Understanding Music Listening Intents During Daily Activities with Implications for Contextual Music Recommendation

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ABSTRACT

Why do we listen to music? This question has as many answers as there are people, which may vary by time of day, and the activity of the listener. We envision a contextual music search and recommendation system, which could suggest appropriate music to the user in the current context. As an important step in this direction, we set out to understand what are the users’ intents for listening to music, and how they relate to common daily activities. To accomplish this, we conduct and analyze a survey of why and when people of different ages and in different countries listen to music. The resulting categories of common musical intents, and the associations of intents and activities, could be helpful for guiding the development and evaluation of contextual music recommendation systems.

CCS CONCEPTS

• Human-centered computing → User studies; HCI theory, concepts and models;

KEYWORDS

contextual music recommendation; music listening intent

ACM Reference Format:


1 INTRODUCTION AND MOTIVATION

Music is an integral part of our life and accompanies us everywhere we go, from stores and cafes, to taxis and elevators. With almost ubiquitous smartphone and digital music player devices, listening to music continues to increase in popularity[18]. Hagreaves et al. [17] have surveyed people about their music listening habits, and concluded that people listen to music mainly during another activity (such as exercising or driving), rather than as a deliberate, exclusive process. This was true in 2004, and the trend has only increased in the following decade. 51.6% of people in the world (roughly 3.9 billion) and 82.6% of people in North America and Europe use the Internet [23], and 96% of Internet users consume licensed music, primarily (76%) via smartphones, which often accompany users through their activities [18]. Furthermore, most people discover music to listen to through recommendation or search (e.g., via services like Pandora, Spotify, or YouTube). For all these reasons, music recommendation is a critical and impactful aspect of the users’ online experience.

It is also widely known that people prefer different types of music for different activities [15, 17]. However, we hypothesize that even for the same activity, such as driving, people may want to listen to music for different reasons, for example, for relaxation, or for inspiration, or to aid concentration. Thus, in this paper, we introduce and study the concept of music listening intent, which we believe is an important component of contextual music recommendation. Specifically, our hypothesis is that there may be multiple music listening intents associated with each activity, and that in order to accurately recommend music to match the users’ need, a recommendation system must take the music listening intent into account.

We further hypothesize a correlation between activities and associated intents. That is, we hypothesize that a small group of intents cover a vast majority of music listening needs for each activity. Identifying this association would allow for more accurate modeling of the latent factors, such as intent, for predicting the music to recommend to the user, and would naturally support generalization (exploration) and diversification of the recommendations.

Next, we describe existing work on music recommendation (2), to place our work in context. Next, in Section 3 we describe our study methodology and data. Section 4 presents our findings and analysis. Finally, in Section 5 we discuss the implications of our findings and promising directions for future work.

2 RELATED WORK

Music recommendation has been extensively studied from different angles, taking into account a variety of features and factors, that could influence the users’ choices or preferences. The most common approaches are variations of collaborative filtering [21, 28, 29] and content-based filtering [12, 13, 27]. These methods perform satisfactory in the long run, but immediate preferences can be heavily influenced by a range of different factors and characteristics, which is generally referred to as ‘context’.

Context-aware recommender systems can be effective for immediate or online recommendations [2]. Several context representations have been studied with regards to music recommendations, including emotions and mood [3, 7, 16, 22], time of day and microprofiling [4], location [6, 8], weather [19, 30], and demographic information [31]. One of the most effective contexts is ‘activity’, which have been previously studied [5, 10, 21, 26]. These works have focused on the activity itself, and do not ask about the intent of listening, but rather map music recommendation directly to the activity. We go a step further, aiming to understand the intent of the user, as the reason for music listening may differ even for the same activity.
We now describe our survey-based methodology, which consisted of asking people why they listen to music, for what reasons, and we used a pilot survey, using the SurveyMonkey platform, where we refined the survey of activities and musical intents, which we then avoided 'pleasure' as an intent and 'listening to music' as an activity, providing a list of intents with their brief descriptions. We specifically viewed as "resource search", i.e., searching (or recommending) entertainment resources. Our goal, however, is to classify the type of music appropriate for a given situation, which is a more specialized task with different characteristics from general Web search intent. User intent was also previously studied for recommendation systems [25], but not specifically in the music recommendation field. To the best of our knowledge, this paper is the first to explicitly study music listening intent, and our work builds on the extensive research of intent classification in other domains.

### 3 METHODOLOGY

We now describe our survey-based methodology, which consisted of an initial pilot survey, followed by survey refinement and a large scale survey of a different, more diverse set of users, recruited via social media as well as through SurveyMonkey research panel.

