Soundscape and waterscapes: The use of water features for improving the soundscape of indoor and outdoor built environments

Citation for published version:

Link:
Link to publication record in Heriot-Watt Research Portal

Document Version:
Publisher's PDF, also known as Version of record
SOUNDSCAPE IN PRACTICE: OVERCOMING TRADITIONAL ACOUSTIC CHALLENGES TO URBAN PLANNING AND DEVELOPMENT

SOUNDSCAPE & WATERSCAPES: THE USE OF WATER FEATURES FOR IMPROVING THE SOUNDSCAPE OF INDOOR AND OUTDOOR BUILT ENVIRONMENTS

Laurent Galbrun
Institute for Sustainable Building Design, Heriot-Watt University, Edinburgh

INTRODUCTION

Conventional noise control methods aiming at reducing noise levels do not always improve acoustic comfort and can be costly. The research presented here makes use of pleasant water sounds as an innovative and cost-effective solution for masking noise, for both indoor and outdoor environments.

Indoor context: open plan offices (masking irrelevant speech)
Outdoor context: gardens/parks (masking road traffic noise)

TEST RIG STRUCTURE

A rig structure built in the laboratory allowed testing a wide range of small to medium size water features (waterfalls, upward jets, cascade, foam fountain, etc.). One stream (flowing water) was also measured in the field.

PREFERRED SOUND PRESSURE LEVELS

The preferred sound pressure level of water sounds has been found to be the same or 3 dB below background noise (whether the latter is road traffic noise or irrelevant speech). This suggests that water sounds work as information maskers (i.e., distracting/focusing effect) rather than energetic maskers, also considering that water sounds of small to medium size features have limited low frequency content compared to road traffic noise and speech.

PREFERRED WATER SOUNDS & AUDIO-VISUAL INTERACTION

Stream sounds tend to be preferred to fountain sounds, which are in turn preferred to waterfall sounds. Furthermore, water tends to be the preferred impact material. Correlation analysis shows weak associations between preferences and acoustical psychoacoustical parameters, whilst evocation can play a role (e.g., a stream evokes nature, whilst a single jet of water can evoke a drain). Audio-visual tests indicate that audio and visual stimuli are equally important in preference assessments, i.e., equal attention should be given to the design of both stimuli. Similar findings were obtained for indoor/outdoor cases.

COGNITIVE PERFORMANCE, SATISFACTION & LONG TERM EXPOSURE (OFFICES)

Better accuracy and faster responses were found in a short-term memory test (serial-recall task), when a water sound was used over irrelevant speech. The overall satisfaction also increased significantly with the presence of the water sound. Furthermore, a long-term test (water feature kept in an open-plan office for 3 weeks) indicated that including the water feature significantly improved the comfort/functionality of the work environment.

SOUND MAPS

Sound maps can be used to identify how many water features might be needed to improve the soundscape (optimum zone maps with preferred sound pressure levels), or how distraction areas might vary in an open-plan office.

HIGHLIGHT

Water features with a sound pressure level similar to background noise can be used for informational masking. Flowing water sounds (e.g., streams) are preferred and the visual stimulus should be taken into account in the design.