

# Studying with Learners' Own Music: Preliminary Findings on Concentration and Task Load

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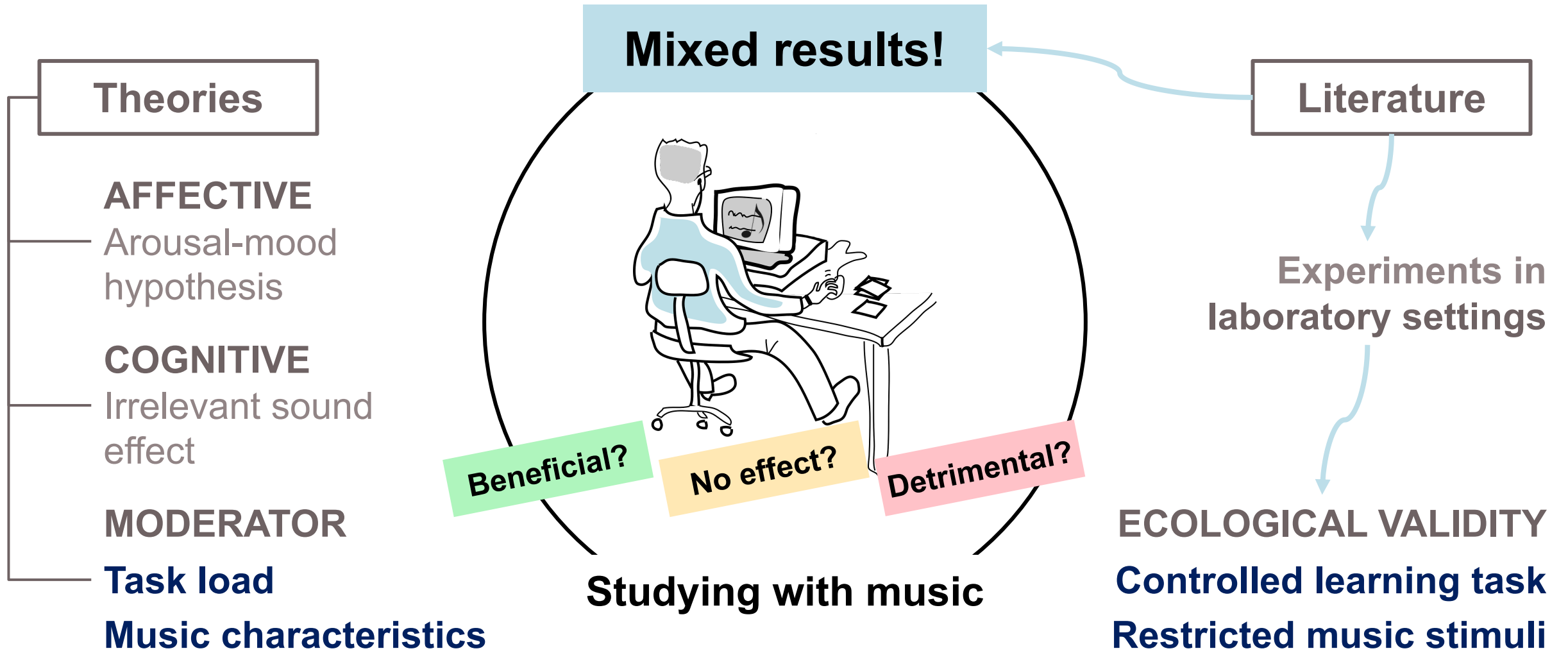


