

## Auditory Signal Detection in Various Levels of Restricted Environmental Stimulation

### ABSTRACT

This study was designed to measure how various degrees of reduced stimulation (REST) influence the detection of a tone presented in noise. Twelve groups of subjects experienced six degrees of reduced stimulation in two different environments, a typical REST chamber and a flotation tank. The six degrees of reduced stimulation were the light and dark versions of three levels of auditory stimulation; silence, music, and recorded text for which the subjects were later tested for content. The task was a two-interval, forced choice, signal-in-noise detection task, presented to subjects once during the first ten minutes and again during the last ten minutes of a one hour and twenty minute period spent in one of the REST conditions. The results suggest that the beneficial effects of REST stem from environmental factors more complex than the mere elimination of stimulation and that the auditory perceptual system may benefit from the pre-task “priming” provided by an hour of music. The effects of the peripheral stimulation provided by the music are contrasted with those attributable to the central (cognitive) stimulation triggered by the recorded text.

### The Restricted Environmental Stimulation Technique (REST)

REST involves the near-complete elimination of external stimulation. In the chamber version, subjects sit in a sound-attenuated and light-proofed room. In the flotation version, subjects lie in a skin temperature, Epsom salt-saturated solution in a sound-attenuated, light-proofed tank. The Epsom salts raise the density of the water such that participants float easily upon the surface of the water, allowing them to breathe normally. The result is a significant reduction in tactile stimulation and the illusion of weightlessness. One objective of the current study was to determine which components of the REST environment are essential to the experience. It was for this reason that we added light and sound to some of the conditions.

### METHODS

84 subjects, 54 female and 30 male, were randomly distributed across the two environmental conditions (Float and brief Chamber REST) which were further divided according to the degree of visual and auditory stimulation they received during an hour spent in the environment. The visual stimulation levels were Dark and Light. The levels of auditory stimulation were Quiet, Music, and Story (see Figure 3). Due to an obvious ceiling effect in the Chamber condition, data collection stopped at 4 individuals in each of the 6 levels of visual and auditory stimulation for the Chamber environment. There were 10 participants in all 6 levels of stimulation in the Flotation Environment.

The Music and Story conditions were intended to provide peripheral and central stimulation, respectively. Participants in the Story condition were later tested for story content in order to insure they were paying attention. All participants with test scores lower than 50% were eliminated from the present analyses. Participants in all conditions began the experiment by completing two measures intended to gauge their hearing sensitivity. The data for those scoring outside the pre-specified parameters were discarded prior to further analyses. After the pre-experimental tests, subjects entered the experimental environment and were presented with the first signal detection session. The second session, identical to the first, was presented after an hour spent in the environment with the designated degree of stimulation throughout. The signal detection task was a two-interval forced-choice task wherein the participant was to indicate which of two static bursts contained a high-pitched beep.

