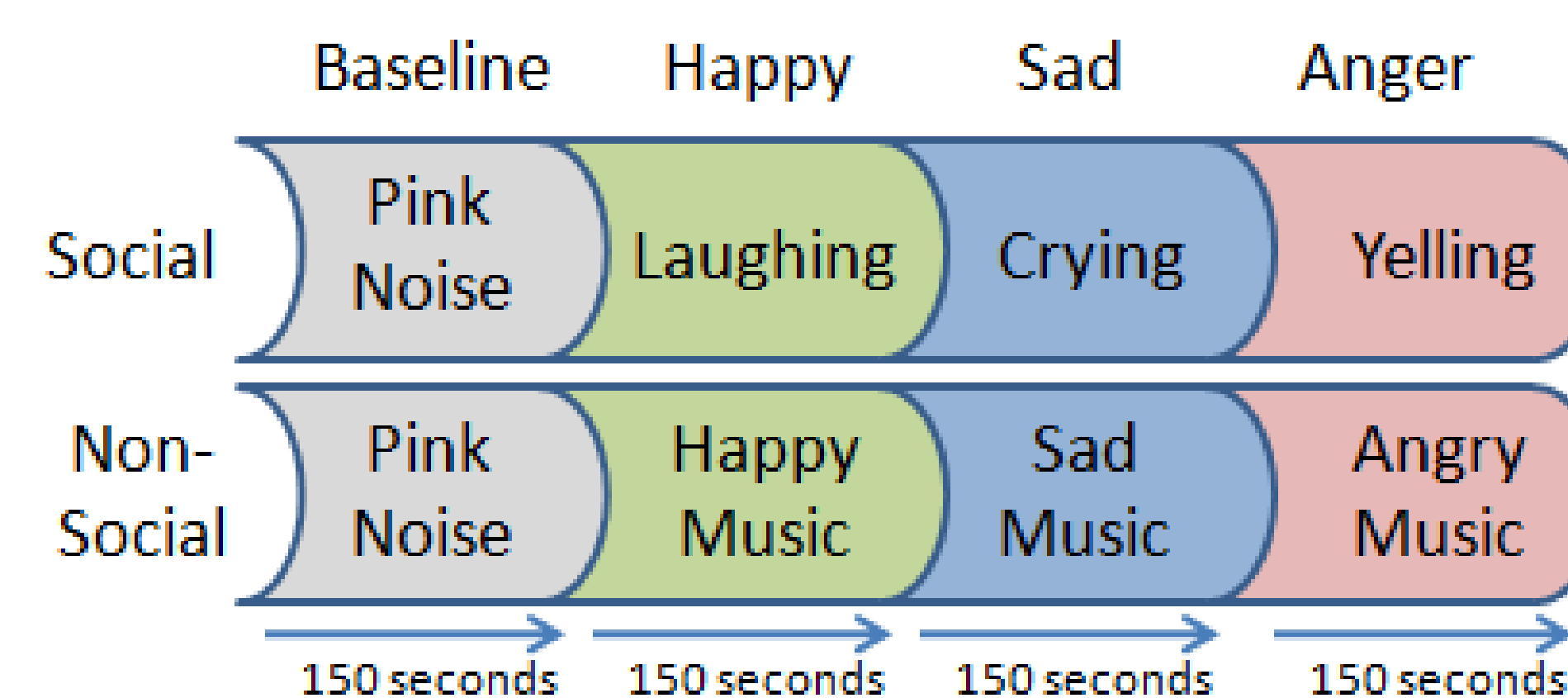


Figure 1: Structure of Experiment

Results

Results were assessed using a three-level multilevel model in which the autonomic biomarkers (HR, RSA, PEP, GSC) were used as the outcome variable with block (social/non-social) and condition (happy/sad/angry) serving as individual predictors.

The findings were as follows (see Table 1):

- **HR:** A significant relationship was found in which HR was lower during the social block, indicating a reduction in physiological arousal.
- **GSC:** A trend-level relationship was found in which elevated GSC was higher (thus higher dermal sympathetic activation) during the social block compared to the non-social (i.e., music condition).
- **RSA/PEP:** No significant relationships were found between RSA/PEP and block

Table 1: Autonomic data by Block

	β	Sig.
HR	-1.68	0.040
RSA	0.16	0.340
PEP	-0.48	0.177
GSC	0.36	0.057

Discussion

Findings show inconsistent effects of the modality of emotionally evocative sounds (i.e., voices vs. music) on autonomic responsiveness. Despite HR showing an overall reduction in cardiovascular arousal, no individual effects were found for the sympathetic (PEP) and parasympathetic (RSA) branches. SNS activity was however found in GSC, in which the social modality showed elevated reactivity. Skin conductance is known to be a fast-acting response that occurs in response to discrete stimuli. This suggests that the actions of the SNS may be more present in its influence on the skin than in its cardiovascular effects.

Future Directions

Further work on the modality of emotionally-evocative auditory stimuli would benefit from using a larger, more representative sample. An additional consideration would be to examine whether these changes differ in groups in which music is particularly salient (e.g., musicians).

References

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