The impact of background music on cognitive task performance: a systematic review
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Review question

Primary review question:
What is the impact of background music on the individual performance in different cognitive tasks involved in mental work?
Secondary review questions:

Which individual factor (e.g., personality, musical aptitude/experiences, personal music preferences) affect the impact of background music on cognitive task performance?

Which musical factors (e.g., genre, emotional character, loudness) affect the impact of background music on cognitive task performance?

Searches

Due to the vast number of terms related to cognitive tasks, a preliminary manual search was conducted to identify relevant articles that could be used to optimise the search strategy. This search was done through the analysis of existing literature reviews and meta-analyses and searches of relevant journal. We identified a total of 67 relevant articles. These articles were then used as the gold standard to evaluate the optimal search strategy, i.e., with that led to the identification of the highest number of relevant articles and the minimum number of total hits.

The optimal search strategy identified through this method was "music AND cogniti* OR task". Using this strategy, we searched for journal articles published in English from 1960 until the present in the following electronic databases:

• PubMed

• PsycINFO

• Scopus

• Web of Science

• Google Scholar

Articles in our initial list of relevant sources that were not located by the search strategy were added to the search list manually. Other articles found in relevant peer-review journals after the searches were conducted were also added.

Types of study to be included

Inclusion criteria:

• Any type of study published as an academic journal, written in English and reporting primary research findings.

Exclusion criteria:

• Studies published in any language other than English;

• Articles that do not report primary findings such as systematic reviews, literature reviews, meta analyses, book chapters, opinion articles, commentaries, etc.;

• Studies published only as abstracts, extended abstract and/or not accessible.

Condition or domain being studied
Performance on cognitive tasks (e.g., reading comprehension, writing fluency, memory performance) in the presence of background music.

Participants/population
Inclusion criteria:

• Human participants, aged 16+ years old.

Exclusion criteria:

• Abnormal hearing;

• Special populations with particular disabilities/conditions that systematically affect cognitive performance (e.g., people with dementia, Parkinson's, Autism Spectrum Disorder, etc.)

Intervention(s), exposure(s)
Inclusion criteria:

• Studies where background music is being played in the background whilst performing a cognitive task;

• All types of music;

Exclusion criteria:

• Studies where music is not being listened to during the execution of a cognitive task (e.g., music is listened to before the task);

• Studies that include stimuli labelled as music but are not actual music pieces (e.g., binaural beats, isolated chords, dyads, white/pink/brown noises, only environmental sounds);

• Studies that involve music making.

Comparator(s)/control

Inclusion criteria:

• Studies with at least one control condition consisting of silence or no music being played in the background.

Exclusion criteria:

• Studies without a control group.

Main outcome(s)
Inclusion criteria:

• Any quantitative outcome measure of cognitive performance (e.g., N-back task, Flanker task, Stroop test, Go/NoGo task, reading comprehension, writing fluency, exam performance, etc.);

• Any other measures that assess performance on cognitive tasks that are typically required in office desk jobs, production, or studying (e.g., productivity in factory production lines, divergent/convergent thinking).

Exclusion criteria:

• Cognitive performances that require substantial motor coordination that is routine and/or largely automatic (i.e., actions mastered from practice), e.g., driving, dancing, exercising, surgical procedures;

• Decision making involving moral reasoning/solving moral dilemmas, e.g., the Trolley dilemma;

• Studies of communication/social/interpersonal skills in relation to music, e.g., attention to body language of others under effect of background music, interpretation of facial expression of others under the effect of music, interpersonal/group bonding, controlling of agitated behaviours, etc;

• Musical tasks such as pitch identification, tempo recognition, memory for musical melody, etc;

• Sensorimotor adaptations/skills, e.g., pain tolerance, odour discrimination, time perception;

• Other types of activities that although rely on cognitive skills, are not typical of a regular desk job or studying, e.g., gambling, remembering film scenes/events, remembering advertisements, autobiographical memory, purchasing behaviours, affective impressions, sleep quality, psychological wellbeing, eating behaviours, and alcohol consumption.

