

A WEB PLATFORM TO EXTRACT AND INVESTIGATE MUSIC GENRE LABELS IN SPOTIFY

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ABSTRACT

The growing use of music streaming platforms is changing the listening taste and habits of users. While the problem of defining music genres and classifying compositions accordingly has been widely debated in musicology, little attention has been paid to the redefinition of the concept of genre in the light of new distribution models and technological devices. In this paper, we first describe *SpotiGeM*, an interdisciplinary project involving musicology, sociology, and IT experts, aiming to understand the effects of streaming platforms in general, and Spotify in particular, on the concept of genre. After defining the background, we focus on the Web platform implemented and publicly released to support such research. We list the main findings that emerge from use cases and scenarios. We also propose some directions to generalize the project's outcomes, showing that the Web platform can be employed also to investigate other aspects of individual music consumption, artistic processes, and distribution models.

1. INTRODUCTION

The growing use of streaming platforms for listening to music is radically changing the taste, habits, and attitudes of listeners [1]. One aspect, in particular, has been little studied in detail, so far: the definition and consequent redefinition of the concept of music genre. Streaming platforms such as Spotify propose public playlists called, e.g., “Kitchen Jazz Music” or “Classic Rock Drive”, shared by thousands of users and having half a million likes. This investigation on genre labels can be enlightening, not only to investigate listening behaviors through genre-based clustering but also to better understand the relationship between recommendation systems and music genres.

The Web platform described in this work has been developed in the context of a multidisciplinary project of the University of Milan titled “I generi musicali nell’era di Spotify – Costruzione sociale, fruizione computazionale e pratiche produttivo-distributive” (in English: “Music genres in the Spotify era – Social construction, computational fruition and productive-distributive practices”). Such a project,

for the sake of brevity *SpotiGeM* from now on,¹ combines sociological, musicological, and computer science skills in order to investigate the transformation of the concept of music genre operated by digital streaming services such as Spotify, YouTube, Apple Music, etc. The diffusion of these platforms has generated a reorganization of the strategies of production, distribution, experience, and marketing of music [2–5]. The presence of algorithms that orient user choices [6–8] resulted in forms of categorization able to overcome the traditional notion of music genre, rather promoting aspects such as the mood and the situational contexts in which listening takes place.

According to [9], a *music genre* is a conventional category that identifies some pieces of music as belonging to a shared tradition or set of conventions. Another definition, currently considered normative, is presented in [10]: music genre is a set of musical events, real or possible, whose course is governed by a definite set of socially accepted rules. Genre labels are problematic for several reasons. First, they are often broad terms that are used to describe artists, albums, and pieces that may vary greatly in their characteristics. For instance, The Beatles, AC/DC and Queen are all “rock” bands, and Madonna, Elton John, and Katy Perry are all considered “pop” artists, but their styles, intentions, and audiences are very different. Oddly enough, sometimes there is the opposite problem, namely a proliferation of sub-genres whose lines are blurred. For example, a comprehensive list of “metal” music sub-genres can embrace more than 40 main items and several sub-items. Moreover, genre labels are often decided by record companies with the intent of targeting a particular type of audience or age group. Music streaming platforms, with their recommender systems and mood/situation-oriented playlists, are further complicating this already articulated picture.

Nowadays, a comprehensive study on the definition of music genre and its redefinition due to streaming services is necessarily a multi-disciplinary activity. To this end, *SpotiGeM* aims to achieve an innovative investigation of the encounter between cultural conventions, computational dynamics, and forms of music consumption following the spread of digital-music streaming platforms, a phenomenon of growing interest for both scholars of various disciplines and the music industry.

The present contribution can be framed in the context of

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¹ *SpotiGeM* stands for **Spotify’s Genres for Music**.

SpotiGeM as the first step, in charge of the IT subgroup, necessary to complete the project's tasks. The goal of the Web platform proposed here is to support musicology and sociology experts by providing an easy-to-use interface to query, cross-correlate, and track Spotify data over time. But the scholarly contribution of this initiative goes beyond, constituting an enabling technology to conduct analyses also outside *SpotiGeM*'s scope. First, the Web platform lets Spotify users perform personal explorations of their music library, highlighting some data that are typically hidden and offering aggregated graphical representations. Moreover, data can be compared across different track collections and users, and downloaded in standard formats, thus paving the way for other kinds of quantitative and qualitative investigations.

