

**THE INFLUENCE OF ACOUSTIC REFLECTIONS
FROM DIFFUSIVE ARCHITECTURAL SURFACES ON
SPATIAL AUDITORY PERCEPTION**

By

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ABSTRACT

This thesis addresses the effect of reflections from diffusive architectural surfaces on the perception of echoes and on auditory spatial resolution. Diffusive architectural surfaces play an important role in performance venue design for architectural expression and proper sound distribution. Extensive research has been devoted to the prediction and measurement of the spatial dispersion. However, previous psychoacoustic research on perception of reflections and the precedence effect has focused on specular reflections. This study compares the echo threshold of specular reflections, against those for reflections from realistic architectural surfaces, and against synthesized reflections that isolate individual qualities of reflections from diffusive surfaces, namely temporal dispersion and spectral coloration. In particular, the activation of the precedence effect, as indicated by the echo threshold is measured. Perceptual tests are conducted with direct sound, and simulated or measured reflections with varying temporal dispersion. The threshold for reflections from diffusive architectural surfaces is found to be comparable to that of a specular reflection of similar energy rather than similar amplitude. This is surprising because the amplitude of the dispersed reflection is highly attenuated, and onset cues are reduced. This effect indicates that the auditory system is integrating reflection response energy dispersed over many milliseconds into a single stream. Studies on the effect of a single diffuse reflection are then extended to a full architectural enclosure with various surface properties. This research utilizes auralizations from measured and simulated performance venues to investigate spatial discrimination of multiple acoustic sources in rooms. It is found that discriminating the lateral arrangement of two sources is possible at narrower separation angles when reflections come from flat rather than diffusive surfaces. Additionally, subjective impressions are recorded for each of the conditions to assess effects other than spatial acuity.