Effects of listening to music on headphones upon reaction to a range of traffic sounds

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Introduction

Recently more and more people are listening to music through head-phones when in traffic. It can be assumed that this behaviour causes accidents because the person reacts to traffic sounds either too late or not at all. There is little empirical evidence on this.

- experiment examined how reaction times to traffic noises change when people listen to music through headphones
- participants were exposed to eight different traffic sounds in sequence which they were required to react to by pushing a button
- conditions :

no music, soft (low volume) music or loud (high volume) music

through on-ear or in-ear headphones

Pre-study and Participants

- pre-study to determine the volume of the music with 19 pedestrians
    - were given an MP3 player and asked to adjust the volume so that it was comfortable for them (on-ear and in-ear headphones)
    - we used the interquartile range to determine the volumes for the soft and loud conditions

- a sound level meter was held directly against the headphones for 30 seconds
- volume varied depending on the music with a mean volume
    - on-ear: 59 dB(A) for soft condition and 73 dB(A) for loud condition
    - in-ear: 44 dB(A) for soft condition and 64 dB(A) for loud condition
- main experiment: 20 female and 20 male participants aged between 20 and 48 (mean 27.7)
- most participants between 21 and 31 years

Stimuli

- eight traffic sounds of varying loudness
  - a tram bell with 84 dB(A),
  - a bicycle bell with 65 dB(A), 
  - an approaching tram with 81 dB(A),
  - a passing car with 74 dB(A),
  - a lorry starting up with 58 dB(A), 
  - a passing car with a long horn honk with 70 dB(A),
  - a siren with 81 dB(A), 
  - an announcement “Train approaching Platform 11. Please be aware of train approaching” at a central station with 76 dB(A).

Method

- study in a laboratory of the IAG
- traffic sounds played over loudspeakers – in random order every 15 seconds
- participants were required to react by press-ing the space bar on a computer keyboard as quickly as possible to the sounds (stimuli)/ 40 reactions (8 sounds times 5 conditions)

participant during the experiment

- sound of real traffic was simulated in the background: traffic noise was recorded prior to the study and was played over loudspeakers with an average volume of 65 dB(A)
- repeated measures were done with permutation of the sequence of the conditions

