

# Enhancing the Warehouse Soundscape with Music: Effects on Performance, Affect and Psychophysiological Responses

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| 論 文 名  | Enhancing the Warehouse Soundscape with Music: Effects on Performance, Affect and Psychophysiological Responses<br>(音楽による倉庫のサウンドスケープの向上：パフォーマンス、感情、精神生理学的反応への影響) |           |     |                  |
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### 論 文 審 査 の 結 果 の 要 旨

The aim of the dissertation was to provide a structured and comprehensive approach to determine the impacts of music on warehouse order picking. Six studies were performed. Studies 1 and 2 each consisted of a questionnaire. Study 1 described the (sub)tasks involved in order picking and the picker's mental and physical demands, while Study 2 focused on the sound environment of order pickers. It revealed that order picking is typically done in the presence of a combination of continuous and intermittent noise sources with varying sound pressure levels (SPLs). Studies 3 and 4 consisted of a visual search experiment, simulating how adding music and nature sounds to the picker's typical sound environment would contribute to task performance and various physiological and psychological metrics. Results showed that adding music pieces to the typical picker sound environment was more effective than adding nature sounds in improving perceived groove, and mood and arousal, without posing detrimental effects on the visual search task performance. However, especially as the music's SPL increased, the perceived clarity of truck beeps was reduced, which could pose a safety risk. Therefore, to achieve optimal balance between productivity, comfort and safety, the level difference between noise and background music should not exceed 5 dB (A). Study 5 simulated the entire order picking process, demonstrating that music produced no significant impairment in picking speed and accuracy. While continuous music playback resulted in higher valence and likeability, it was suggested that playing music during specific periods of the workday shift could reduce the physical demand and effort dimensions of workload. Study 6 validated the laboratory findings in a real-world occupational setting (i.e., a distribution center); interviews with warehouse employees suggested that music could improve valence and arousal, reduce fatigue, and boost performance.

Together, the findings imply that music can be a valuable tool to foster a human-centric work environment, such as the order picking environment, reinforcing both employee well-being and productivity goals. Based on the obtained variety and the amount of data, as well as the practical applicability of the research results in the field of music psychology and ergonomics in general, the committee members concluded that Ms. Clarissa Montecalto PESIGAN's thesis is of a solid academic level, worthy of the Degree of Doctor of Engineering.