EMBODYING THEORETICAL RESEARCH IN MUSIC COGNITION

Four Proposals for Theory-Driven Experimentation

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Introduction

Most music cognition studies are based on **cognitivist assumptions**. We elaborated an **alternative model** to test its heuristic and explanative capacities doing explorative research.

It draws on developments such as **distributed cognition** (Hutchins, 1995), the **embodied mind** thesis (Varela, Thompson & Rosch, 1991), the **extended mind** thesis (Menary, 2010) and **enactivism** (Thompson, 2007).

Thesis: **Some crucial aspects of music have nothing to do with wave propagation or the individual perception of sound**.

(1) Embodied Music Thesis: Details of physical embodiment are relevant to music cognition.

(2) Embedded/Extended Music Thesis: Interaction with technical instruments and with the environment is relevant to musical phenomena.

(3) Musical Interactionism/Anti-individualism: Interpersonal interactions not directly related to acoustics are relevant to music.

Experimental setup

Conducted **online**, with a sample of 110 people, in english, catalan and spanish.

Subjects' relationships with music were profiled through a **survey**. A wide range of dimensions of **knowledge**, **production** and **reception** was considered.

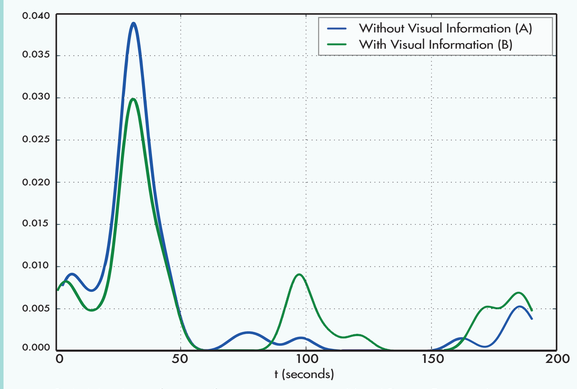
Tags from experiment A

Experiment B

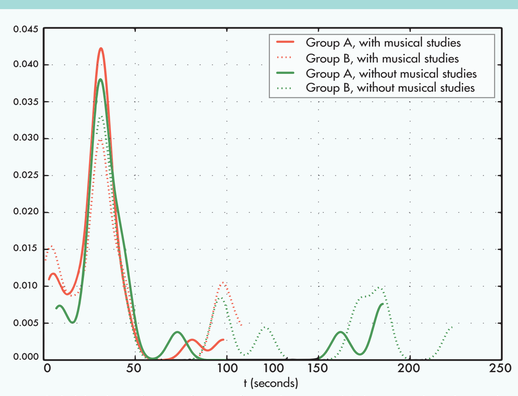
Subjects were presented with a piece in which different musical elements appear against a backdrop of noise, so that it "**progresses from noise to music**".

Subjects in **condition A** were asked to listen to the piece of audio and report the exact moment in which they started to perceive music.

Subjects in **condition B** were asked to do the same while watching a video clip with the audio track paired with footage from an experimental music performance.



Probability density function of music detection time t (Kernel Density Estimation).



Probability density function of instant t for conditions A and B decomposed into those with music studies and those without (Kernel Density Estimation).

Participants with **musical studies tend to situate the transition earlier**: on average, 36 seconds earlier than participants without musical studies ($F = 160.5$, $p = .006$).

This indicates that **having musical studies has a bigger impact than being exposed to music-related visual information**. One possible explanation is that the slightly dissonant harmonic element introduced at time 00:30 on the audio track is not being considered as music by participants without musical studies.

Experiment A

Subjects were asked to listen to several **audio samples** (30 seconds from a song, diverse genres).[1] Then they had to complete **4 tasks**. All responses were considered in relation with know-how and know-what variables. Open answers and tag-based answers were coded and categorized a posteriori.

(i) identify the number of **voices**; **(ii)** segment the sample in **parts**;

(iii) provide **tags describing** the songs; **(iv)** provide **tags comparing** two given songs.

Results

	VOICE DISCRIMINATION	SEGMENTS
MUSICAL STUDIES $N_{yes} = 59$, $N_{no} = 42$	$p = .004$ W = 824.5	$p = .986$ W = 1242
MUSIC PERFORMER $N_{yes} = 56$, $N_{no} = 45$	$p = .011$ W = 898	$p = .507$ W = 1364
Instrument player $N_{yes} = 56$, $N_{no} = 45$	$p = .033$ W = 950	$p = .822$ W = 1293
Singer $N_{yes} = 43$, $N_{no} = 58$	$p = .007$ W = 860	$p = .520$ W = 1339
Performs in public $N_{yes} = 31$, $N_{no} = 24$	$p = .010$ W = 221	$p = .931$ W = 367
Plays with others $N_{yes} = 35$, $N_{no} = 18$	$p = .223$ W = 250	$p = .946$ W = 319
Listening practices		

Wilcoxon Rank Sum tests, significance ($p < .05$)