Results

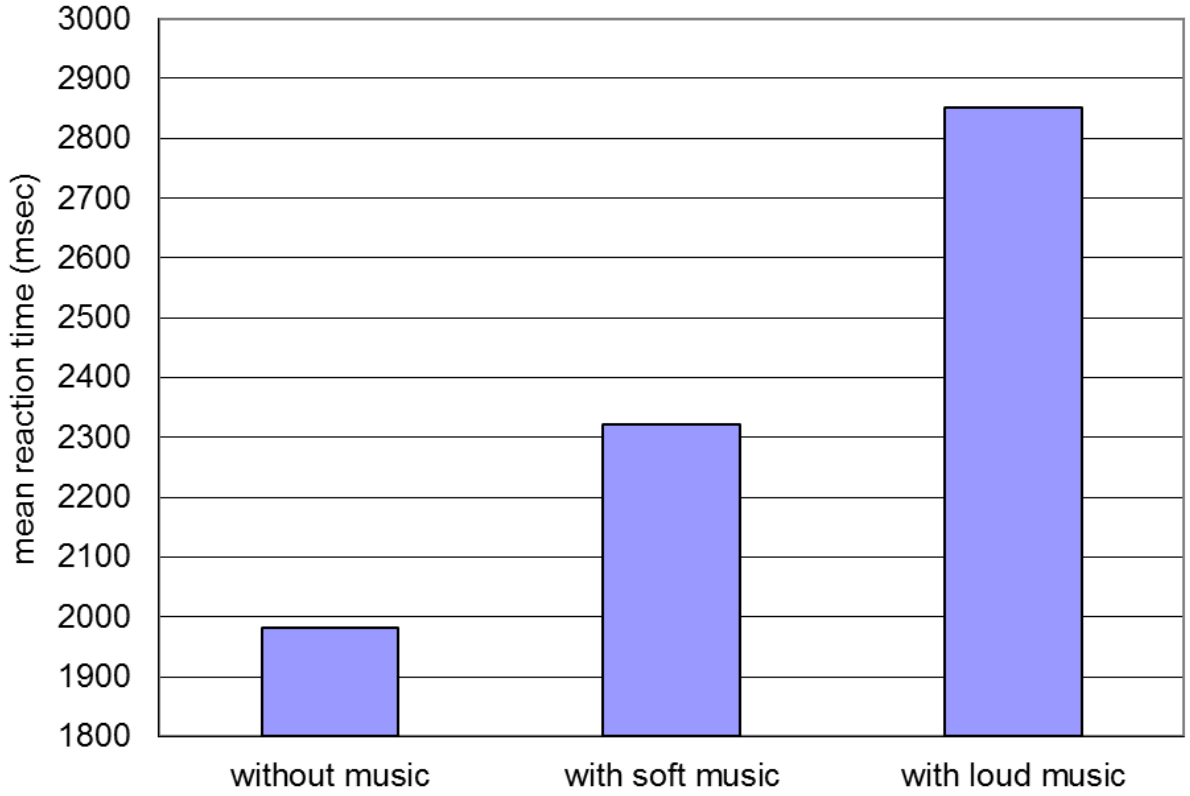
no reaction to the stimuli

- 5 times in the “no music” and
- 5 times in the “soft music” conditions

(the lorry starting up was not heard a total of 7 times; the car horn, the train station announcement and the approaching tram were not heard once each)

- 30 times in the “loud music” condition

(starting lorry 13x, bicycle bell 12x, tram 3x, siren 1x, and train station announcement 1x)

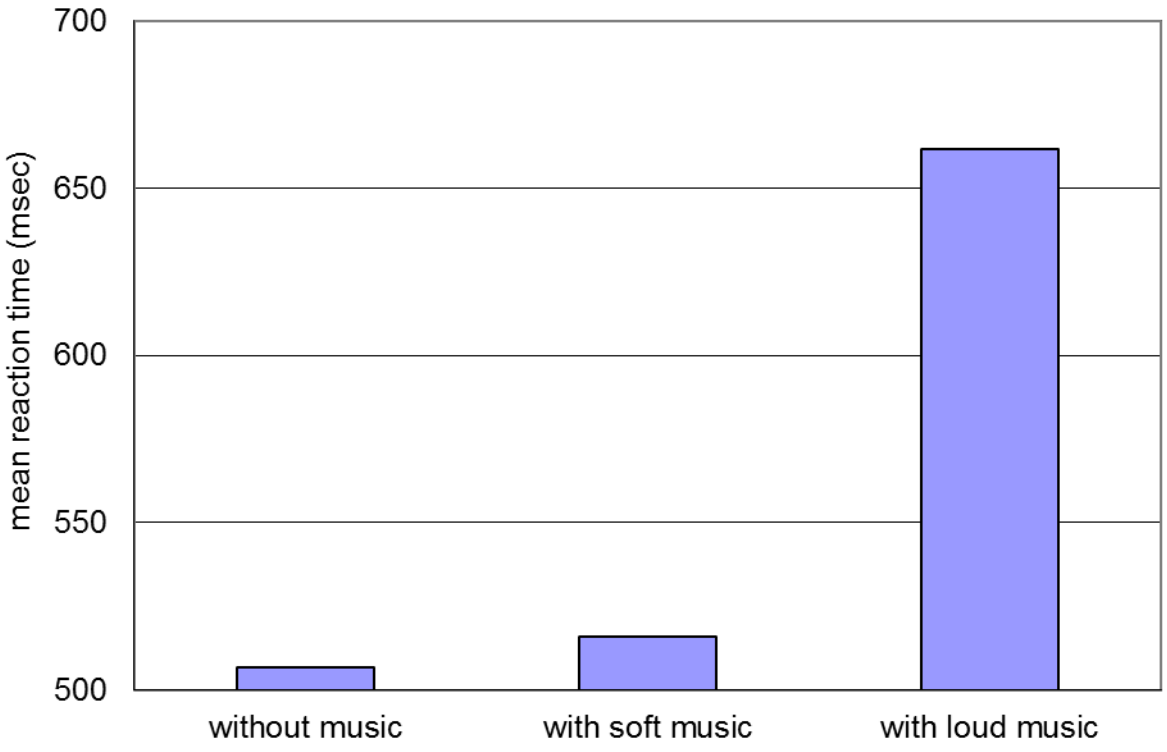


- RT without music 1,981 msec
- RT with soft music 2,323 msec (compared to control 17 %)
- RT with loud music 2,852 msec (compared to control 44 %)

mean reaction time across all traffic sounds for the three experimental conditions “without music”, “with soft music” and “with loud music”

significant RT increase (F(2.37) +7.9; $p < 0.001$)