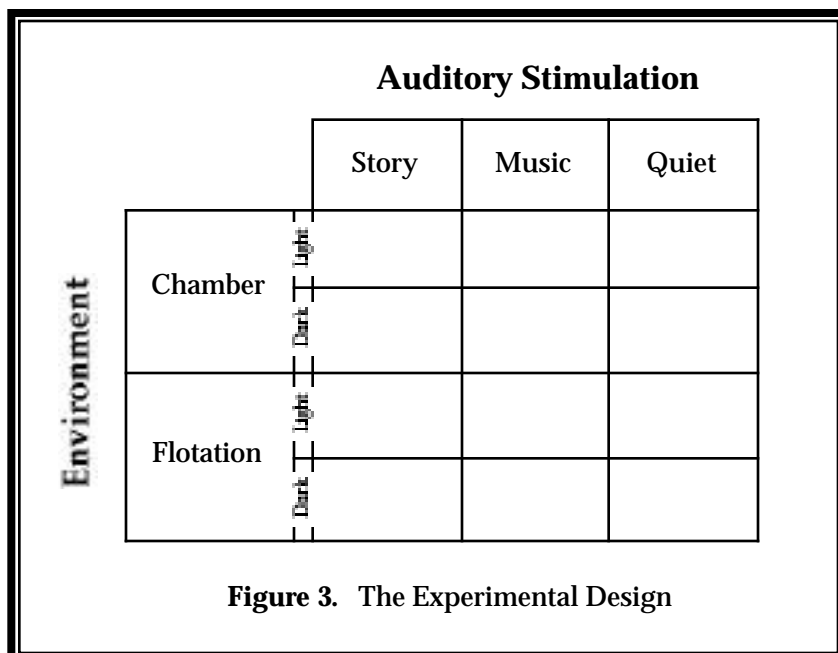
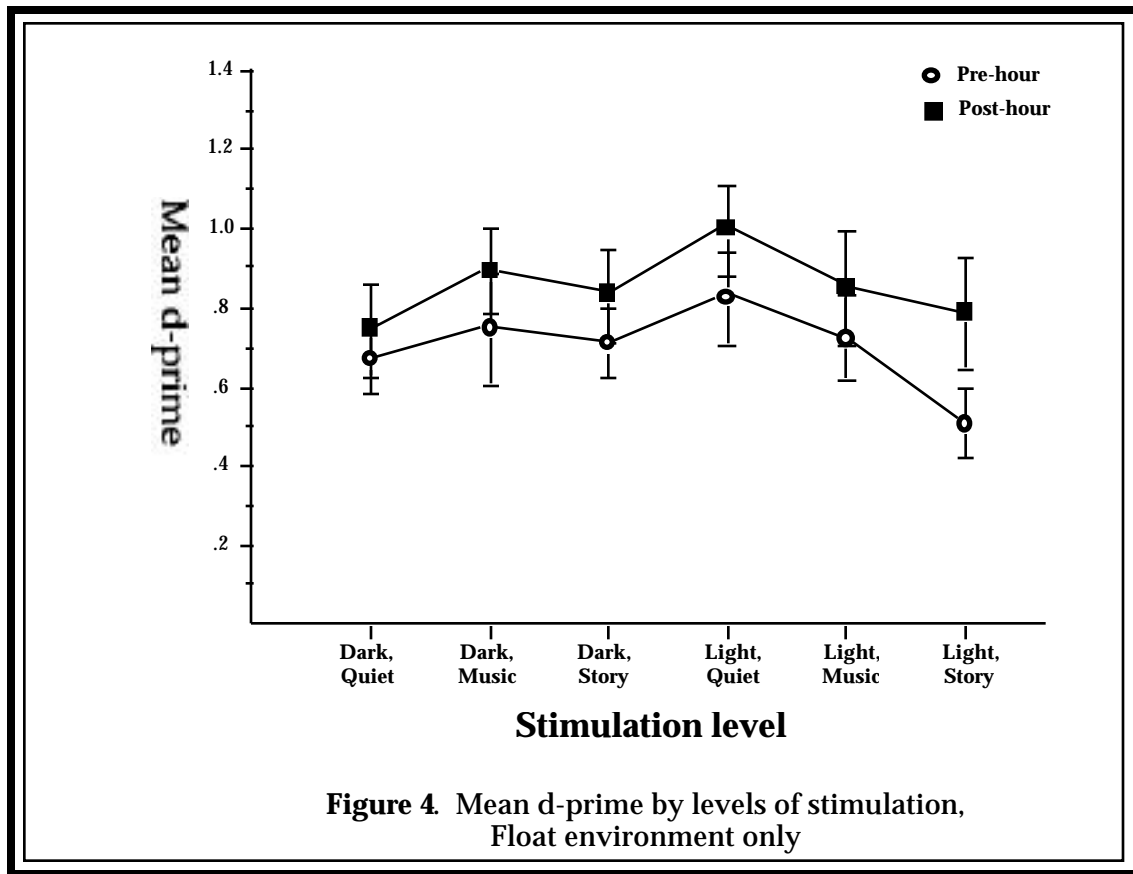


Figure 3. The Experimental Design

## RESULTS

Signal detection performance was expressed in terms of d-prime for all analyses. Despite significant findings in pilot versions, the present experiment only yielded a significant difference between pre- and post-hour d-prime, indicating a learning effect in all conditions. Due to the ceiling effect in the Chamber environment, Figure 4 displays the results for the float participants only. Clearly, the manipulation of light and sound levels had no significant effect upon signal detection performance increases.

