MPATC-GE 2042:
Psychology of Music

Emotion and Expectation
Assignment reminder

- **Experiment design** – NEW DEADLINE: *Sunday, November 11 at 11:55pm*
- The experiment design includes (1) a very specific research hypothesis related to your research topic and (2) the design for an experiment to verify or refute your hypothesis. The hypothesis should be informed by what you have learned from the literature review process. It should be framed in a way that, when tested properly, will offer new information or help answer a research question in your topic area. In your experiment design write-up, you must address the following:
  - Explain why your research question has value to the field
  - Point to a gap in current state of the art (as described in your literature review) that you are trying to address with your research question
  - Translate that research question into a testable hypothesis
  - Present a design for an experiment to test that hypothesis
  - Make sure you use APA citation style and include at the end of your text a list of any references you cited
Emotion: Some useful definitions

- **Affect** – a term that refers to mental states associated with emotion or mood
- **Arousal** – activation of the autonomic nervous system
  - Physiological arousal is one of the components of emotional response but can also occur in the absence of emotions (e.g. exercise)
  - Psychological arousal – state of being alert and awake (associated with intensity/excitement level in music)
- **Valence** – Dimension of affect that extends from positive to negative
- **Cognitive appraisal** - An individual’s subjective evaluation of an object or event on a number of dimensions in relation to the goals, motives, needs and values of the individual
Cognition and emotion

• How do cognition and emotion relate?
• Are emotions part of cognition or do they operate in a distinct mental system that is separate from the cognition that underlies our emotional intelligence?
  • View 1: Emotional responses depend on prior cognitive processing
  • View 2: Emotional responses occur prior to, or independently of, cognitive processing
  • View 3: Emotions are highly integrated with cognitive processing
Cognition and emotion, View 1: Emotion dependent on prior cognitive response

• Emotional responses, such as feelings of sadness or pleasure, are the outcome of a series of cognitive processes in which features are coded, classified, and finally evaluated and appraised. (Lazarus, 1982; Thompson, 2009)

• The interpretation is the cognitive act, the appraisal or evaluation is the point at which emotion occurs.
Cognition and emotion, View 2: Emotions independent of cognitive processing

• Early extreme view: emotional responses correspond to activity in the peripheral (autonomic) nervous system

• William James (1890) suggested that feelings of emotion were merely the feelings associated with physiological or behavioral states
  – Criticism: autonomic responses lack the specificity to define the emotions; also specific emotion experienced may be determined by a cognitive evaluation of that physiological state
Cognition and emotion, View 3: Emotion integrated with cognition

- Emotions are highly integrated with cognition from an early stage (Damasio, 1994)
- Central to Damasio’s theory is the concept of a somatic marker: affective tags that are attached to sensory images, “marking” each image with an emotional association
- This hypothesis underscores the possible adaptive/functionalist approach to emotions: they prepare us for biologically significant events like threatening situations, finding food, etc.
- The idea is that the somatic markers help narrow our attention so that we focus on the critical aspects of an event
Cognition and emotion: conclusions?

- Appears to be considerable confusion
- However, these contrasting perspectives can be reconciled by assuming that there are several mechanisms involved in the connection between music and emotion—some conscious, some unconscious
- The idea of multiple mechanisms for emotional responses to music is advocated by Juslin and Västfjäll (2008)
Juslin & Västfjäll (2008): The need to consider underlying mechanisms

- Juslin & Västfjäll suggest music and emotion researchers are not adequately taking into account underlying mechanisms
  - Musical emotions have either been studied without regard to how they were evoked
  - ...Or cognitive appraisal has been assumed as the default mechanism for inducing emotions
- They conclude that failure to control for the underlying mechanism may lead to inconsistent or non-interpretable findings
Juslin & Västfjäll 2008: Six psychological mechanisms

- Brain stem reflexes – most primitive mechanism; occurs in response to fundamental acoustic characteristics of sound
- Evaluative conditioning – occurs when music has been repeatedly associated with an emotional context
- Emotional contagion – the phenomenon that perceiving an emotion can sometimes induce that same emotion
- Visual imagery – music sometimes evokes visual information, and sometimes that the imagery has associated emotions
- Episodic memory – personal memories associated with a particular piece of music
- Musical expectancy – refers to the process by which an emotion is induced when a musical event violates, delays, or confirms the listener’s expectations
### Juslin & Västfjäll 2008: Six mechanisms

