A STUDY OF CULTURAL DEPENDENCE OF PERCEIVED MOOD IN GREEK MUSIC

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ABSTRACT

Several algorithms have been developed in the music information retrieval community for predicting mood in music in order to facilitate organising and accessing large audio collections. Little attention has been paid however to how perceived emotion depends on cultural factors, such as listeners' acculturation or familiarity with musical background or language. In this study, we examine this dependence in the context of Greek music. A large representative database of Greek songs has been created and sampled observing predefined criteria such as the balance between Eastern and Western influenced musical genres. Listeners were then asked to rate songs according to their perceived mood. We collected continuous ratings of arousal and valence for short song excerpts and also asked participants to select a mood tag from a controlled mood vocabulary that best described the music. We analysed the consistency of ratings between Greek and non-Greek listeners and the relationships between the categorical and dimensional representations of emotions. Our results show that there is a greater agreement in listener's judgements with Greek background compared to the group with varying background. These findings suggest valuable implications on the future development of mood prediction systems.

1. INTRODUCTION

A large body of research [3, 5, 16] supports that music can either evoke emotions in listeners, a phenomenon known as felt emotion, or express emotion, known as perceived mood. For this reason, understanding emotion or mood [1] is useful in daily experiences listening to music. Several Music Information Retrieval (MIR) related studies [2, 19, 20] have demonstrated the importance of mood-based organisation when accessing music catalogues. For instance, Lee [20] showed that participants of a survey conducted to assess the relevance of different modalities in music searching and browsing would use emotional or mood states in their queries. More recently, Bischoff [2] reported that over 15% of the song queries on the Web-based music service Last.fm were made using mood tags. MIR systems that facilitate the use of mood to interact with music rely on specific mood models. For instance, categorical organisation, or dimensional representation of emotion stated in a mathematical space associates mood with musical audio, tags or other information sources using selected machine learning algorithms [3,9]. In this paper, a dimensional representation of emotion is demonstrated.

A wealth of research focuses on the above problems in the context of Western musical culture [5, 29], assuming that generic models can be built independently from musical style, culture, genre or listeners' acculturation. This study investigates these issues in the context of Greek musical culture. In particular, we focus on the following research questions:

1. Do Greek and non-Greek people agree with each other on the ratings of perceived arousal and valence?
2. Are there any differences in the music perception of Western and Eastern influenced musical genres between Greek and non-Greek people?
3. Are specific mood labels originated from Western musical studies suitable for Greek music?

The rest of the paper is organised as follows: In Section 2, related work on the field is presented as well as cases that show why Greek music is particularly relevant for study. Due to the unique properties of Greek musical culture, we investigate the culture dependence of valence-Arousal (VA) ratings and tagging in the context of Greek music. Section 3 outlines the mood classification models and music perception background considered. In Section 4, we analyse the database collection that we created and used. In Section 5 we present the design of the study, while in Section 6 we show our results. In Section 7 we conclude and outline some directions for the future work.

2. BACKGROUND

2.1 Cross-Cultural Mood classification

It is well known that music emotion perception is influenced by cultural background. For instance several studies have attempted to explore the emotion perception of pop songs between American and Chinese listeners [33], the music emotion classification between Chinese and English songs [14], and perceived complexity of Western and

[1] Albeit we acknowledge the difference between emotion and mood, in this work, the terms will be used interchangeably.

African folk melodies by Western and African listeners [6]. To our knowledge, no previous studies have been performed using Greek music which holds particular interest as it features compositions influenced by both Eastern and Western culture.

2.2 Why do we use Greek Music?

Greek music databases do exist, and many of them can be found on the Internet. However they are either related to specific music labels or come from individuals, hence they are limited in their scope. A broader database is provided by the Greek Music Information Centre of the Institute for Research on Music and Acoustics [2]. This database however lacks popular and modern Greek music metadata.

A study for using principles of MIR Systems in Greek Music is described in [17], where a case study for the usage of the "Music Control" system by Nielsen - VNU is presented. This system provides an airplay monitoring service based on MIR principles, but it struggles with two kinds of issues. Firstly, although it could be efficiently used in the context of musical genres such as pop and rock, it could not be utilised for Greek musical genres such as "Entehno" (described as "Alternative" in Section 3). Secondly, the system was misleading due to the "secondary importance" of the international musical menu, counting their airplay time. The above indicate the uniqueness of Greek music, which provides the motivation for our further exploration.