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# Background



# Research Questions

## Laboratory studies

Confounded by

- **Ecological validity**
- **Restricted music stimuli**

## Current study

**A field experiment**

- in **naturalistic settings**
- with **diverse, authentic music**



**RQ1:** Would the **effect of background music** on learning vary across levels of **task load**?

**RQ2:** Which **types of music** would learners **prefer** under high versus low **task load**?



# Methods

## Pop-up surveys

**A field experiment**

- in naturalistic settings
- with diverse, authentic music

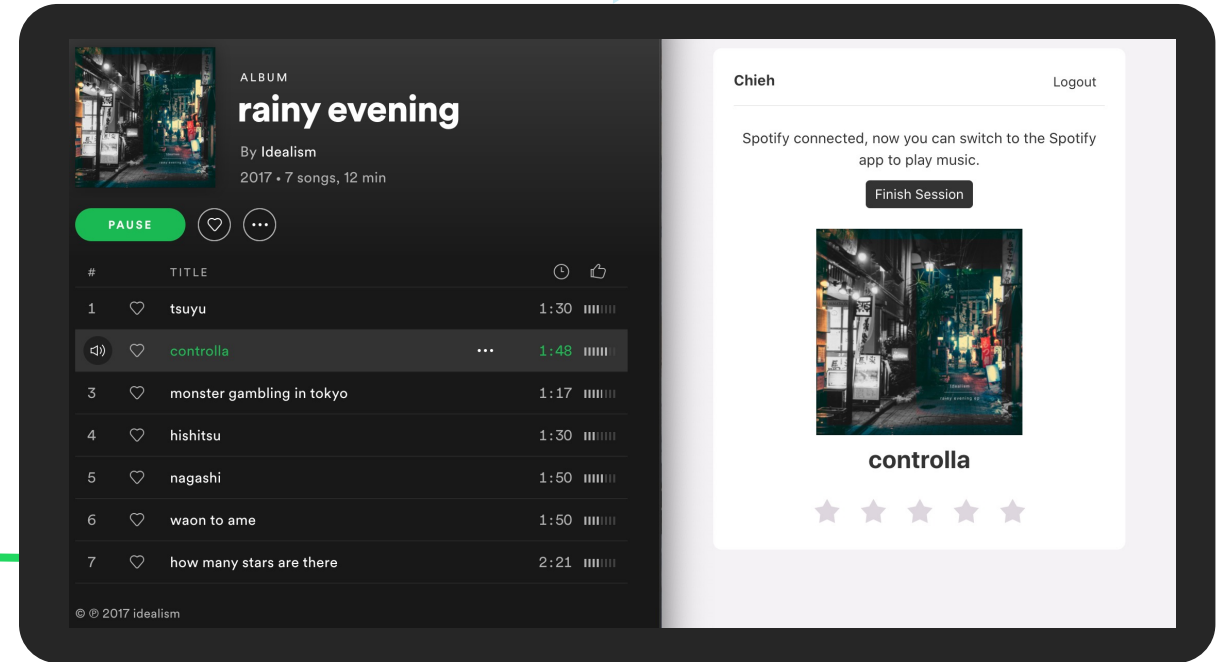
Concentration

Task load

Learners' own playlist

Music listening history

Music signal processing



# Methods

## Pop-up Surveys

### Task load

Tap here to briefly describe your learning/working task.

How mentally demanding is this task?



How rushed is the pace of this task?

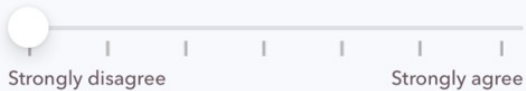


### Concentration

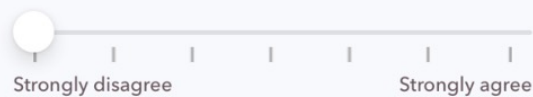
My attention was focused entirely on what I was doing.



I had total concentration.



I was completely focused on the task at hand.



### Perceived learning effect

To what extent did the music affect your performance on this task?



- 1 = Very much distracted me
- 2 = Moderately distracted me
- 3 = Slightly distracted me
- 4 = Had no effect
- 5 = Slightly enhanced my work
- 6 = Moderately enhanced my work
- 7 = Very much enhanced my work



# Data Collected

AUDIO FEATURES	SURVEY	POST-INTERVIEW
Meter	Textual task description	Preferred studying music
Tempo	Task load (NASA-TLX)	Characteristics (why)
Loudness	Mental demand	*High vs. low task load
Instrumentalness	Temporal demand	Music listening experience
Speechiness	Concentration	Perceived effects of music on learning
Acousticness	Flow state scale	*High vs. low task load
Danceability	Perceived learning effect	
Energy	Enhance vs. distract	
Valence		

Descriptive Analytics

Triangulation







# Preliminary Results

481 listening records 13 songs per session (on average)

