







Alarms: designed in order to attract the human's attention
 Need:

- - based on task-oriented transparency and understandability with respect to the context of a particular application domain.
- Sounds
 - Vehicle guidance
 - Medicine
 - Cinema
 - Industrial plans
 - Mobile phones

Application-Oriented Classification

- Functional objectives
 - State and internal information
 - Functioning of sysyem components
 - Intent comunicaction
 - Request of human inputs
 - Alarms and warnings
 - Urgency
 - Distinctiveness
 - Arousal
 - Appeal of products
 - Desired emotional impressions

User-Oriented Classification

User classes

- different jobs, task allocations and resposabilities
- Operators, engineers, managers
- Complementary sounds fro team members
- Communications with individuals preferences and needs
 Depending on capabilities, impairments, tasks, environments
 Sighted and blind users
 - Transforming data and graphics into auditory display
- Individual user capabilities
 - Experts, novices, occasional users
 - Practice and quality of hearing sense
 - Non musicians v.s. musicians
 - Human errors











Sound and meaning in speech and music (cont.)

- Prosody is a major channel across which many of the above features become transmitted.
 - makes speech more impressive than writing
 - encode emotional information
 - shares its major elements with music:
- intensity, melody, articulation, and rhythm.
- Songs: language as a carrier medium for melodic sounds
- Prosody and music performance
- see story telling
- Strong role of culture imprint for the constitution of meaning.
 - interpretation of musical meaning can be extremely subjective.

IIB. Meaning from the Perspective of Function Meaning usually is closely related with function Language and music 10 predominant functions may be seen as communication and enjoyment. Further acoustic experiences The oldest function of sound is alerting. capability of auditory localization. Locating a prey or predator Ability to learn new sounds: iconic meaning the slamming of a door, the arrival of a particular person from the sound of her footsteps, the starting of a car. Acoustic scenery: complex mixtures of natural or artificial acoustic events ▶ telling us about the current weather, the situation on a busy city place, or what is happening in a forest Function: aid coordination of actions. E.g.the coordination of footsteps of marching soldiers.

17

18

IIC. Meaning from the Perspective of Listening

- Listening types:
 - Musical listening
 - pitch, melody, or harmonic organization or rhythmical patterns of a sound signal
 - Also rhythm of a bouncung ball
 - Everyday listening
 - identify the sound source
 - relative location of the sound source
 - Analytical everyday listening
 - learning about properties of the sound-producing process
 When we shake an opaque box and try to guess its contents from the sound

IID. Meaning from the Perspective of Physics

- Many aspects of meanings in sound have their origin in conventions
 e.g. language
- Meaning rooted in conveying information about important physical properties
 - interaction sounds.
 - allow us to discriminate a remarkable number of object properties
 - relative movements bringing the objects into contact
- Generate sound from first principles
 link between the situational features and the emitted spatiotemporal sound pattern

20

can be computationally too heavy



Parameter mapping

- Parameter mapping sonifications
 - Superimposition of data-driven sound events, e.g., instrument sounds, according to given parameters like onset time, duration, pitch, and amplitude.
 - Each data point is mapped into the parameters of a separate sound event
 - Offers much more flexibility than audification
 the underlying instrument sounds as well as the data-toparameter mapping can be specified by the designer
 - Require explicit knowledge of the employed mapping
 - Non trivial the specification of a good mapping

23

Earcons

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- *Earcons*: auditory patterns, usually composed of musical sounds, that represent a message in a short musical motive.
- association from an earcon to its meaning has to be learned.
 Each earcon represents an entire message of its own;
- several earcons can be combined into a sequence to represent more complex messages
 Suitable to convey symbolic messages, but limits their use for
- displaying continuous-valued or high-dimensional data items
- Sonifications of such data by other means can benefit from earcons by embedding them as symbolic acoustic markers to annotate particular parts of the underlying continuous sonification.

24

Auditory icons

- Auditory icons follow the same purpose as earcons, to convey abstract symbolic messages by using nonspeech audio.
 - do not base their meaning on a mere convention (which can only be acquired by learning),
 - but instead employ a crisp sound metaphor to encode their message.
 - Ex.: a trash container sound to confirm the deletion of a file • The main problem with auditory icons
 - for many messages (e.g., "silence") it can be very difficult or even impossible to find an adequate sound pattern.

25

Not suited for presenting high-dimensional data sets

Parameterized auditory icons

- Parameterized auditory icons
 - borrows some additional features from parameter mapping
 - in order to convey additional analog information by suitably controlling the parameters of the icon sound
 - Example of trash container:
 - sound level → the size of the deleted file
 - ♦ sharpness → the elapsed time since the most recent modification date

26