



Virtual control-rooms assisted by 3D-sound

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A master thesis at NTNU/Statoil,
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[Presentation]

- Introduction
- Theory
- Challenges
- Suggested solution
- Discussion

Introduction

- Observations
 - Traditional control rooms
 - Monitors, switchboards and monophonic acoustic alarms
 - Larger facilities, more technology
 - Produce more information to monitor
 - Difficult to keep overview
 - Simultaneous alarms

Introduction

- Hypothesis

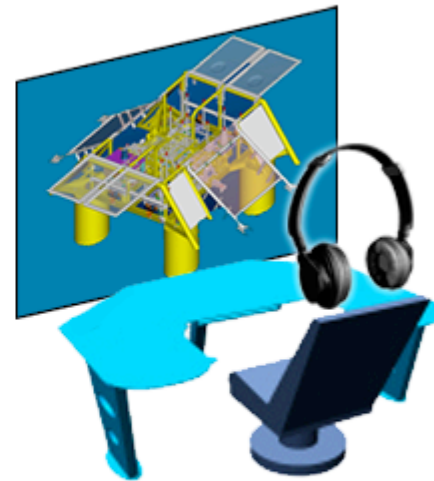
*An interactive virtual representation of a facility assisted by **3D sound** will give the operators a better overview of the facility' condition than a traditional control-room. A better overview refers to **identifying** possible problems regarding type, severity and **localization**.*

[Introduction]



Traditional

Observe



New

Immerse

[Theory]

- Elements to be used in the solution
 - Auditory display
 - 3D sound
 - Reproducing 3D sound

[Theory]

- Auditory display
 - "Using sound to present information that previously have been communicated through visual aids" [Cohen 94]
 - Different techniques
 - Auralisation (visualization)
 - Audification (visualization)
 - Sonification (visualization)
 - Earcons & Auditory Icons (UI)

[Theory]

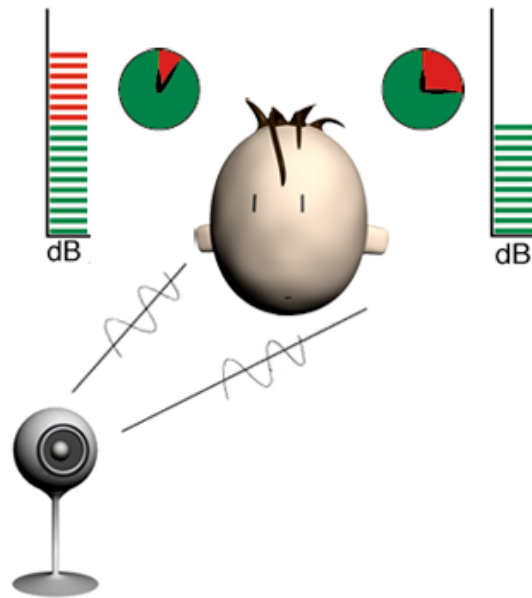
- Why auditory display?
 - 1000 words << picture << picture + sound
 - Audio does not take up screen space
 - Audio easily fades into the background, but users are alerted when it changes
 - People can process audio information while simultaneously engage in an unrelated task
 - "Cocktailparty"-effect

[Theory]

- 3D sound
 - Ear have >1 million moving parts
 - Different techniques for localization
 - Situation dependent

[Theory]

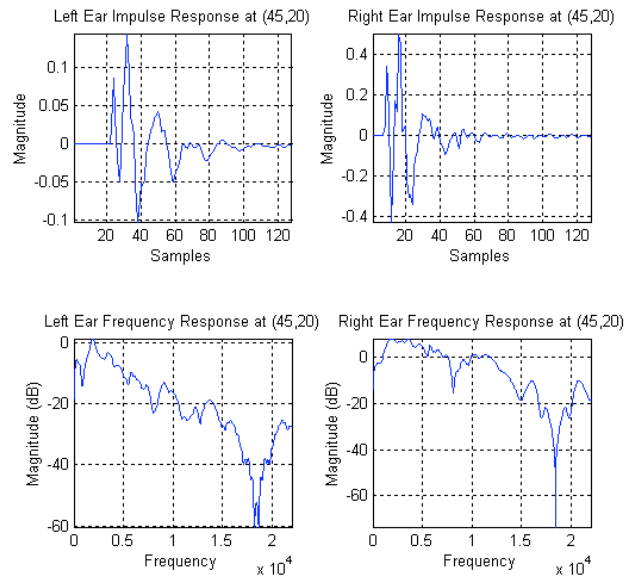
- 3D sound



Time & level difference

[Theory]