317 unique pieces

Descriptive statistics of audio features

Feature	Meter	Tempo	Loudness	Instrumentalness	Speechiness	Acousticness	Danceability	Energy	Valence
M	3.798	106.66	-17.340	0.442	0.056	0.664	0.445	0.283	0.265
SD	0.673	32.95	10.134	0.440	0.055	0.344	0.189	0.234	0.227





# Preliminary Results

## Learning Experience Under Varying Task Load

**Table 3: Concentration under varying levels of task load**

Task condition	All sessions ( $N_{LS}=37$ )	Mental demand		Temporal demand	
		Low ( $N_{LS}=12$ )	High ( $N_{LS}=25$ )	Low ( $N_{LS}=8$ )	High ( $N_{LS}=29$ )
M	4.802	5.167	4.627	4.917	4.770
SD	1.104	1.106	1.081	1.551	0.980

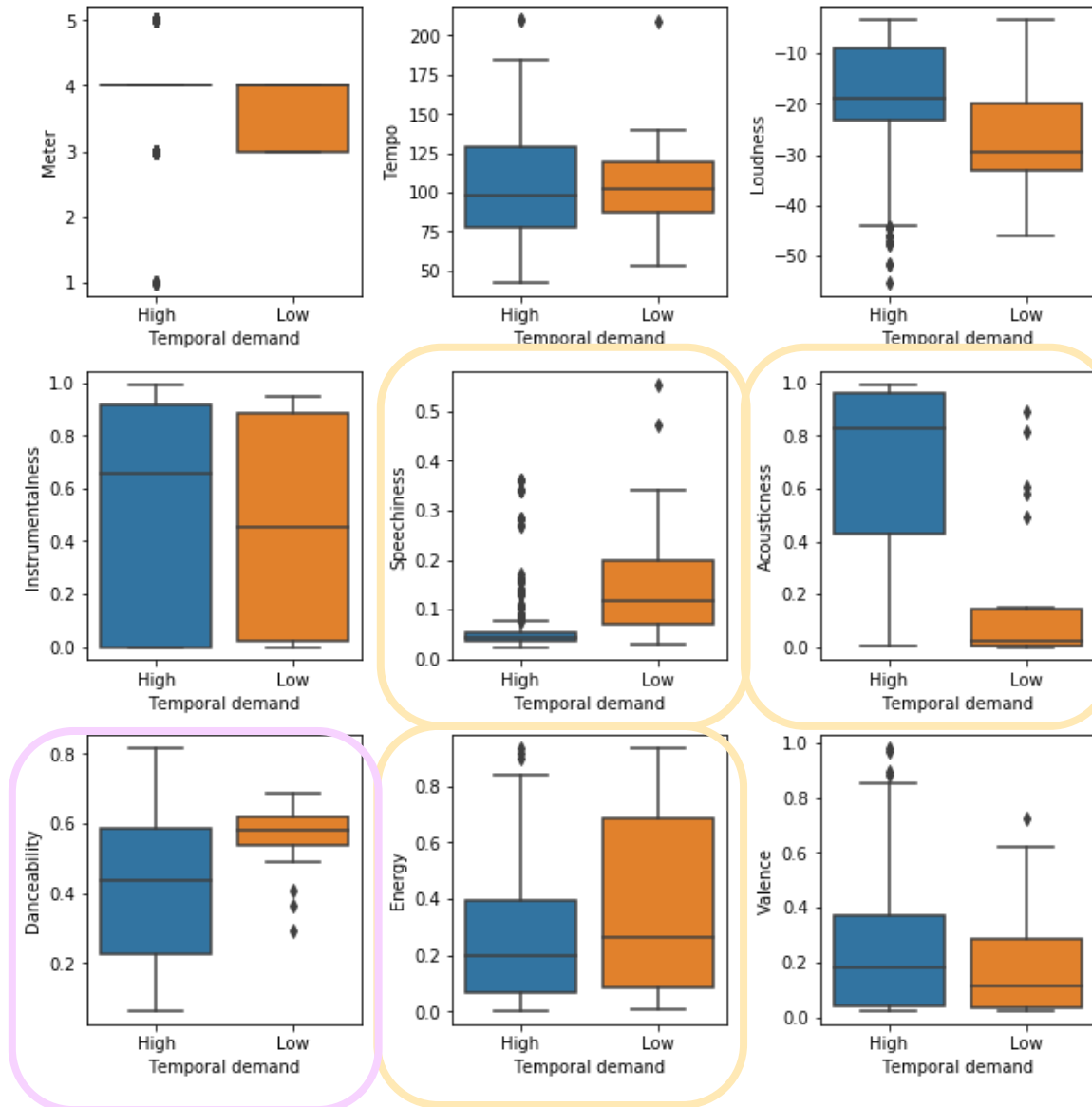
**Table 4: Perceived learning effect (enhance vs. distract) under varying levels of task load**

