The Multisensory Benefit of Informative Sound in Visual Task Performance

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Abstract Content: Auditory alarms are relied upon to provide cues in industries with high-risk, multisensory performance tasks such as those utilized in health care environments. When simultaneous sounds enter the auditory field, this increases the difficulty of differentiating, interpreting, and responding to those sounds in the most effective manner. Without being able to respond to such alarms with precision, professionals can fail to execute their duties. In addition, those patients or individuals who are dependent on the task at hand can reap serious ramifications which include, but are not limited to, injury, distress, or even death. The purpose of this study is to examine the ways in which the performance of multiple activities that require both auditory and visual attention can be maximized in terms of efficiency, accuracy, and timeliness. This study shows how relevant sensory stimuli, containing pertinent information, influences crossmodal task performance. Using an anechoic chamber, anesthesiology residents (N = 25) were tested in a simulated multi-task setting, including a patient monitoring primary task with alarmed events, and a visual vigilance task. Throughout the study, participants were exposed to background noises and sounds relevant to anesthesiology settings, as well as to background music, during the assigned tasks. During visual vigilance tasks, observable LED signals served as distractions during simulated emergency situations that required immediate participant responses. Alarm type was varied between conventional (following the International Electrotechnical Commission Standard 60601-1-8) and novel auditory icon alarms, which provided additional information about the event causing the alarm. This study found that background music was associated with reduced accuracy of responses and increased errors in task performance. Additionally, the type of alarm utilized during medical-related tasks impacted the participants' ability to complete demanding tasks with precision. Novel alarms demonstrated a 37% increase in vigilance accuracy and 160 ms reduction in response time when compared with traditional alarms. Such findings imply that the use of auditory icon alarms can provide multisensory benefits, enabling clinicians to distinguish between concurrent sounds and noises when under high amounts of pressure with potentially serious ramifications. Because the novel auditory icon provided more information about the type of simulated emergency, the findings suggest attention can safely spared and divided across cognitively demanding tasks. The results of this study recommend that external distractions like background music should not be used during such tasks when alarm recognition is required. These findings call for reconsideration of the conventional alarm and supported the novel auditory icon alarm design, especially in high-stakes environments, in order to improve patient safety and outcomes.