The goal of this paper is, on one side, to present the Web platform developed in the context of *SpotiGeM* and, on the other side, to unveil the possibilities offered by its use in a more general research context. For the sake of clarity, the contribution does not address the problem of how the concept of music genre is being redefined, rather it aims to support the investigation of such a process in the era of music streaming platforms.

The rest of the paper is organized as follows: Section 2 lists the research questions of the *SpotiGeM* project, Section 3 discusses the most relevant references in the scientific literature, Section 4 presents the developed Web platform, Section 5 reports some preliminary results emerging from the use of such a platform and explains how this approach can answer the research questions of the project, and, finally, Section 6 draws the conclusions.

2. BACKGROUND

SpotiGeM research team has focused on Spotify,² a streaming service of increasing importance for both individual consumption and the music industry. Unlike other platforms that host user-generated content, Spotify is a closed system of infrastructures that regulate and organize the musical offer combining digital methods and qualitative research [11].

The research questions of *SpotiGeM* are:

- RQ1 How do music streaming platforms reflect and/or reconfigure the musicological definitions of music genres?
- RQ2 How does the music industry (e.g., record companies, music publishers, musicians) dialogue with music platforms, thus contributing to the definition of music genres?
- RQ3 How do the affordances of digital platforms influence the relationship with the music genre in individual consumption?

As mentioned before, by combining sociology, musicology, and information technology, *SpotiGeM* aims to offer

an innovative and original contribution to the study of music listening as a cultural practice increasingly re-mediated by digital technologies.

3. RELATED WORK

The scientific literature on Spotify has mainly focused on three aspects, so far: music distribution, user-customization of the music experience, and user interactions. Concerning the former aspect, researchers investigated how the record industry relates to the platform, discussing economic and artistic strategies, the establishment of new models, and copyright issues [12–15]. As it regards user-customization of music experience, the attention of scholars focused on how Spotify influences listening methods through its recommendation system [16–18]. Finally, the aspects of interactions among users and interactions between the user and the platform, mainly resulting in the creation of playlists, have been explored in [19, 20].

Recently, several studies based on the qualitative and quantitative analysis of data that can be extracted from Spotify are emerging. For instance, as demonstrated by [21], a cluster analysis of musical attributes computed by Spotify algorithms can help understand what makes a song trend.

The relationship between platforms such as Spotify and the definition of music genres has never been studied in detail. Following the multidisciplinary approach of the project, we explored the subject from a sociological, musicological, and technological point of view.

From a sociological perspective, it was observed how the encounter between the practices of musical consumption and the algorithms that guide navigation on the platform fosters the emergence of listening practices defined as “situational”, that is, based on the mood or situation in which music experience takes place. This view refers to the concept of music genre as a cultural construction [22].

From a musicological point of view, many scientific works agree on defining the music genre as a discursive and historicized category, whose construction embraces all the actors involved in the processes of production, circulation, and enjoyment [23–25]. With few exceptions [26–28], the scientific literature lacks in approaching the role of platforms as agents and interfaces for music genre definition, concerning both historically established genres, and the constitution of new ones. In this context, the role of Spotify and other platforms can be evaluated as cultural practice in terms of *musicicking*, namely a phenomenon that opens up the research to include all the activities and people involved [29].

Finally, concerning the technological side of the project, IT-related literature focuses on the heterogeneous possibilities offered by Spotify APIs³ for automatic data analysis [30, 31], platform assessment [32], and the release of advanced services built on top of Spotify [33, 34].

4. THE WEB PLATFORM

To support scholars in answering the research questions cited in Section 2, we have designed and released a Web

² <https://www.spotify.com/>

³ API stands for application programming interface.

Title	Artist	Genres	Preview	Audio Features
1. Boom Boom Pow	Black Eyed Peas	dance pop pop pop rap		
Release Year: 2009	Duration: 4:11	Key: A	Mode: Major	Time Signature: 4
Acousticness: 0.13	Danceability: 0.867	Energy: 0.857	Instrumentalness: 0.00171	Liveness: 0.13
Loudness (dB): -6.892	Speechiness: 0.0663	Valence: 0.402	BPM: 120.040	

Figure 4. Track features computed by Spotify. The panel is opened and closed by the green arrow in the *Audio features* column.

