Our Perceptions of Music: Why Does the Theme from Jaws Sound Like a Big Scary Shark?

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Our Perceptions of Music

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Why does the theme from Jaws sound like a big, scary shark?

Well... why?
A Different Context …
Emotion and Meaning in Music

The Stimulus

The Listener

The Context
Properties of Musical Sound

Periodic Sound Waves
Described in terms of:

Frequency
Waveform
Amplitude
Duration
Sound is Pressure Waves

Time

dB

dB
Perceptual Correlates of Physical Properties

Physical
Frequency
Waveform
Amplitude
Duration

Perceptual
Pitch
Tone Quality
Loudness
Articulation
Rhythm
Tempo
Sound is variations in air pressure produced by physical vibration
Wave Motion Demos
Ears detect pressure changes

Outer ear: pinna, meatus

Tympanic membrane
... and analyze the frequency of the changes
Physiology of the Human Auditory System

- Pinna
- Eardrum
- Ossicles
- Semicircular Canals
- Cochlea
Cochlea
Organ of Corti

Hair cells

10 µm
Models of the cochlea at work

Mechanical cochlea model
The Auditory System:
- Detects changes in pressure
- Analyzes the **frequency** of changes
- Analyzes the **amplitude** of changes

Timbre?
Pure tone sine wave

Complex tone

Perspective plot of Amplitude x Harmonic Number x Time for a violin tone. The fundamental harmonic is plotted in the background with higher-frequency harmonics in the foreground.
Harmonics

C 65.4 Hz
C 130.8 Hz
G 196.2 Hz
C 261.6 Hz
E 327.0 Hz
G 392.4 Hz
Harmonic Series

Overtone Series
(Chart of harmonics on C)

- Darkened notes denote approximate pitches. These tones are considered out of tune.
Perspective plot of Amplitude x Harmonic Number x Time for a violin tone. The fundamental harmonic is plotted in the background with higher-frequency harmonics in the foreground.
What do you hear?

Violin
French horn
Piano
Sine wave

Violin sound
Synthetic Clarinet-like Sound
Synthetic Bell-like Sound
Synthetic Bell-like Sound with Different Fundamental Envelope
Synthetic Clarinet-Like Sound
Synthetic Clarinet Sound with Different Fundamental Envelope
Sonogram of cardinal vowels

Time (sec)

Frequency (Hz)
Probability of perceptual skills determined by

Nature:
Sets parameters (opportunities)

Environment:
Provides experience (probability)

Perception
Sound Spectrum

Pitch Loudness Timbre
Consonance/dissonance ...

Preference Enjoyment
Pleasure Emotion ...

Aspects of Human Perception

Pattern Recognition - Expectation
Orienting Response - Habituation
Paired Association

Ligeti
Adventures

Haydn
Symphony No. 101 in D
Aspects of Human Perception

Pattern Recognition - Expectation
Orienting Response - Habituation
Paired Association

Holst
Mars, from The Planets

Strauss
Tod und Verklarung
Characteristics of the Stimulus

Intensity
Density
Continuity
Redundancy

Mantovani
The Nearness of You

Coltrane
Giant Steps

Smashing Pumpkins
Responses to Sound Stimuli

Response Variable

Stimulus Variable

Stimulus Variable

Response Variable
Characteristics of the Listener

Experience (language, time scale)

Familiarity with Stimulus

Paired Associations with Stimulus

Mood State

Raga Mishra Gara  Raga Mishra Gara  Randy Newman  Etta James
Characteristics of the Listening Context

Solitary - Group

Social Occasion

Societal Conventions

Level of Active Participation

Williams
So why does the theme from Jaws sound like a big scary shark?
Because of the characteristics of ... 

The Stimulus
Parameters of sound waves
Organization of sounds in time

The Listener
Innate predispositions
Learned associations

The Context
Social cues and expectations
Observations of the responses of others
Questions?

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Robert Duke is the Marlene and Morton Meyerson Centennial Professor of Music and Human Learning, University Distinguished Teaching Professor, and Director of the Center for Music Learning. Widely published in music and education, he has directed national research efforts under the sponsorship of such organizations as the National Piano Foundation and the International Suzuki Institute. His work has been presented at national and international conferences in music education, music therapy, and music psychology, and appears in major research journals and texts. Dr. Duke serves on the editorial boards of the Journal of Research in Music Education, the Bulletin of the Council for Research in Music Education, and Psych musicology. A former studio musician and public school music teacher, he has worked closely with children at-risk, both in the public schools and through the juvenile court system, and he remains an active clinician and researcher in music learning, systematic observation and evaluation, and behavior management, presenting lectures and teaching demonstrations throughout the United States.
Eugenia Costa-Giomi (Ph.D. Ohio State University), teaches research methods in music education, psychology of music, and musical development. Her research focuses on music perception and cognition during childhood, the nonmusical benefits of music instruction, and the relationship between specific abilities and behaviors and musical achievement. She chaired the third International Conference in Music Perception and Cognition with Dr. Pennycook (1996), the 13th Symposium for Research in Music Behavior (1999), the Music Perception Interest Group of the Music Educators National Association (1998), is part of the editorial committees of the Journal of Research in Music Education and Musicae Scientiae, and past member of the editorial board of the Bulletin of the Music College Symposium. She has taught music to children in Argentina, Mexico, Canada, and the United States and was Associate Professor of Music Education at McGill University, Canada (1991-2002).