Results

	TOTAL TAGS	GENRE TAGS	INSTRUMENT TAGS	MUSIC THEORETIC TAGS	QUALITY TAGS
MUSICAL STUDIES $N_{yes} = 59$, $N_{no} = 42$	$p = .098$[1] W = 999	$p = .127$[2]	$p = .003$[2]	$p = .659$[2]	$p = .005$[2]
	$p = .023$[3] $F(1,97) = 5.30$	$p = .792$[3] $F(1,97) = 0.07$	$p = .874$[3] $F(1,97) = 0.03$	$p = .199$[3] $F(1,97) = 1.67$	$p = .164$[3] $F(1,97) = 1.97$
	$p = .175$[3] $F(1,97) = 1.87$	$p = .004$[3] $F(1,97) = 8.87$	$p = .001$[3] $F(1,97) = 11.1$	$p = .003$[3] $F(1,97) = 9.58$	$p = .678$[3] $F(1,97) = 0.17$
MUSIC PERFORMER $N_{yes} = 56$, $N_{no} = 45$	$p = .024$[1] W = 938	$p = .043$[2]	$p = .004$[2]	$p = .016$[2]	$p = .026$[2]
	$p = .004$[1] W = 836	$p = .024$[2]	$p = .002$[2]	$p = .002$[2]	$p = .157$[2]
	$p = .032$[3] $F(1,97) = 4.73$	$p = .005$[3] $F(1,97) = 8.39$	$p = .030$[3] $F(1,97) = 4.86$	$p = .003$[3] $F(1,97) = 9.55$	$p = .813$[3] $F(1,97) = 0.05$
Singer $N_{yes} = 43$, $N_{no} = 58$	$p = .959$[3] $F(1,97) = 0.00$	$p = .779$[3] $F(1,97) = 0.08$	$p = .188$[3] $F(1,97) = 1.75$	$p = .484$[3] $F(1,97) = 0.49$	$p = .330$[3] $F(1,97) = 0.96$
	$p = .032$[1] W = 936	$p = .130$[2]	$p = .008$[2]	$p = .079$[2]	$p = .014$[2]
Listening Practices					

musical studies: yes/yes 47, yes/no 7, no/yes 12, no/no 35
instrument player: yes/yes 40, yes/no 3, no/yes 16, no/no 42

[1] Wilcoxon Rank Sum Tests, significance ($p < .05$). [2] Fisher's Exact Test (two-sided), significance ($p < .05$). [3] Two way ANOVA, significance ($p < .05$)

Listening practices do not relate with the capacity to discriminate voices, but **musical studies** and **performing music** do.

Data suggest that the know-what aspect that comes with **music studies** is more relevant than the embodied and know-how aspect of **musical practice**.

Data provide no strong evidence that people who make music have a more detailed or diverse impression of music. Music **performers**, however, choose tags such as 'Genre', 'Instrumentation', 'Musical Attributes' and 'Quality' significantly more often.

Features that attract a special attention from **instrument players** (genre, melody) are different from those features that attract **singers** (instrumentation, quality).

The effects of **singing** seem to align, up to a point, with those of having **musical studies**.

Non-implemented proposals

Experiment C focuses on the **relationship between music discrimination and the subjects' listening practices**. Similarly to the performed experiments, subjects are provided with pairs of musical segments of different styles and with different relationships (same musical style, performances of the same piece, etc.). They are asked to provide detailed information on their listening practices and to answer short open questions on the paired segments. In one group the pieces are accompanied by some "exemplifying" descriptions; the influence of this elements in the responses and its interaction with listening practices is analyzed in contrast with the control group.

Experiment D is an extension of the experiment designed to explore the **relationship between the perception of sound as music and the concurrent activity of the listeners**. Different groups of listeners are asked to perform (i) a simple puzzle-solving task, (ii) a puzzle-solving-task involving sound elements and (iii), a puzzle solving-task in coordination with another subject, and the influence of these practices in the perception of sound as music is compared to that of the control group.

Discussion

Active musical practice (as opposed to listening practices) has several effects on musical perception: people who make music seem to have a different capacity to discriminate voices, and they perceive some features as more salient. Having music studies has several significant effects, but they do not align with the effects of music performance. This discrepancy between the effects of the domain of the abstract know-what and the domain of the embodied know-how can be accounted for in terms of our **embodied music thesis**.

Considering specific dimensions of musical performance in further detail, we see that the effects of playing an instrument differ quite systematically from those of being a singer, the latter aligning with those of having musical studies. This points to the fundamental distinction between the bodily engagement with an external artifact implied in the act of playing an instrument and the practice of singing, in which there is no such external integration. This goes along the lines of our **embedded/extended music thesis**.

The results do not directly support our **anti-individualistic thesis**.

Research in musical cognition can be illuminated by adopting a framework that distances from the common assumption that music is fundamentally an acoustic phenomenon.

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SAMPLE LIST

Alexander Borodin – Polovtsian Dances; Transatlantic – Suite Charlotte Pike; Shakira – Whenever, wherever; The Doors – Love me two times; Deadmau5 – Fustercluck; Grateful dead – Touch of grey; Jefferson Airplane – Somebody to love.

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