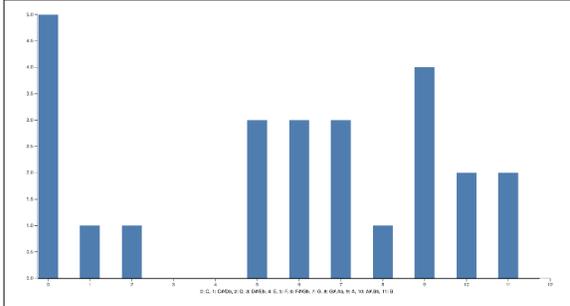


Figure 5. This bar chart shows the distribution of key signatures across a music collection.

the plots dedicated to audio features, there is a chart for music genres with two additional functions:

1. The possibility to exclude underrepresented genres, namely those appearing only once in the whole collection. This option improves the readability of the chart, in general very crowded due to Spotify’s approach to genre classification described below;
2. The possibility of weighing the presence of a genre in the playlist in different ways. Any track can potentially present – and, in general, presents – many genre labels. On one side, each occurrence of a given label can increment the total amount of that genre; in this case, “Bohemian Rhapsody”, classified as classic rock, glam rock, and rock, adds +1 to the amount of each genre. On the other side, the track is considered to be the bearer of only one genre, and, when many genres occur, they are suitably weighed; in the example above, classic rock, glam rock, and rock add +0.33 to the amount of each genre.

Please note that Spotify does not assign genre information to single tracks. It should be possible to infer such information from the album, and the data structure returned by the API call actually contains such a field but, as a known issue, it is left blank. Consequently, the only available information about the genre has to be retrieved from artists’ metadata. Thus, in our platform, tracks inherit genres from artists, in the awareness that such an assumption could introduce ambiguity and inaccuracy.

A paradigmatic example is provided by the track “Cheek to Cheek” performed by Tony Bennett and Lady Gaga. Even if the piece is a well-known jazz standard, in our platform it is labeled by the genres linked to Tony Bennett (adult standards, easy listening, lounge, vocal jazz) plus those linked to Lady Gaga (dance pop, pop, post-teen pop). Thus, vocal jazz, the most plausible genre among those

mentioned, is one label out of 7, and the platform user could erroneously infer that “Cheek to Cheek” is about 15% vocal jazz, 15% dance pop, etc.

As a final remark, even artists are not necessarily associated with any genre. For example, the analysis of a dataset made of about 625,000 artists [35] revealed that only 10% had a genre assigned.

These critical issues seem to suggest that Spotify’s recommendation system is not fed by genre information, rather it relies on other characteristics, including audio features, track and artist cross-correlation, popularity, collaborative filtering, and Web scraping [36, 37]. Nevertheless, the musicological and sociological investigations of the *SpotiGeM* project do not depend on the actual use of genre-related data in Spotify, but on the complex and evolving relationships between listeners’ habits and genres in music streaming services. Under this perspective, the low importance attributed by Spotify to this type of information can constitute a point of reflection in itself.

4.2 Playlist Comparison

Another feature of interest, for both the *SpotiGeM* project and more general studies, is the possibility to perform a numerical and graphical comparison between playlists. Such a tool is accessible from the bottom part of the *Playlist* tab, where the second id can be picked from the shortlist of the other user’s playlists or input by hand. The latter option allows comparisons with any other valid playlist, including the thematic collections published by Spotify and the public playlists of other users.

In the framework of *SpotiGeM*, there are mainly two uses of this feature:

1. A *peer mode*, where two different playlists linked by some kind of relationship are studied. An example is comparing a given user’s top-hits collection of last summer with the one of 10 years before (Figure 6). Another example is comparing the playlists of favorite rock songs of two users who share some common characteristics in terms of age, education, geographical areas, music abilities, etc.;
2. A *time-machine mode*, where the data of the same playlist are sampled at regular intervals to investigate the evolution in time. Please note that this approach can be applied not only to users’ playlists but also to Spotify’s trending collections, which are periodically updated.