<table>
<thead>
<tr>
<th>Nature of induction process</th>
<th>Characteristic</th>
<th>Induction speed</th>
<th>Degree of volitional influence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanism</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brain stem reflex</td>
<td>General arousal, unpleasantness versus pleasantness (Berlyne 1971; Lane</td>
<td>High (Goydke et al. 2004)</td>
<td>Low (Foss et al. 1998; Joseph</td>
</tr>
<tr>
<td>Evaluative conditioning</td>
<td>Basic emotions (Joseph 2000; LeDoux 2002; Olatunji et al. 2005)</td>
<td>High (LeDoux 2002)</td>
<td>Low (Martin et al. 1984; De</td>
</tr>
<tr>
<td>Emotional contagion</td>
<td>Basic emotions (Juslin &amp; Laukka 2003; Lane 2000, pp. 361–63; Laird &amp;</td>
<td>High (Dimberg &amp;</td>
<td>Low (Neumann &amp; Strack 2000;</td>
</tr>
<tr>
<td>Visual imagery</td>
<td>All possible emotions (Lane 2000, pp. 361–63)</td>
<td>Low (Bunt 2000;</td>
<td>High (Bonde 2006; Farah 2000;</td>
</tr>
<tr>
<td>Episodic memory</td>
<td>All possible emotions, though especially nostalgia (Juslin et al., submitted;</td>
<td>Low (Conway &amp; Holmes 2005, p. 526)</td>
<td>Medium (Conway &amp; Holmes 2005;</td>
</tr>
<tr>
<td></td>
<td>Wildschut et al. 2006)</td>
<td></td>
<td>Tulving 1983)</td>
</tr>
<tr>
<td></td>
<td>Huron 2006)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Juslin & Västfjäll 2008: Six mechanisms

<table>
<thead>
<tr>
<th>Nature of induction process</th>
<th>Characteristic</th>
<th>Modularity</th>
<th>Dependence on musical structure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanism</strong></td>
<td><strong>Availability to consciousness</strong></td>
<td><strong>Modularity</strong></td>
<td><strong>Dependence on musical structure</strong></td>
</tr>
<tr>
<td>Visual imagery</td>
<td>High (Kosslyn 1980)</td>
<td>Low (Farah 2000; Kosslyn 1994, p. 29)</td>
<td>Medium (Bonde 2006, Bunt 2000)</td>
</tr>
</tbody>
</table>
Cooke (1959): Melodic cues

- Cooke argued that different melodic intervals and patterns have their own distinctive emotional quality.
- He speculated that composers draw on these intervals and patterns in their compositions.
- This theory implies that music is a kind of language of emotion, with its components and patterns representing different feelings or emotions.

<table>
<thead>
<tr>
<th>INTERVAL</th>
<th>FAMOUS SONG</th>
<th>COOKE’S EMOTIONAL ASSOCIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major third</td>
<td>“Doe a Deer” (the leap from “male” to “deer” in “a female deer”)</td>
<td>Joy, triumph</td>
</tr>
<tr>
<td>Major sixth</td>
<td>“My Bonny” (the leap from “my” to “bon-”)</td>
<td>Longing for pleasure</td>
</tr>
<tr>
<td>Augmented fourth</td>
<td>“Simpsons Theme” (the leap from “The” to “Sim-”)</td>
<td>Hostility, disruption</td>
</tr>
</tbody>
</table>
Kivy (1980): Contour and convention

• Kivy argued that music has the power to express specific emotions such as joy, sadness, and anger, but did not confine his discussion to just intervals.

• He looked at various musical features such as tempo, mode, and melodic patterns that displayed a “structural resemblance” with features of human behavior that are expressive of these emotions.

• The “contour” part of his theory refers to the “natural” connections between music and emotion.

• Conventional connections between music and emotions are those where no obvious natural connection is evident (culture specific).
Langer (1957): Morphology of feeling

• Unlike Cooke and Kivy, Langer (1957) rejected the idea that music is capable of representing specific emotions.
• She proposed that music is only capable of representing an undifferentiated quality of emotion.
• Music has no specific vocabulary linking musical patterns to individual emotions, rather music represents emotion in general by reflecting the “morphology of feeling” – that is, the ebb and flow of music resembles the ebb and flow of affective changes we experience.
Meyer (1956): Embodied meaning and expectation

- Meyer (1956) described two different types of meaning: designated and embodied
  - Designated meaning: the symbol or referent are different in kind from what they are referring to
  - Embodied meaning: symbol and referent are the same kind
- Meyer said that musical meaning is embodied and that its aesthetic power lies in the expectations that it creates in listeners
- Meyer did not believe that music can refer to specific emotions, rather violations of expectations result in undifferentiated arousal
Mandler (1984): Adaptive arousal

- Mandler proposed that emotional responses to music are instances of a more general adaptive biological response that occurs following all unexpected or novel events.
- The ability to anticipate events is essential to survival, therefore when something happens that’s incongruous with one’s expectations, an arousal response occurs.
- The arousal response does not itself give rise to emotion, but the combination of the response with a cognitive appraisal of the stimuli does.
- Mandler thought that listeners prefer a moderate degree of incongruity in music.