3. MOOD CLASSIFICATION AND MUSIC PERCEPTION

3.1 Representation of Emotions

Several representations of emotion or mood have been proposed in psychology and related disciplines. For recent thorough reviews in the context of music see for instance [5] or [3]. Among these representations, the *categorical model*, which assumes that emotion may be represented as a set of distinct categories, and the *dimensional model*, which characterises emotions using a small number of dimensions corresponding to the internal human representations are paramount. Categorical approaches have been criticised since they constrain emotions to be represented as a set of predefined families or landmarks [23]. As a result, dimensional models have emerged as dominant, with perhaps the most influential work being Russell's circumplex model of affect [25]. This consists of a two-dimensional circular structure involving the core affect dimensions of *arousal* and *valence*. A space corresponding to these dimensions is often referred to as the VA space. The relevance of these dimensions in music, where emotions may be defined in terms of arousal or energy (i.e. how exciting or calming musical pieces are) and valence or stress, (i.e. a dimension of positive or negative emotions), were experimentally validated by Thayer [30].

[2] http://www.musicportal.gr/?lang=en

3.2 Music Emotion Recognition

Early music emotion recognition (MER) studies focused on categorical models and approached emotion recognition from audio as a classification or auto-tagging problem (see e.g. [21, 28]). However, due to the limitations of categorical models, (e.g. ambiguity in the meaning of adjectives associated with emotion categories, and the potential heterogeneity of the taxonomical organisation) recent studies have focussed on continuous valued dimensional models. In the first study that addresses these issues [34], MER is formulated as a regression problem in order to map high-dimensional features extracted from audio to the VA space directly. However, the dimensional model also presents some barriers, for instance, it is difficult to use in browsing and searching, where interfaces based on generic or music related emotion tags dominate.

3.3 Music mood tags

In order for dimensional representations to be ultimately useful in conventional browsing interfaces, it is necessary to establish connections between continuous valued emotion states and mood tags. As a solution, one may use the Affective Norm for English Words (ANEW) database [1] which contains VA values for a large number of English words derived from psychological experiments. However, these values are not validated in the context of music. More recently, Saari and Eerola [26] proposed a technique called Affective Circumplex Transformation (ACT) which uses Vector Space Modelling, Latent Semantic Analysis (LSA), Multi Dimensional Scaling (MDS) and Procrustes analysis [10] to derive dimensional mood models from music related social tags (such as those available form Last.fm) whose axes, among other possible dimensions, may be interpreted in terms of VA. This method has been validated against human ratings using a listening test, and found to be robust in the context of 600 songs drawn predominantly from Western music genres. It was also shown to be useful in the context of curated editorial tags used by production music libraries [27].

These studies, as well as most recent works in MIR and music emotion recognition have attempted to use generic mood models assuming that the relation between continuous emotion states and mood words is independent from musical style, genre or culture. A notable exception is the work of Eerola [7] demonstrating the genre specificity of mood modelling. In this present work, we investigate the last issue further.

4. GREEK MUSIC DATABASE AND ANALYSIS

In order to perform our study, a music database was created which includes tracks from the Greek musical scene from the 1970's until recent years, containing the most critically acclaimed compositions. It is a continuously growing resource, containing 2087 songs at present, all taken from personal collections [3].

[3] The Greek songs metadata can be found online at http://greek_music_data.isoftcloud.gr

In order for efficient categorisation, certain descriptions such as genre titles have been taken from the Western musical vocabulary, however, new genre titles have also been introduced to best describe the music. This is crucial because of the principles described in [31] and also because the structural categorisation that musical genres provide is important for MIR systems. The final number of the categories as shown in Table 1, is 25. Out of these, 16 genres identified using grey cells in Table 1 were used for our experiment.

Western Influenced	
Alternative Pop (AP)	Pop (P)
Ballad (B)	Progressive Rock
Blues	Rap (Ra)
Dance (D)	Reggae (Re)
Electronic	Rock (R)
Hip Hop (HH)	Ska
Latin	Tango
Lounge	Trip Hop
New Age (NA)	
Eastern Influenced	
Alternative (A)	Laiko-Pop (LP)
Cretan	Laiko-Rock (LR)
Experimental (E)	Tsifteteli (T)
Laiko (L)	Zeibekiko (Z)

Table 1. Greek Database Musical Genres. Samples from the genres indicated using grey background have been used for the experiment.

The primary demarcation between Western and Eastern influenced musical groups depends on the song's rhythm pattern and the origination of the instruments used. The genres presented as Western influenced are defined in similar terms as corresponding music in standard Western culture.