While the former kind of investigation can be conducted both online (by graphical comparison) and offline (by CSV files), the latter requires downloading data periodically, since in Spotify the playlist id is not renewed when the track composition changes and old versions cannot be retrieved.

5. DISCUSSION

The Web platform presented in Section 4 is a tool that can be applied to heterogeneous research scenarios. It was developed in the framework of *SpotiGeM*, being influenced

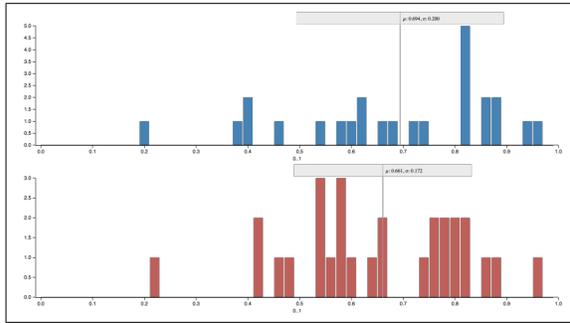


Figure 6. The two bar charts show the evolution of the valence for the author’s summer hits collections in 2020 and 2021.

in its functionalities and interface by the sociological and musicological aims of the project, nevertheless, it supports other use patterns (e.g., an alternative exploration of Spotify data by standard users) and can address different research questions by a data-driven approach (e.g., the way Spotify defines audio features such as speechiness and instrumentality).

The first point to clarify is how to read data since the risk is to confuse the evolution of musical characteristics (for tracks, genres, artists, albums, etc.) with the evolution of users’ tastes and listening habits. For example, let us recall the comparison shown in Figure 6, concerning the valence dimension of 2020 and 2021 summer hits chosen by the same user. Changes in the distribution of values could depend on intrinsic track characteristics, but also on the selection operated by the user in two different periods of his/her life. This is the reason why the *SpotiGeM* project is strongly multidisciplinary and the research team includes different competencies and embraces different visions.

After clarifying this aspect, let us go back to the research questions mentioned in Section 2.

RQ1 concerned the way music streaming platforms reflect and/or reconfigure the musicological definitions of music genres. Our investigation focusing on Spotify demonstrated, on one side, the tendency to be exhaustive, defining multiple genres and sub-genres for single artists. For example, Madonna is marked as “pop” and “dance pop”, the English band Portishead as “electronica”, “laboratorio” and “trip hop”, and the famous piano player Liberace as “adult standards”, “easy listening” and “kermis”. Moreover, even if an exhaustive list has never been officialized, Spotify is supposed to contain an extremely high number of genres. Alongside well-established labels (e.g., “hard rock”, “techno”, “pop”, “jazz”, “industrial”, “indie pop”, “folk”, “classical”, “heavy metal”), Spotify includes very detailed (e.g., “British garage”, “Canadian contemporary r&b”, “LGBTQ+ hip hop”) and – sometimes – quirk categories (e.g., “animal singing”, “neo-singer-songwriter”, “wrock”). Spotify’s search engine allows queries by genre by typing “genre:name” in the search text box.⁵ On the other side, Spotify seems to deliberately ignore the pos-

⁵ If a search term consists of more than one word or includes special characters, the label has to be indicated between quotation marks.

sibility to assign genres to albums and tracks. The Web platform made this aspect clearly emerge, presenting the same information for all the tracks performed by the same artist. For the same reason, tracks with multiple performers have very long lists of genres, coming from the union of all the labels of each artist.

RQ2 focused on the dialogue between the music industry and streaming platforms such as Spotify in the definition of music genres. This relationship is made even more complex by the fact that the biggest major labels, i.e. Sony Music Entertainment, Universal Music Group, and Warner Music Group, partially own and/or have signed deals with Spotify [38–40]. Even if the Web platform does not offer functionalities explicitly conceived to address such an issue, use cases fostered some interesting considerations. For instance, Spotify’s playlist titled “This is Buckwheat Zydeco” (id: 37i9dQZF1DZ06evO1KdFST) contains 50 tracks whose genres are “swamp pop” and “zydeco” (*sic*): a curious case of overlap between genre (zydeco) and artist (Buckwheat Zydeco), maybe driven by commercial interests by the music industry. Furthermore, the phenomenon of advertised artists is out in the open. As an example, in 2019 Spotify added a feature that occasionally pops up a full-screen recommendation for a new album of interest for the user, based on a combination of his/her listening taste and human curation. This feature allows artists and their teams to pay to target their fans or acquire new ones potentially interested in their music.