Task condition	All sessions ( $N_{LS}=37$ )	Mental demand		Temporal demand	
		Low ( $N_{LS}=12$ )	High ( $N_{LS}=25$ )	Low ( $N_{LS}=8$ )	High ( $N_{LS}=29$ )
M	4.864	5.167	4.720	5.000	4.828
SD	1.084	0.835	1.173	0.756	1.167

- Generally reported positive influence of background music on learning
- Beneficial effect of BGM: more apparent under low mental or temporal demand



# Preliminary Results Music Preference Under Varying Task Load



For **temporally demanding** task, participants would prefer music of .....

## low speechiness

- less spoken words
- versus rap music (high speechiness)

“feel annoyed”

## high acousticness

- more acoustic instrument
- versus electronic synthesizer

## low energy

- less energetic

“excited but distracted”

When the learning task was **less urgent**, participants would prefer music of .....

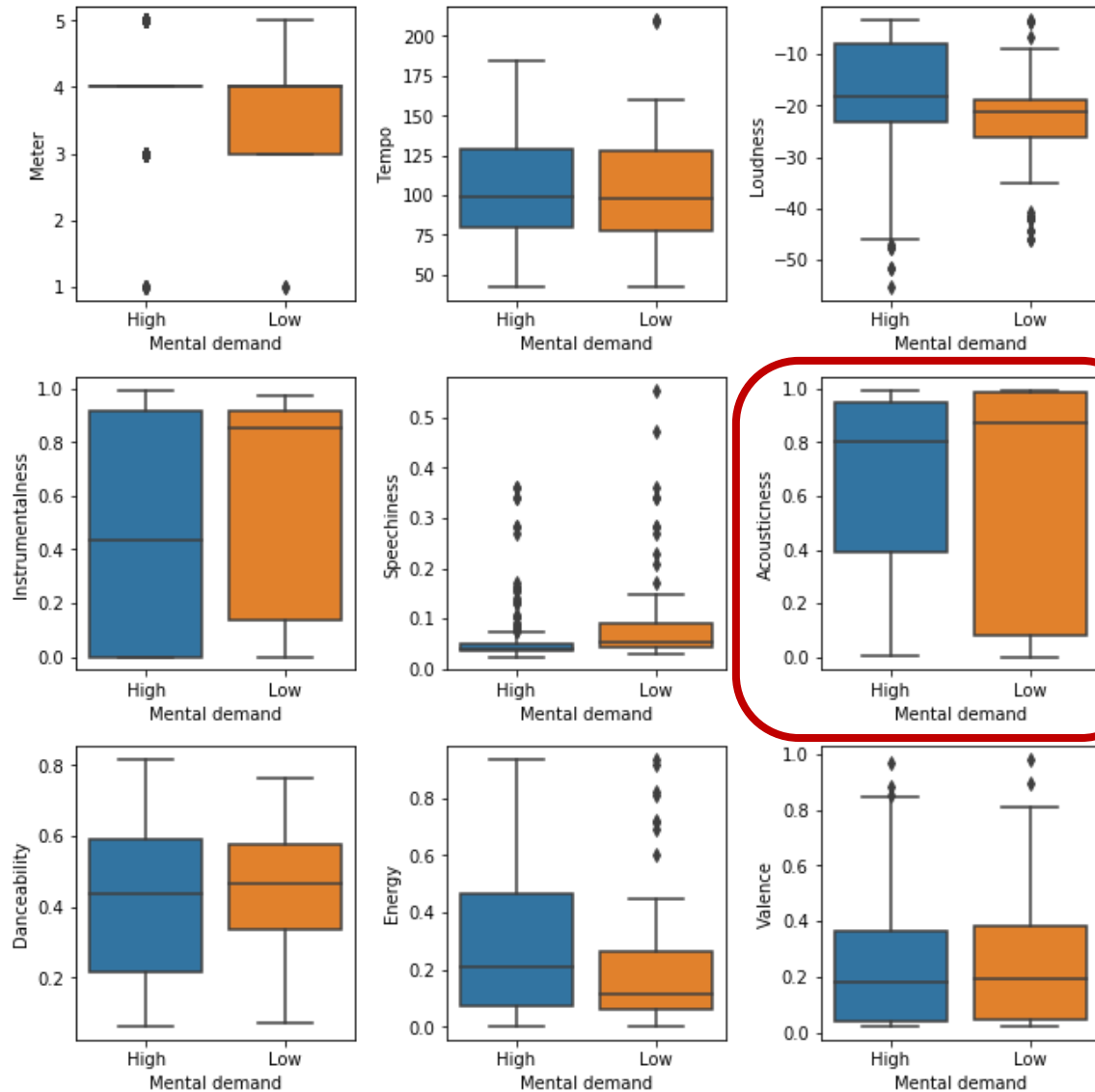
## high danceability

- high beat strength, stable rhythm

“less sleepy”



# Preliminary Results Music Preference Under Varying Task Load



When considering **mental demand** .....

- pattern was less apparent