Mandler’s idea that listeners prefer moderate incongruity comes the work of Berlyne, who argued that “hedonic value” changes with arousal according to an inverted U function.
Huron (2006): ITPRA theory

<table>
<thead>
<tr>
<th>Response system</th>
<th>Epoch</th>
<th>Biological function</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I) imagination response</td>
<td>pre-outcome</td>
<td>future-oriented behavioral motivation; enables deferred gratification</td>
</tr>
<tr>
<td>(T) tension response</td>
<td>pre-outcome</td>
<td>optimum arousal and attention in preparation for anticipated events</td>
</tr>
<tr>
<td>(P) prediction response</td>
<td>post-outcome</td>
<td>negative/positive reinforcement to encourage the formation of accurate expectations</td>
</tr>
<tr>
<td>(R) reaction response</td>
<td>post-outcome</td>
<td>neurologically fast responses that assume a worst-case assessment of the outcome</td>
</tr>
<tr>
<td>(A) appraisal response</td>
<td>post-outcome</td>
<td>neurologically complex assessment of the final outcome that results in negative/positive reinforcements</td>
</tr>
</tbody>
</table>
Do listeners agree on the emotional meaning of music?

• Hevner (1935)
  – Presented listeners with two version of 10 short musical excerpts. One version was in major mode, the other minor mode, everything else identical
  – Responses clearly indicated that different types of affect were perceived for the two modes

• Terwogt and van Ginsven (1991)
  – Found a high level of consistency in judgments of happiness and sadness in music across all age groups
Cognitivist vs. emotivist perspectives

• Does music actually cause listeners to actually feel emotions?
• Cognitivist position – listeners are sensitive to the emotional meaning of music but they don’t actually experience that emotion
• Emotivist position – music actually elicits an emotional response (this perspective is questioned by Meyer and Kivy)
Krumhansl (1997): Support for emotivist perspective?

- Twelve physiological measurements were obtained while musicians listened to six musical excerpts.
- All physiological measures were significantly affected by music listening.
- On average, music caused a decrease in heart rate, skin conductance, finger temperature, and respiratory depth, but an increase in breathing rate and blood pressure.
- Interestingly, the direction of these physiological changes was the same regardless of emotion.
Article discussion:
Balkwill and Thompson (1999)

• Discussion leaders: Jess Bauer, Wei-Tsung Lu
Reading question: Tonal influence?

• Even though the participants were not familiar with the North Indian tonal system, tonal hierarchies do exist in raga music and therefore an amount of consonance and dissonance that, as Rigg (1940) concludes, are directly correlated to the “listener’s judgement of emotion in music”. Do you think it would have been relevant to include this parameters in the experiment? What would the results be if we used atonal music, where hierarchies are non-existent, and recreate an experiment with the same considerations of tempo, complexity and so on? (Julian T.)

• The ragas generally have a some parallels with the way western scales and modes are. For example, Bhupali raga could be interpreted as a major pentatonic scale. Could this cause the listeners to simply draw familiarity with their own musical cultures? (Mihir)
Reading question: Articulation

- How would an analysis of articulation factor into the participants' perception of the stimuli? One would think staccato might lead participants to draw a connection to joy or anger while legato might lead them to identify sadness or peace. Would these connections override the relationship with tempo? How would having a piece with a slow tempo but staccato articulation be evaluated? (Max)
Reading question: Enculturation

• Even though musical dimensions such as tempo and pitch range, for example, are not culture-specific, some believe that “musical meaning is determined exclusively by cultural convention” (p45). How might we test the degree to which the listener’s correlations between each psychophysical dimension and its associated emotions reflect the listener’s enculturation? If an experiment were conducted in which participants with exposure to different tonal systems rated the emotions of atonal pieces of music at different tempos, for example, would the emotional categorization vary among participants? In other words, to what extent do we project the conventions of the music familiar to us onto unfamiliar music? (Tyler)
Reading question: Performer expression

• How much did the performers' expression impact the perceived emotion? Would similar results be obtained with the same ragas for a larger group of performers? (Sri)