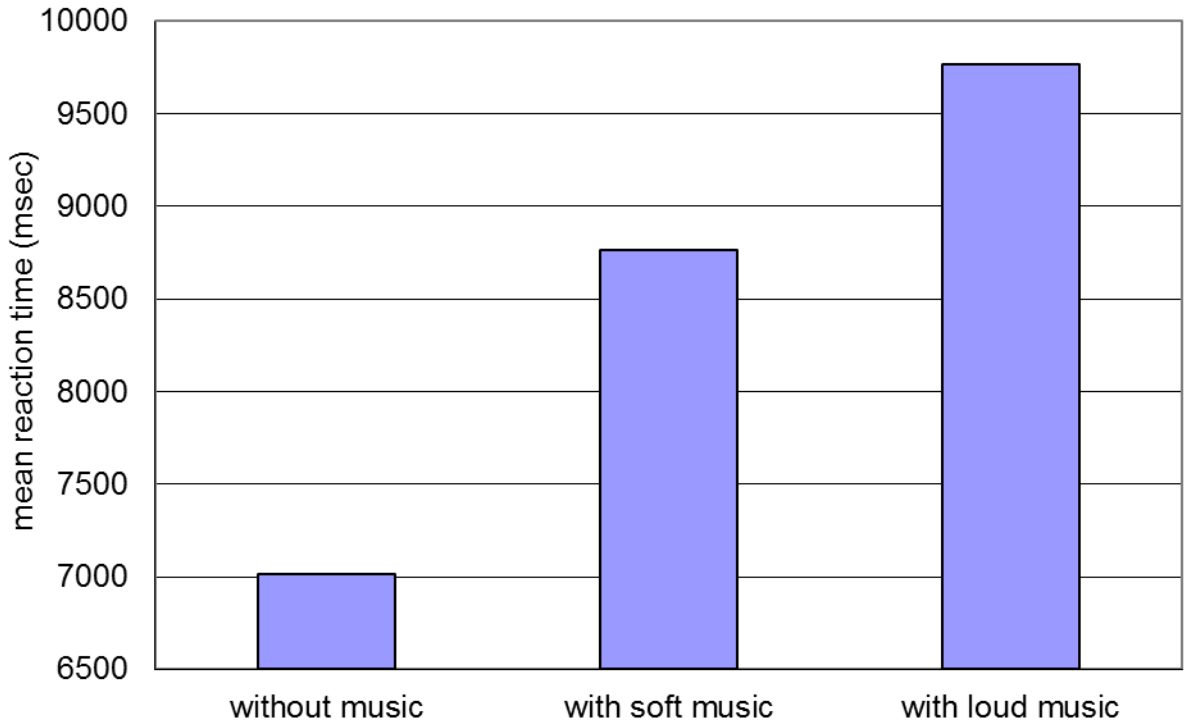
Results: Siren



- RT without music 507 msec
- RT with soft music 516 msec (compared to control 2 %)
- RT with loud music 662 msec (compared to control 30 %)

significant RT increase ($F(2.37) = 11.6$; $p < 0.001$)

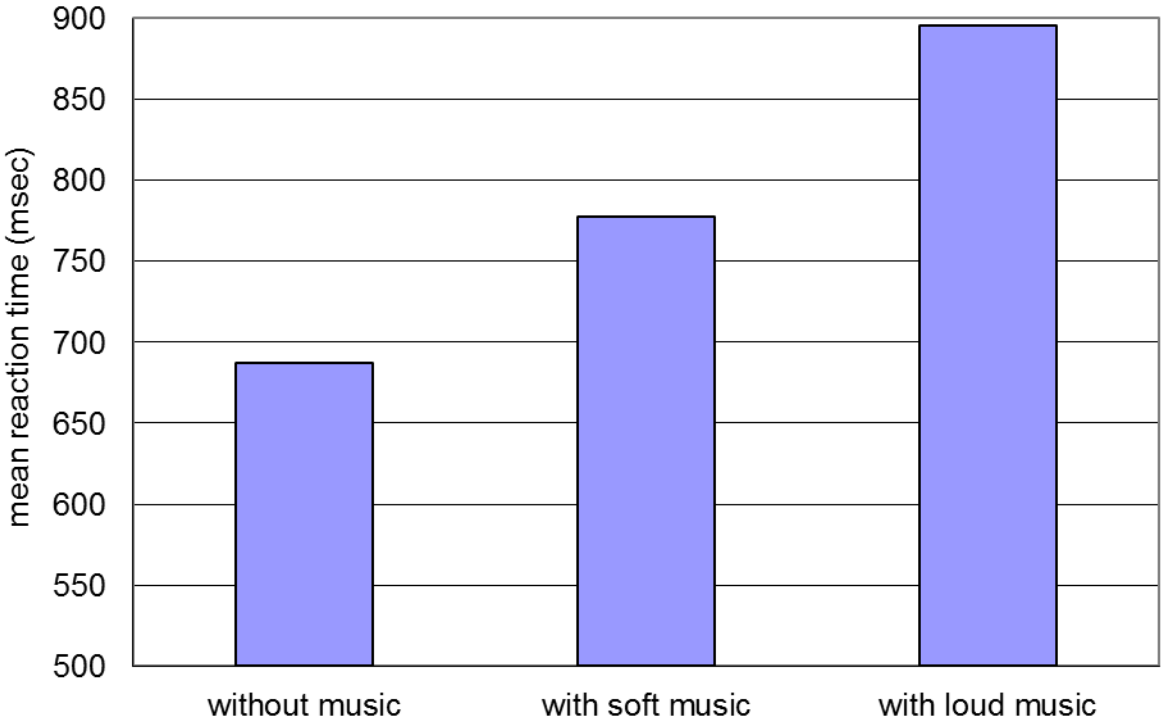
Results: Lorry starting up



- RT without music 7,012 msec
- RT with soft music 8,765 msec (compared to control 25 %)
- RT with loud music 9,768 msec (compared to control almost 40%)

significant RT increase ($F(2.37) = 3.6$; $p < 0.05$)