The Eastern influenced genres consist of the following categories: "Alternative" includes compositions which either have specific tempo variations, or are influenced by different Eastern musical styles within the same piece. "Cretan" is folk music originated from the Greek island of Crete. The music pieces in "Experimental" comprise experimental music with a strong presence of Eastern culture. "Laiko", or otherwise "General folk" includes compositions inspired by popular old folk song arrangements, usually following the rhythm known as "Syrtos". It is a rhythm of the round dance, originating from ancient Greece that was claimed by ancient Greek theory "for the heroic hexameter, that is, the rhythm of Homer". It consists of three counts, in which "the first is longer by one-half than the second and third" [11]. "Laiko-Pop" and "Laiko-Rock" are defined as large sub-categories of "Laiko", where the influence of rhythm patterns and instrumentation from "Pop" and "Rock" respectively are present. The two last genres are "Tsifteteli" and "Zeibekiko" named for their respective dance styles. Tsifteteli is constituted by pieces whose rhythm contains two counts, while Zeibekiko has similarities with the turkish dance "Zeybek" following the rhythm of nine counts [24].

5. EXPERIMENT DESIGN

5.1 Database Sampling

108 songs have been selected in total from a sub-category of our database with their lyrics in Greek. We used pseudo-random sampling observing several criteria to ensure balanced genres and artists. The output of the algorithm selects songs such that there is a maximum 7 songs per genre, with each artist appearing no more than once. The most representative 30 second musical excerpt was selected for each song manually such that it has a lyrical part, except for 3 excerpts from the "Experimental" genre.

5.2 Listening test

Our experiment includes an online listening test. Its first page welcomes the user and introduces the subjects with crucial instructions. After selecting either the English or Greek-translated version of the test, the system presents a form to fill for personal information, including name, age range, gender and nationality. Moreover, it presents the user with a questionnaire about his/her musical culture and about the type of music that he is most familiar with.

The second part consists of the questions detailed below, following the Goldsmiths Musical Sophistication Index, about the musical training level [22]. Here, the answers to the questions 1-3 may be given as discrete ratings on a 7 point Likert scale: (1: Completely disagree, 2: Strongly disagree, 3: Disagree, 4: Neither agree nor disagree, 5: Agree, 6: Strongly agree, 7: Completely agree).

1. *I have never been complimented for my talents as a musical performer*
2. *I can't read a musical score*
3. *I would not consider myself a musician*
4. *For how many hours I engage in regular, daily practice of a musical instrument?*
5. *At the peak of my interest, how many hours per day did I practice on my primary instrument?*
6. *For how many years have I played or sung in a group, band, choir, or orchestra?*
7. *For how many years did I have formal training in music theory?*
8. *For how many years did I have formal training on a musical instrument?*
9. *How many musical instruments can I play?*

The following listening test procedure is repeated for each song; the subject is presented with an audio excerpt and rates the mood suggested by the music in terms of valence and arousal level by selecting a location on a 2D plane representation. This user interface was inspired by that of the MoodSwings game developed to collect music emotion labels from human listeners [32]. Then, a list of the twenty closest emotion tags to the selected position is proposed. The subject may choose the one that best describes the suggested mood. The tag positions were derived from Last.fm data using the ACT transformation [26] mentioned in Section 3.3.

An optional post-experiment questionnaire was sent to all subjects after completing the listening test. The possible answers were designed to use the same rating scale as before:

Rate the following 2 sentences:
a. I could find a tag in the list that was exactly (or really close to) what I wanted to label for the perceived mood of every song.
b. I listened to a song from my favourite genre, at least once.

5.3 Participants

Twenty-two Greek participants (10 male and 12 female) and twenty non-Greek participants (15 male and 5 female) took part in the study. Their ages ranged between 18 to 54. They were recruited without consideration of their musical training. Their musical training level was assessed using the questionnaire shown in Section 5.2. The overall results are shown in Table 2.

	Min	Max	Median	SD
Non-Greek music score	21	43	30	6.07
Greek music score	21	41	30	5.42

Table 2. Musical training level score for Greek and non-Greek participants: min. and max. value, median and Standard Deviation. Ascending scale from 9 to 63.

6. RESULTS

To answer the research questions as described in Section 1, the following four experiments were carried out. The results were aggregated separately in Eastern-influenced and Western-influenced musical genres.

6.1 Effects of Eastern-influenced and Western-influenced musical genres across Greek and non-Greek listeners on valence and arousal (VA) ratings

To find out the effects of culture-biased musical genres between Greek and non-Greek listeners on the VA ratings, we used the two-way analysis of variance (factor 1: musical genre, Western-influenced and Eastern-influenced, factor 2: musical culture, Greek and non-Greek). Significant results were found in the ratings of valence for nationalities ($F(1,0.08) = 72.56$, $p<0.001$) and Eastern-Western influenced genres ($F(1,0.005) = 4.5$, $p<0.05$). Similar results were revealed in the ratings of arousal on nationalities ($F(1,0.19) = 167.16$, $p<0.001$), Eastern-Western influenced musical genres ($F(1,0.006) = 5.7$, $p<0.05$) as well as the interaction of these two factors ($F(1,0.00524) = 4.67$, $p<0.05$). However, no significant result was found for the interaction between culture and nationality on valence ratings.