To determine a list of relevant activities and intents or reasons, we used a pilot survey, using the SurveyMonkey platform, where we asked people why they listen to music, for what reasons, and during which activities. We provided a list of activities, during which people might listen to music, and asked them to provide their intents for each one, or to add new intents or activities if none matched their experience. 20 respondents participated in the pilot survey, allowing us to formulate a comprehensive list of common activities and music intents.

Table 1 provides a list of the available activities and table 2 provides a list of intents with their brief descriptions. We specifically avoided 'pleasure' as an intent and 'listening to music' as an activity, and we are trying to maximize pleasure of user by default, so there is no need to distinguish them. After analyzing the pilot results, we refined the survey of activities and musical intents, which we then posted on social media to recruit respondents. The responses were collected anonymously, and only after the respondents consented to participate in the survey as the first, required question.

The main part of the survey was the Activity-Intent matrix (Figure 2), for which the respondents were instructed to provide up to 3 intents for each activity. We also provided an empty field to add any other activity or intent we may have missed. Very few people proposed any new intents or activities, and those proposed activities or intents, were not directly applicable to our task. For example, two people mentioned 'listening to music to play it using musical instruments', which is a highly specialized intent applicable to only a small fraction of users who are seriously studying musical instruments. Thus, we are confident that our final survey captured the vast majority of common activities and music listening intents. We report the data collected with this survey, and the findings, in the next section.

### 4 RESULTS AND DISCUSSION

In this section we report the general user statistics and main distributions of intent and activity, followed by the more detailed analysis of intents for different activities and user demographics.

We received 166 responses from people 18-76 years old (average age: 37), responding from 12 countries: Belarus, Canada, Denmark, Germany, Hungary, Iran, Netherlands, Niger, Russian Federation, Spain, USA, and Ukraine. 81 of the respondents live in the Russian Federation (Russia for the rest of the paper), and 67 live in the USA. Thus, we report the results both for the whole dataset (N=166), as well as separately for subsets of respondents, namely those from Russia (N=81) and from the USA (N=67).

Figure 3b shows that younger people in Russia listen to more music than older respondents, with number of hours decreasing significantly with age. In contrast, respondents from the USA appear to listen to about the same amount of music across different age groups. Interestingly, ANOVA analysis shows that the difference between countries in terms of hours of listening per day is not significant enough (p=0.178).

Figures 4 and 1 report the distribution by age of the music listening intents, and distribution of listening intents for different activities, for all participants.

#### 4.1 Analysis of intent and activity popularity

Activities associated with music listening for Russia are distributed more uniformly than for the USA respondents: top activity for USA is driving, almost 2.5% more common than most popular activity in Russia – working. Interestingly, respondents from the USA do not report listen to music while eating, whether for concentration, motivation or inspiration, but primarily for relaxing (50%). In contrast, respondents from Russia listen during eating for distraction (26%), relaxing and mood control (23-24%). It is also interesting to note that shopping, eating, and showering are least popular activities for both countries, with 3% drop of popularity in Russia, and ~ 1 – 1.5% in USA. However, since these activities are rare, differences between countries may not be meaningful.

#### 4.2 Most popular intents for different activities

First, we compare the overall distribution of the most popular intents for all activities, with responses from all countries combined, in Figure 5a. The figure shows that the dominant intents are Mood...
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5 DISCUSSION AND FUTURE WORK

One limitation of the survey-based method is that people may not accurately recall their intent or motivation for listening to music. However, we believe that in aggregate, collecting a sufficiently large number of survey responses, as we report in this paper, identified the most common music intents for common activities.

If we are able to more accurately infer music listening intent, it would enable more accurate and effective music recommendation. A natural follow-up to this work is evaluating and quantifying the actual improvements that could be achieved by these additional factors, e.g., by reducing uncertainty about the most likely intents for a given activity. To accomplish this, we plan to build on existing work on recognizing activity [13, 24, 26] and matching music with activity [1, 14], but extending the model with the (latent) intent factor, informed by the prior intent distributions for each activity.

In summary, we introduced the concept of music listening intent, and showed intent to be distinct from the context (i.e., user’s activity). Our empirical findings provide valuable initial data about musical intent distribution for different activities, which could be ultimately incorporated into more effective and accurate contextual music recommendation systems.

REFERENCES

Figure 4: Music listening intent distribution by age groups: overall (a), in the USA (b) and in Russia (c).

Figure 5: Intent distribution across activities: for all respondents (a), separately for Russia and USA (b).