**Perception-Based Engineering**

**Integrating Human Response Into Product Design**

A collaboration between psychologists and engineers

**Mission:** To integrate into the design of engineering systems, the ways in which people perceive, and are affected by, machinery outputs.

- Understand how machine outputs (intended and other) impact people: Comfort - Annoyance - Quality of Life - Task Performance - Perception of Product Quality
- Develop people-sensitive metrics for product design
- Understand human processing of information (tactile, acoustic, visual...)
- Emulate efficient human information processing to enhance machine performance
- Understand human-machine interactions
- Develop safer, more efficient, user-friendly interfaces

**Electrical and Computer - Mechanical - Industrial Engineering**
**Psychological Sciences - Speech, Language & Hearing Sciences**

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**Perception-Based Engineering**

Combining engineering and perception models to optimize impact on people

**Stimuli:**
- Noise
- Vibration
- Heat
- Humidity
- Chemicals
- Force
- Images

**Human Performance/ Productivity**
- Annoyance/ Comfort
- Quality of the Environment/ Complaints
- Perceived Product/ Performance/ Product Quality

**Engineering Models:**
- Physics-based & Measurement-based

**Perception/ Human Performance Models**

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**Combustion Timing and Strength Variability in Diesel Engines and its Impact on Sound Quality**

**Engine Problems:** e.g.,
- periodic variations in timing cylinder misfire
- random variations in timing & strength

**Physical Modeling:**
- CONNECTS controllable combustion and engine parameters TO quality of sound (noise) heard
- Developed from observations & known physical and psychophysical behavior, refined as knowledge improves

- Combustion model to predict cylinder pressure events
- Predict acoustic and vibration sources from combustion pressure and cylinder operation
- Engine sound quality & environmental impact models

- Models connecting noise signal attributes to perceived sound attributes
- Path model to predict noise at receiver

**Noise Attributes:**
- level (loudness)
- variations in level
- rough sounding
- accessory tones