6.2 Comparison of Greek and non-Greek responses on VA

To compare the difference in non-Greek and Greek responses on VA ratings, the Wilcoxon Signed Rank test was carried out across all the listeners on the mean value of VA ratings. A significantly higher standard deviation value was found in the ratings of non-Greek people for both valence ($p<5.1427e-13$) and arousal ($p<6.6826e-17$). This suggests that the ratings of Greek listeners are more consistent than those of non-Greek listeners, since Greek listeners are more familiar with these musical excerpts.

6.3 Comparison of emotion perception across Western influenced and Eastern influenced musical genres between Greek and non-Greek participants

As mentioned in section 6.1, (Western-influenced or Eastern-influenced) musical genres have an effect on VA ratings. Previous studies also showed a link between particular emotions and specific musical genres [8]. Therefore, we investigated whether in Greek music, a certain musical genre was linked to a category of emotions. The Wilcoxon Signed Rank test was conducted to compare the mean VA ratings between non-Greek and Greek listeners.

		Greek		Non-Greek		*P-Value*
Genre		**Mean**	**SD**	**Mean**	**SD**	
Eastern Infl.						
A	V	0.38	0.10	0.33	0.06	0.08
	A	0.55	0.06	0.43	0.06	**0.02**
E	V	0.36	0.06	0.32	0.04	0.31
	A	0.42	0.10	0.37	0.07	0.31
L	V	0.68	0.08	0.50	0.10	**0.02**
	A	0.63	0.07	0.55	0.06	**0.05**
LP	V	0.64	0.10	0.66	0.06	0.47
	A	0.51	0.11	0.61	0.07	**0.02**
LR	V	0.57	0.09	0.60	0.11	0.30
	A	0.42	0.09	0.44	0.05	0.69
T	V	0.68	0.06	0.61	0.07	0.08
	A	0.54	0.09	0.53	0.07	1.00
Z	V	0.61	0.09	0.47	0.07	**0.02**
	A	0.40	0.05	0.47	0.07	0.22
Western Infl.						
AP	V	0.58	0.07	0.58	0.06	**0.58**
	A	0.59	0.08	0.56	0.06	0.47
B	V	0.51	0.16	0.47	0.14	0.22
	A	0.42	0.06	0.42	0.05	**0.81**
D	V	0.73	0.07	0.70	0.07	0.16
	A	0.56	0.06	0.62	0.07	0.16
HH	V	0.66	0.08	0.68	0.05	0.47
	A	0.51	0.13	0.48	0.08	**0.58**
NA	V	0.39	0.12	0.32	0.07	0.05
	A	0.49	0.10	0.46	0.14	0.11
P	V	0.64	0.08	0.63	0.09	**0.94**
	A	0.59	0.13	0.63	0.08	0.30
Ra	V	0.61	0.06	0.69	0.07	0.06
	A	0.41	0.04	0.41	0.10	**0.84**
Re	V	0.58	0.11	0.54	0.10	0.16
	A	0.66	0.11	0.63	0.09	0.44
R	V	0.73	0.09	0.69	0.08	0.08
	A	0.57	0.08	0.54	0.05	0.22

Table 3. Valence (V) - Arousal (A) Mean and SD values for each genre (abbreviations from Table 1). Genres Z and P are chosen as representatives of low and high P - value respectively.

Significant differences in the ratings of either valence and/or arousal were found in the following genres: "Alternative (A)", "Laiko (L)", "Laiko-Pop (LP)" and "Zeibekiko

(Z)". Interestingly, all these genres belong to Eastern-influenced musical styles. It substantiates the VA rating results, since most Western listeners are especially not familiar with these types of compositions. Likewise, a greater consistency in ratings between Greek and non-Greek listeners are presented in Western-influenced genres. Mean ratings and standard deviations (SD) of Greek and non-Greek users in Eastern-influenced and Western-influenced genres are shown in the Table 3.