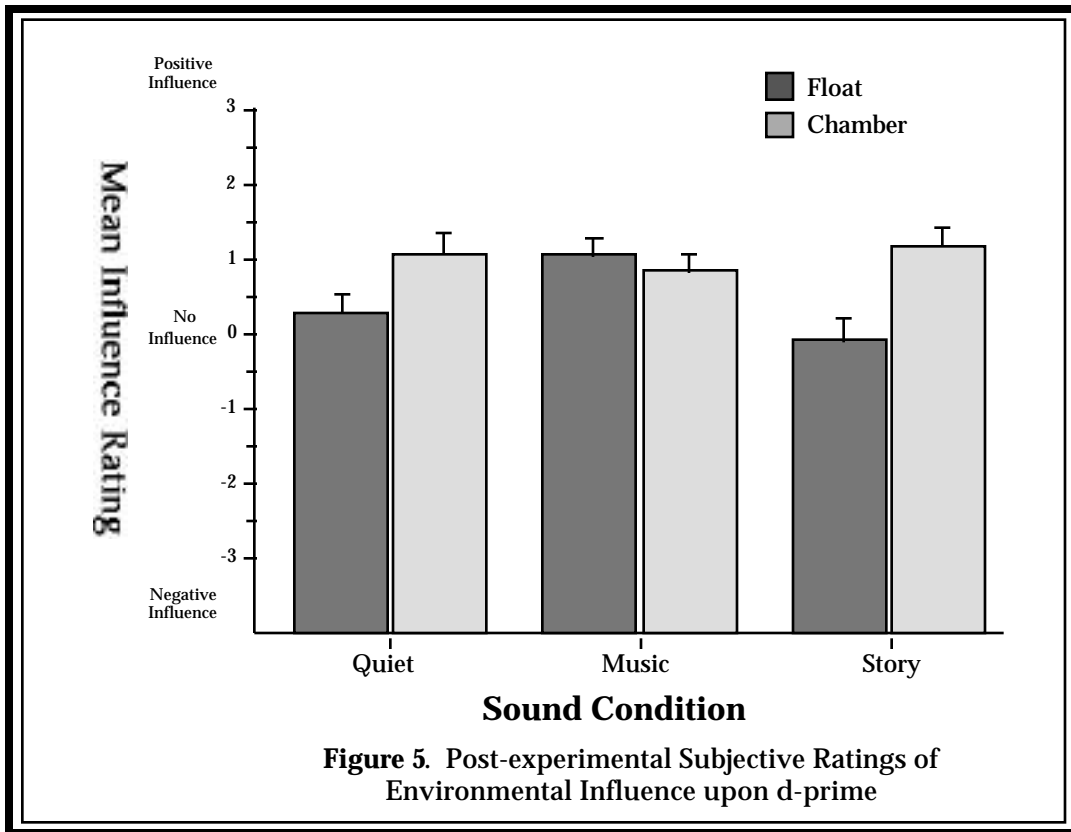


Analysis of the post-experimental questionnaire responses yielded three interesting results:

1) Subjective ratings of the influence exerted by the physical environments differed by levels of the Environment and Sound manipulations. That is, in the Float environment, those in the Quiet and Story sound conditions rated environmental influence as significantly less positive than those in the Music condition, whereas there was no influence of Sound condition upon Chamber subjects' ratings of environmental influence (see Figure 5).

2) The Environment and Light manipulations were also interactive in their effects upon environmental influence ratings. Those in the Dark Chamber condition rated the environmental influence as significantly more positive than did those in the Light Chamber condition, whereas Light level did not influence Float subjects' ratings of environmental influence, which remained at the "slight" level expressed by those in the Light Chamber condition.

3) On average, all participants felt as though they were guessing approximately the same percentage of the time for each signal detection session, showing no awareness of the pre- to post-hour decrease in errors exhibited by nearly all groups.



### CONCLUSIONS

- The level of stimulation experienced for an hour after a first try at an auditory signal detection task does not improve performance upon subsequent tasks any more than can be explained by simple learning.
- Sound level influences Float participants' estimation of the influence of the environment whereas Light level does not. Conversely, Sound level does not influence Chamber participants' estimations whereas Light level does. These results suggest the differential importance placed upon various sources of stimulation by participants in the two primary REST environments.
- Participants' perception of their performance (as measured by how much they thought they were guessing during the first and second sessions) are inconsistent with actual performance improvements. This suggests an implicit improvement in performance of which the participants were not subjectively aware.