■ 3D sound



Head-related transfer functions

Theory

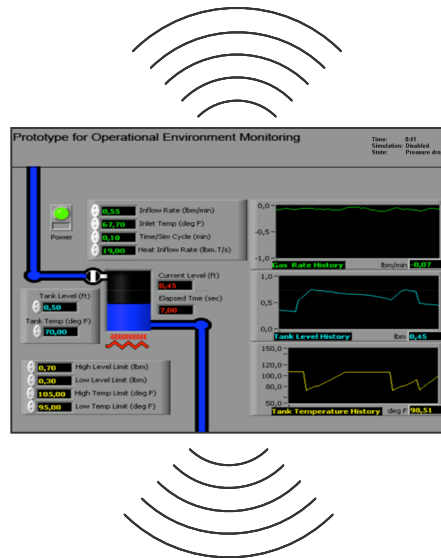
- Reproducing 3D sound
 - Imitate reality
 - Binaurale techniques (head-related)
 - Headphones
 - Speakers
 - Soundfield techniques
 - Wavefield
 - Ambisonics
 - Surround Sound (3/2, 5.1, 7.1)

Challenges

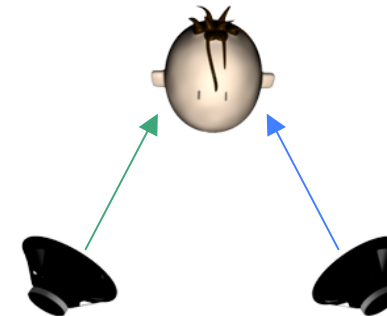
■ Solution



VR-model
(SnøhvitSim)



+ Auditory display
(Status: Type & Severity)



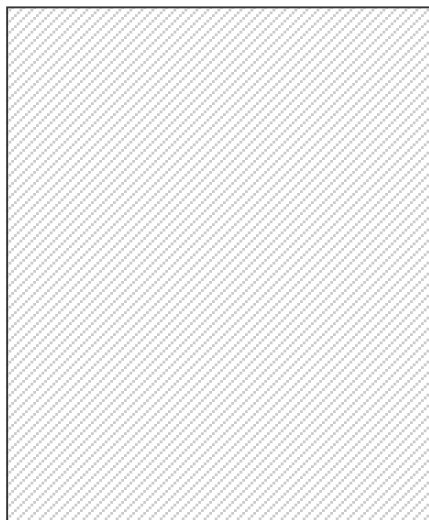
+ 3D sound
(Localization)

[Challenges]

- Auditory Display
 - Easy association
 - Avoid masking (Psychoacoustics)
 - Dynamic v.s. static characteristic
 - Continuity v.s. non-continuity
 - Comfortable & informative
- 3D sound
 - Reproduction: easy & flexible

[Solution]

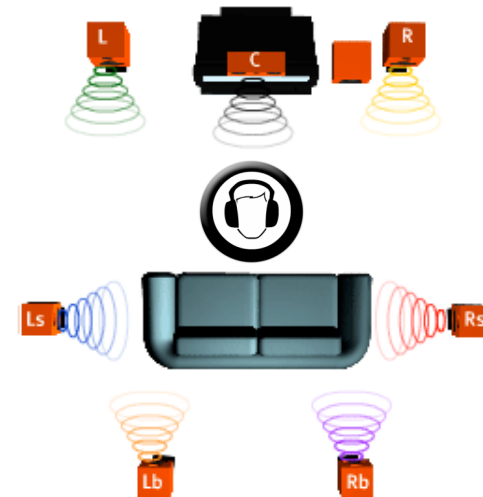
■ Solution



VR-model
(SnøhvitSim)


Dynamic
non-continuous sound
+
Auditory icons


+ Auditory display
(Status: Type & Severity)



+ 3D sound (HP & 7.1)
(Localization)

Discussion

- Is this a good idea?
 - If yes: why is it not already made?
 - If no: please explain.