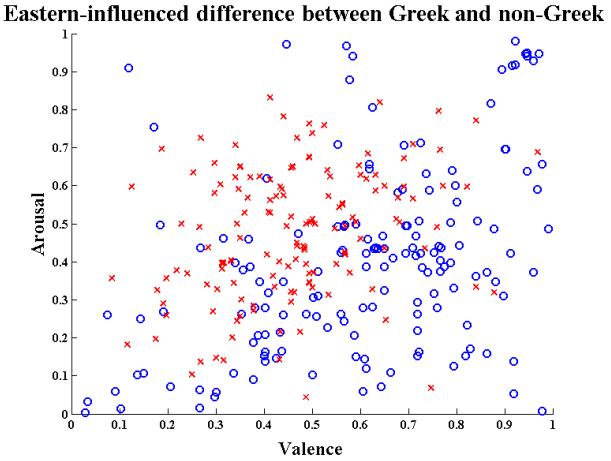

Figure 1. VA Ratings of Greek (circles) and non-Greek (crosses) for the Eastern-influenced genre "Zeibekiko"; the clusters created by both groups are separable.

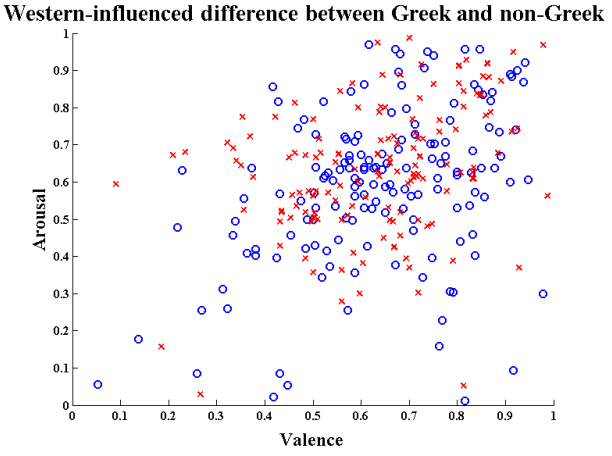

Figure 2. VA Ratings of Greek (circles) non-Greek (crosses) for the Western-influenced genre "Pop"; the clusters created by both groups overlap.

Figure 1 shows an example of the Eastern-influenced genre "Zeibekiko". The ratings of Greek listeners were closer to high valence and low arousal. However, the ratings of non-Greek listeners were closer to the upper-left part of the valence-arousal space. The cluster from Greek Listeners' ratings indicates that certain emotions are better expressed by certain genres. In addition, the ratings distribution of the Western-influenced genre "Pop" is shown in Figure 2. Although no significant differences were found between Greek and non-Greek listeners, the cluster of user ratings in genre "pop" tends to be in the right top quadrant in two-dimensional model.

6.4 Examination of the Tag Labels

Ten responses from each group (Greek and non-Greek) were collected to the optional post-experiment questionnaire. An interesting question to investigate is the conformity between their perceived emotion and the proposed tag labels in our system for every song.

When answering the question if they could find a tag in the list that was exactly or really close to what they wanted to label for the perceived mood of every song, the mean response from Greek participants is close to "Neither agree nor disagree", while non-Greek participants' mean response is close to "Disagree" (see Table 4). To some extent, it suggests that our proposed tags can represent Greek listeners but doesn't work at all for non-Greek listeners. However, the results remain tentative.

	Greek	**Non-Greek**
Mean	4.2	3.3
SD	1.32	1.41

Table 4. Mean and SD for level of tag agreement (scale 1-7).

7. CONCLUSIONS AND FUTURE WORK

This study investigates the cross-cultural applicability of mood categories and classification models of perceived emotion through different musical genres of Greek music. The responses by Greek people on the rating of music perception tend to agree with each other, while this does not appear to be the case as strongly with non-Greek people. A likely reason for this is differences in acculturation. Indeed significant difference can be observed in the perception of Eastern influenced musical genres between these two groups.

We have also examined whether specific metadata that is designed for Western music are applicable to Greek music. The negative results we obtained concerning tag positions derived from predominantly Western music seem to indicate that either the VA positions for the tags were less meaningful in the context of Greek music, or the tag selection mechanism was too constrained.

In future work we will compare mood classification results of perceived emotion from the Western influenced musical genres with those of Western music tracks. Additionally, an experiment with participants of specific non-Greek origination could be designed. Another alternative is to include the translation of lyrics for non-Greek participants.

In addition, expansion of the existed database is foreseen. In the new version, the genre "Rebetiko" (cf. [13] for details) will be included, and a comparison with other databases of Greek music containing folk songs from different geographical areas will be made.

Finally, it will be interesting to examine the validity of the results from western designed automatic audio feature extraction and mood estimation techniques on the less-western Greek database. This work may be enhanced using the system described in [15] for detecting similar phrases in music of the Eastern Mediterranean.

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