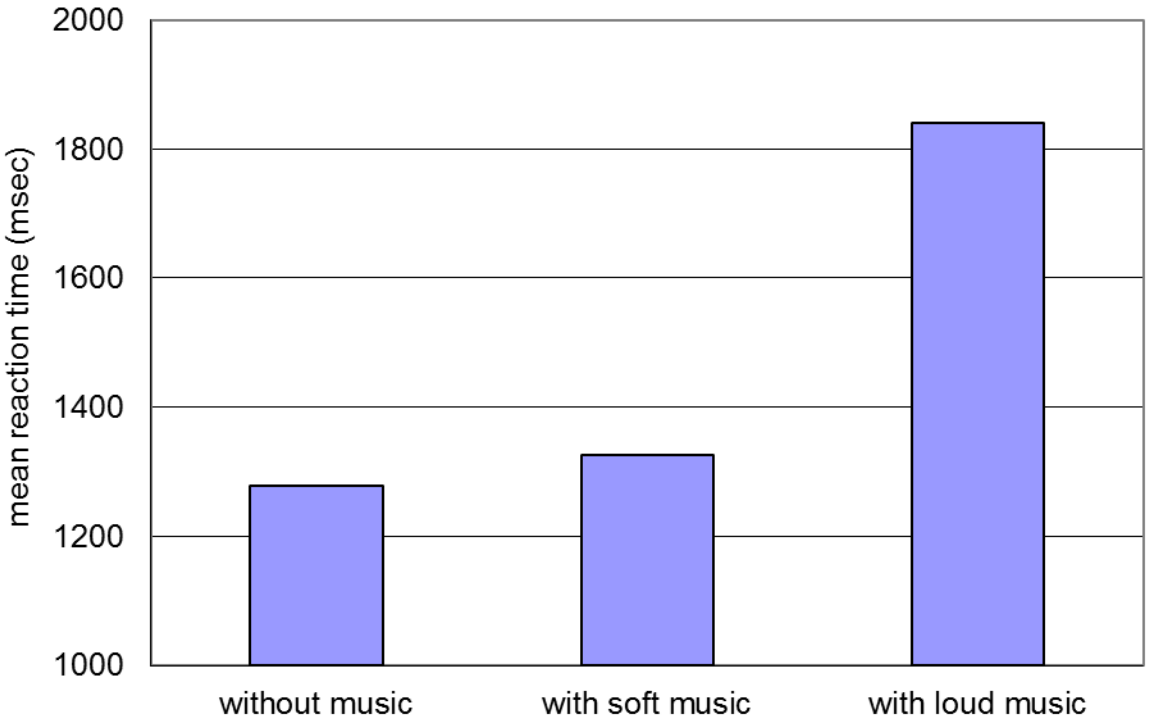
Results: Tram bell



- RT without headphones 688 msec
- RT with soft music 777 msec (compared to control almost 15 %)
- RT with loud music 968 msec (compared to control 40 %)

significant RT increase ($F(2.37) = 13.5$; $p < 0.001$)

Results: Approaching tram



- RT without music 1,277 msec
- RT with soft music 1,325 msec (compared to control 4 %)
- RT with loud music 1,841 msec (compared to control more than 40 %)

significant RT increase ($F(2.37) = 6.0$; $p < 0.01$).

- listening to music through headphones delays reaction times to traffic sounds and in some cases the sounds are not heard at all
- participants react very quickly to a loud pulsing sound such as a siren but they react slower to a softer sound such as a lorry starting
- RT to all sounds, however, increases when listening to music through headphones

- degree of this increase for the eight sounds used in the study was between 2% and 390%
- even with soft music there were increases in reaction times of more than 50%
- RT in real traffic would probably be even longer or sounds would be missed more often because in this experiment the participants were instructed to concentrate on the traffic sounds

- two causes for increased risk and/or reaction times due to music (Lichenstein et al., 2012):
  - traffic noises are masked: Being isolated from the environment due to headphones means that certain sounds cannot be perceived.
  - distraction: Allocating cognitive resources to various stimuli takes away from the ability to pay attention to external stimuli.

Take-home message

Take care without headphones.

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