* Measures of effect

Measures of effect will be determined by articles included in the review. This information will also be retrieved during data extraction.

Additional outcome(s)
None

* Measures of effect

Not applicable.

Data extraction (selection and coding)
The PRISMA flow-chart will be used to track the number of articles initially identified, screened, checked against the eligibility criteria, and the final number included in the review. The justifications for excluding any articles from the review will also be recorded in both the flow-chart and an Excel spreadsheet.

Titles and/or abstracts obtained from online databases and manually searched articles will be screened by two independent reviewers to identify studies that potentially meet the eligibility criteria outlined. Conflicts will be resolved by a third, independent reviewer. The full text of selected studies will be retrieved and assessed against all the criteria outlined by two independent reviewers. Any discrepancies in decision will be resolved by a third independent reviewer. Details of the decision-making process and disagreements will be recorded in the same Excel spreadsheet for future references.

Tabulated displays will be used to record detailed and relevant data from suitable articles: year of publication, author(s), title, study design, participant characteristics (sample size, age, sex, musical background, education level), intervention (types of music, number of comparison groups, types of comparisons) , and outcomes (tools, nature of tasks, trend of results). Data to be extracted may be adjusted based on data available. Double extraction will be utilised to ensure quality control. This will apply to either all studies (if less than 20) or 25% of the studies (with a minimum of 20). Discrepancies between extractors will be resolved through discussion among the wider research team.

Risk of bias (quality) assessment
The Mixed Methods Appraisal Tool (MMAT; version 2018) will be utilised to assess risk of bias in included articles, and the relevant sections of the tool used where applicable to each source. Items not relevant to the topic of the review (e.g., double-blinding) will be removed. All articles included in the review will be assessed

by two independent reviewers against relevant domains in the MMAT. Discrepancies in judgement will be resolved by a third reviewer.

Tabulated displays will be used to record information relevant for quality assessment of the sources. Criteria of the sensitivity analysis will be determined when specific issues are identified during the review process.

Strategy for data synthesis
Critical analysis will be conducted on all relevant studies based on the above quality assessment and reported in the format of a systematic narrative synthesis. Texts and tables will be utilised to summarise and explain characteristics and trends from reviewed studies, including population characteristics, characteristics of IVs, and outcomes. Studies with secondary outcome(s) measures will also be compared. Due to the variations of methodology and outcomes being assessed in this review, a meta-analysis is not anticipated.

Analysis of subgroups or subsets
Musical responses can differ between individual with different characteristics, such as, personality, musical background, cognitive competency (i.e. IQ/working memory capacity), etc. Different types of music (genres, emotional character) can also impact listeners differently. Therefore, subgroup analysis will be implemented to detect possible sources of heterogeneity or covariates among reported results. Analyses will be based on the following domains:

• Individual characteristics (e.g., musical preference, musical aptitude, level of IQ, personality);

• Music characteristics (familiar/unfamiliar, genre, emotional character).

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Type and method of review
Narrative synthesis, Systematic review

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Conflicts of interest
None known

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English

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England

Stage of review

Review Ongoing

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Subject indexing assigned by CRD

Subject index terms
Cognition; Humans; Music; Task Performance and Analysis

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18 September 2020

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01 September 2020

Details of any existing review of the same topic by the same authors

Stage of review at time of this submission

Stage	Started	Completed
Preliminary searches	Yes	Yes
Piloting of the study selection process	Yes	No
Formal screening of search results against eligibility criteria	No	No
Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

The record owner confirms that the information they have supplied for this submission is accurate and complete and they understand that deliberate provision of inaccurate information or omission of data may be construed as scientific misconduct.

The record owner confirms that they will update the status of the review when it is completed and will add publication details in due course.

Versions
18 September 2020