A different phenomenon is the promotion of ad-hoc track collections by firms and companies to directly or indirectly advertise their products. Sponsored playlists, i.e. playlists where commercial products and services are advertised, are widespread, but a more interesting approach is that of branded playlists, where the advertising message is at the core of musical choices. Examples include the Martini music official playlist (id: 7LylxM89goS7AYsIIHUKKO) and the selection of Christmas songs by Coca-Cola (id: 6H2zbgZg8k6i9iq7r7a798). Though not directly traceable to the *music* industry, the intertwining between music and business is an emerging aspect that is worth studying. The target audience is very broad: in April 2020, Spotify was reported to have 286 million monthly users [41]. Tracking the evolution of the most popular playlists published by Spotify – one of the features of the *SpotiGeM* environment – can help understand to what extent such a streaming service can influence the habits and preferences of music listeners, and how advertising sponsorship initiatives affect (and are, in turn, affected) by such a phenomenon.

Finally, RQ3 addressed the way digital platforms influence the relationship with the concept of music genre in the individual music experience. The platform brings out different scenarios, namely the existence of commonly-accepted genres (e.g., “progressive rock”, “new wave 80’s”, etc.), recently defined categories (e.g., “Italian indie”, “djent”, etc.), and mood-based/situational genres (e.g., “good vibes”, “dark & stormy”, “Monday motivation”, etc.). Spotify and other streaming platforms can actively influence the three scenarios by redefining historical genres, aiming to frame emerging genres, and promoting algorithm-based affective

pseudo-genres. The Web platform we developed can play a concrete role in such an analysis, providing the possibility to empirically and innovatively evaluate the reconfiguration or generation from scratch of musical categories. The individual user's listening behaviors can be either assessed by themselves or compared with other users.

The results of the *SpotiGeM* project will be produced by scholars and experts in sociology and musicology, after multiple user sessions and focus groups. In this framework, the developed tool will play a fundamental role. The present paper, on one side, is a way to present the Web platform and the general project to the scientific community, and, on the other, aims to encourage further research on the subject.

6. CONCLUSIONS

SpotiGeM is a multidisciplinary project joining musicological, sociological, and digital competencies to analyze the complex and rapidly evolving phenomenon of digital music consumption via streaming platforms. Narrowing the field of investigation to a specific subject, the project aims to stimulate a debate regarding the definition and redefinition of the concept of music genre as a consequence of new models of music experience.

This paper has introduced the technological tool designed and implemented in the framework of *SpotiGeM* to support the musicological and sociological investigation. This is the first step of the initiative, namely an enabling technology to let experts from the mentioned domains conduct their research. Anyway, the valence of the Web platform, publicly and freely available, is more general. It can also be employed, e.g., as an alternative viewer for users' playlists, or as a way to unveil some hidden Spotify's characteristics, such as the extraction of track-by-track audio features.

Concerning the future development of the Web platform, we are planning to extend some of its functionalities and introduce new ones. Since *SpotiGeM* was a user-centered study, only playlist comparison was relevant for the goals of the project. Nevertheless, implementing album comparison could be useful to deepen the evolution of an artist (e.g., early vs. late albums of the Beatles) or match the musical production of contemporary performers (e.g., the Sex Pistols vs. the Clash).

Another future direction is the characterization of users via the creation of a profile page based on Spotify data. So far, the interface has been presenting the information from API calls with no other form of aggregation than playlists and albums. Conversely, synoptic tables and charts fed by a full load of Spotify data, possibly tracked over time, could effectively draw a comprehensive picture of users' listening tastes and habits.

Finally, we are studying the possibilities to generalize the described approach. We would like to turn a user-based application into a large-scale investigation tool, relying not only on selected users and focus groups but also on crowd sourcing and data donation from users. The final goal is the exploration of Spotify's entire genre space, the universe

of mood-based and situational playlists, and their mutual interactions.

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