  - compared to high versus low temporal demand

An interesting observation .....

- **acousticness** is more **diverse** under **low mental demand**
  - a possible explanation:
  - learners may be **more tolerant to timbral complexity** introduced by electronic synthesizer (Parmer et al., 2019) in low mental demand conditions



# Summary

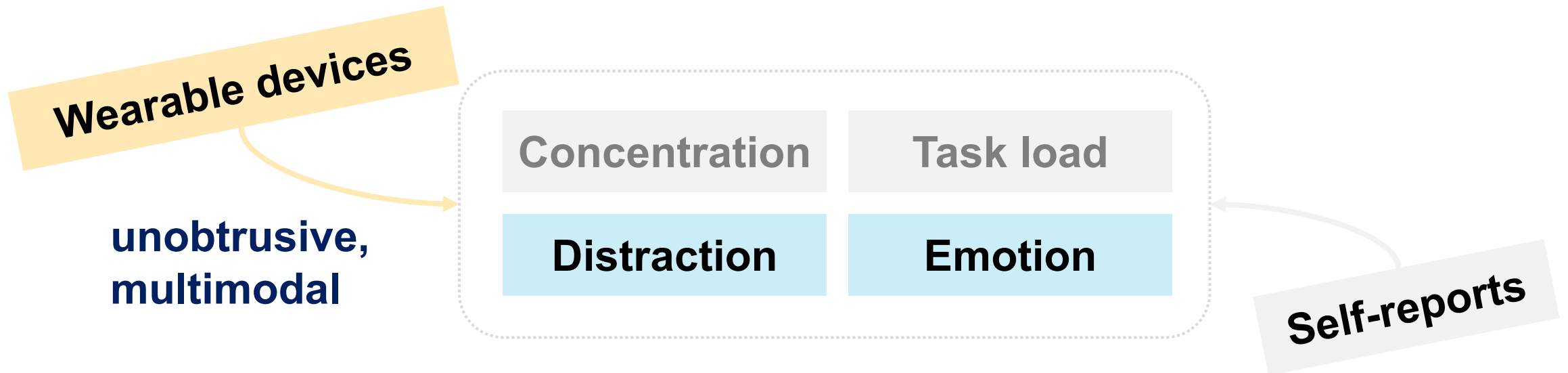
- ❑ Improved **ecological validity** of studies on BGM and learning
- ❑ Learners' **self-selected** background music could **enhance (rather than distract)** their learning
- ❑ Beneficial effect of background music: more apparent under **low mental or temporal demand**
  - Cf. Irrelevant sound effect hypothesis
- ❑ Learners' **music preference** differ considerably under **high versus low temporal demand**, particularly on **speechiness, acousticness, danceability, and energy**.



# Limitations

- ❑ A small-scale experiment with a limited sample size
  - Findings should not be deemed as conclusive
- ❑ Only included self-reported learning experience measures

# Future work



# Thank You!



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