• Contrary to many of the articles we have read, this paper used real performances rather than MIDI/computer generated recordings (The authors even confirmed their authenticity and effectiveness through playing them to raga experts.) Would we ever want to study emotion in music with computer recordings, e.g. if we wanted to finely control certain musical parameters? What does it mean if listeners find emotion in a piece of music that doesn't involve a human producing emotion. Of course a human might still involved to put notes on paper, but we could go even further and write music-generating algorithms instead to distance a person as far from the music as possible. (Willie)
The findings in Balkwill & Thompson (1999) seem to suggest that listeners can correctly assess the intended emotional content of a given piece by gauging its tempo, rhythmic complexity, melodic complexity, pitch range, and timbre, even when the piece comes from another culture, in this case, Hindustani ragas. How might these psychophysical dimensions help convey specific emotional frameworks? Would Juslin & Västfjäll (2008) consider these dimensions to be brain stem reflexes, rhythmic entrainment, or something else? (Johnny)
Reading question: Expectation and psychophysical cues

• Is it possible that listeners can decipher the emotional intention of an unfamiliar piece by attending to its musical expectancy in addition to perceiving its psychophysical attributes? Does the perception of surface level musical structures, such as tempo, rhythm, melody, pitch, and timbre, affect musical expectancy in terms of imagination, tensions, prediction, reaction, and appraisal? How might these two factors, psychophysical and musical expectancy, relate to each other regarding emotional perception? (Johnny)
Reading question: Timbral variety in study

- Is it fair to draw conclusions about timbre in this study? Only two examples of timbre were considered (string or flute) of the almost infinite possible timbral combinations available. In addition, they did not examine the acoustic differences between these instruments that lead to these differences in timbre, but just relied on the fact that they were different instruments. Finally, no participant ratings were given to timbre in this study as opposed to the other acoustic variables, which makes it hard to compare with the others. (Henry)
Reading question: Sadness and tempo

• Why do you think there was a negative relationship with sad emotion and tempo? (Rebekah)
Reading question: Consonance and dissonance

• In the paper, Balkwill & Thompson mention that one of the psychophysical dimensions associated with emotion perception is consonance/dissonance. Perception of consonance vs. dissonance seems to vary significantly across cultures, especially with respect to western music vs. traditional Indian raga music, so it seems interesting that the authors would exclude this dimension from their study. Had they included it, could it have lead to a more insightful examination of emotion in music across cultures? (Julian C.)
Reading question: Altering correlated features

- The experiment results indicate that listeners depended on psychophysical cues such melodic complexity and tempo to judge emotion in unfamiliar music. If a raga associated with a certain emotion was rendered atypically, for instance if a joyful raga was performed at a slow tempo, would that significantly impact perceived emotion in unfamiliar listeners? Are there other salient features that might be used as a proxy in those cases, such as consonance/dissonance statistics and dynamics? (Sri)

- The researchers found that there was a positive correlation between tempo rating and happiness ratings and a negative correlation between tempo rating and sadness ratings, meaning that slower tempos were correlated with sad emotional content and faster tempos with happy emotional content. Is it possible that, with all other variables kept equal (psychophysical and compositional), researchers could determine a 'Sad Tempo' window and a 'Happy Tempo' window? If we steadily increase tempos of musical stimuli and have participants rate happiness/sadness, would the tempo range at which happiness and sadness had equal ratings be considered the barrier tempo range between these 'Happy Tempos' and 'Sad Tempos?' (Henry)
Reading question: Timbre and expression

• In his text, the author mentions that “timbre has also found to influence listeners’ rating of emotion in music” and that listeners were more sensitive to sadness and fear expressed in violin and vocal improvisations”. Considering that a bowed string instruments are extremely versatile and capable of expressiveness, unlike percussive instruments, and that this studies were based merely on improvisatory performance. Do you think its accurate to simply conclude that “violin is related with sorrow”? What styles of music or which pieces do you know that use violin and evoke feelings of joy? (Julian T.)
Reading question: Timbre and culture

• Listeners often get a preconception of a certain piece of music being exotic or foreign when they hear different instruments. So how would the listeners perceive Hindustani classical music if it were simply transposed to western instruments? Would it simply blur their perceived cultural line? (Mihir)
Reading question: General perspective

• Through the study, the authors essentially confirmed what they had initially supposed, and proved what had been largely proven before, as far as the correlation between psychophysical dimensions and emotion is concerned. How could they have changed the study to perhaps make the results of their experiment less predictable and more insightful? (Julian C.)