

INPLASY2024110115
doi: 10.37766/inplasy2024.11.0115
Received: 27 November 2024
Published: 27 November 2024

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The impact of emotional face distractors on working memory performance: A meta-analysis of behavioral studies

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ADMINISTRATIVE INFORMATION

Support - None.
Review Stage at time of this submission - Data analysis.
Conflicts of interest - None declared.
INPLASY registration number: INPLASY2024110115

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 27 November 2024 and was last updated on 27 November 2024.

INTRODUCTION

Review question / Objective This study will investigate the impact of emotional face distractors on working memory performance in healthy individuals. The outcome measures will include working memory performance precision (e.g., accuracy, K value, d') and working memory reaction time, assessed using a within-subject design.

Condition being studied Working memory is a vital cognitive function that involves temporarily storing and manipulating information, essential for tasks such as problem-solving, decision-making, and learning. Emotional face distractors, which include facial expressions conveying emotions like happiness, anger, or fear, can capture attention due to their emotional salience. This attention capture may interfere with or modulate working memory processes. By synthesizing evidence from behavioral studies, this meta-analysis aims to understand the overall effect of these distractors

on working memory performance and identify moderators that might influence this relationship.

METHODS

Search strategy (("Face"[Mesh] OR (((Face[Title/Abstract] OR (Faces[Title/Abstract]) OR (Facial[Title/Abstract]) OR (Expression[Title/Abstract]) OR (Expressions[Title/Abstract])) AND (((((((((((Distractor[Title/Abstract] OR (Distractors[Title/Abstract]) OR (Distraction[Title/Abstract]) OR (Distractions[Title/Abstract]) OR (Interference[Title/Abstract]) OR (Interferences[Title/Abstract]) OR (Disturbance[Title/Abstract]) OR (Disturbances[Title/Abstract]) OR (Disruption[Title/Abstract]) OR (Disruptions[Title/Abstract]) OR (Irrelevant[Title/Abstract]) OR (Unrelated[Title/Abstract])) AND ("Memory, Short-Term"[Mesh] OR (((((((((((Memory, Short-Term[Title/Abstract] OR (Memories, Short-Term[Title/Abstract]) OR (Memory, Short Term[Title/Abstract]) OR (Short-Term Memories[Title/Abstract]) OR (Short-Term

Memory[Title/Abstract])) OR (Memory, Immediate[Title/Abstract])) OR (Immediate Memories[Title/Abstract])) OR (Immediate Memory[Title/Abstract])) OR (Memories, Immediate[Title/Abstract])) OR (Memory, Shortterm[Title/Abstract])) OR (Memories, Shortterm[Title/Abstract])) OR (Shortterm Memories[Title/Abstract])) OR (Shortterm Memory[Title/Abstract])) OR (Working Memory[Title/Abstract])) OR (Working Memories[Title/Abstract])) OR (Immediate Recall[Title/Abstract])) OR (Immediate Recalls[Title/Abstract])) OR (Recall, Immediate[Title/Abstract])) OR (Recalls, Immediate[Title/Abstract]))).

Participant or population The review will include healthy individuals, with no restrictions on age.

Intervention Not applicable.

Comparator Not applicable.

Study designs to be included Within-subject design.

Eligibility criteria

1. Participants: Healthy individuals, no age restrictions
2. Study design: Within-subject design: emotional face distractors (task-irrelevant) compared to non-emotional distractors/no distractors in working memory tasks
3. Task type: Laboratory-based behavioral tasks assessing working memory performance (e.g., n-back, change detection, delayed match-to-sample)
4. Outcome measures: Quantitative measures, including performance precision (e.g., accuracy, K value, d') and/or reaction time
5. Sample size: At least ten participants per group
6. Time frame: Published within the last 20 years
7. Language: Published in English.

Information sources The review will utilize electronic databases, including PubMed, Web of Science, MEDLINE (Ovid), APA PsycInfo/ PsycArticles, Scopus, ProQuest, and Embase. Additionally, reference lists of relevant studies will be checked for further literature.

Main outcome(s) The main outcomes include working memory performance measures:
Precision measures: e.g., accuracy (the proportion of correct responses), K value (an estimate of memory capacity), and/or d' (signal detection sensitivity).
Reaction time: e.g., the time taken to respond during working memory tasks, indicating processing speed and efficiency.

Quality assessment / Risk of bias analysis The quality and risk of bias in the included studies will be assessed using the Risk of Bias Assessment Tool for Nonrandomized Studies of Interventions (RoBANS 2).

Strategy of data synthesis Meta-analysis model: A random-effects model will be used to account for variability across studies, given the expected heterogeneity in effect sizes. Hedges' g will be calculated as the effect size measure to compare working memory performance under conditions with and without emotional face distractors.

Exploring statistical heterogeneity: Heterogeneity will be assessed using the I^2 statistic and prediction interval. The I^2 statistic represents the proportion of total variance attributable to true heterogeneity, while the prediction interval estimates the range in which the effect size of a future study is likely to fall, reflecting the dispersion in effect sizes across studies.

Subgroup analyses: To explore potential moderators, subgroup analyses will be conducted based on factors such as emotional type (e.g., positive vs. negative; angry vs. fearful), reference condition (e.g., neutral faces vs. geometric shapes and no distractors), participant characteristics (e.g., age), and the impact of the ceiling effect.

Software: All analyses will be performed using statistical software such as Stata and Comprehensive Meta Analysis.

Subgroup analysis Emotional face type: The impact of positive emotional face distractors (e.g., happy faces) will be compared to that of negative emotional face distractors (e.g., angry or fearful faces).

Reference condition: Studies will be grouped based on the reference condition used: emotional face distractors versus neutral face distractors, or emotional face distractors versus geometric shapes and no distractors.

Participant characteristics: The analysis will examine age-related effects (e.g., children, young adults, older adults).

Ceiling effects: Studies will be grouped according to the presence or absence of ceiling effects in working memory performance.

A random-effects model will be applied to each subgroup separately to estimate effect sizes and investigate potential differences between groups.

Sensitivity analysis Sensitivity analyses will be conducted using a leave-one-out method, where each study is sequentially removed to assess the impact on effect estimates.

Language restriction English.

Country(ies) involved Chenxiao Wu, China, University of Jyväskylä, Finland; Chenyuan Zhang, China, Dalian University of Technology, China; Xueqiao Li, China, University of Jyväskylä, Finland; Piia Astikainen, Finland, University of Jyväskylä, Finland.

Keywords emotion; face distractors; facial expressions; working memory.

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