Just Give Me What I Want:
How People Use and Evaluate Music Search

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ABSTRACT

Music-streaming platforms offer users a large amount of content for consumption. Finding the right music can be challenging and users often need to search through extensive catalogs provided by these platforms. Prior research has focused on general-domain web search, which is designed to meet a broad range of user goals. Here, we study search in the domain of music, seeking to understand how and why people use search and how they evaluate their search experiences on a music-streaming platform. Over two studies, we conducted semi-structured interviews with 27 participants, asking about their search habits and preferences, and observing their behavior while searching for music. Analysis revealed participants evaluated their search experiences along two dimensions: success and effort. Importantly, how participants perceived success and effort differed by their mindset, or the way they assessed the results of their query. We conclude with recommendations to improve the user experience of music search.

CCS CONCEPTS

• **Information systems → Music retrieval**; • **Human-centered computing → User studies**;

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KEYWORDS

search, mindsets, music, user behavior

1 INTRODUCTION

For many, music consumption is an integral part of their daily lives, driven by emotional, social, and cognitive motivations [14]. Over the past few decades, how people access music has shifted rapidly, moving listeners from physical storage devices like records, cassettes, and CDs to digital storage on computers or mobile devices in various contexts.

Most recently, music streaming has obviated the need for storage at all, allowing listeners to access immense music catalogs on demand anywhere with an internet connection on a variety of devices. This development makes easy navigation to the content people want crucial. As a result, these platforms have developed strategies to assist users in discovering and finding the music they want to hear. One such way is through algorithmic recommendations which use data about content and users to help guide users to music [9, 12].

Another way that users can access music on a streaming platform is through search. Search allows users to sift through vast amounts of digital information rapidly, and users can make queries to find music they want to consume. Prior research on general web search has focused on broad user goals, distinguishing between navigational, informational, or transactional needs for example [7, 34]. Further research has distinguished vertical search from general web search as domain-specific search areas (e.g., product, image, or local search [5, 40, 46]). Research on vertical search has extended and refined the concepts of the broader user goals

from web search to describe more specific information needs of users searching in these domains. This research illuminates how narrowing in on the specific goals can improve our understanding and evaluation of search for those contexts. Similarly, we suggest that users of vertical search in music may have distinct and more specific goals than users of general web search, which merits a separate investigation.

Prior HCI research in music has focused on how music sharing influences impression management [44], how users organize their personal media libraries [4, 21, 35], novel interaction techniques to support music creation [3, 19, 20, 41], and social practices surrounding music listening [8, 26, 31]. McMillan et. al. [27] have investigated how the affordances of cloud-based music streaming have changed sharing and gifting music. How users search for music in a cloud-based ecosystem with a catalog larger than one's personal archive, however, is relatively underexplored in HCI.

The present research extends existing literature in domain-specific search by understanding user goals and experiences within the context of the latest music technology, specifically search within the Spotify app. We present two qualitative studies, following an approach adapted from grounded theory [13] with a phased structure that uses learnings from the initial study to design the subsequent study to explore and develop emerging concepts more fully. In particular, Study 1 aimed to understand how participants search in Spotify and identify how they define good and bad search experiences. Study 2 was designed to verify and deepen our understanding of key insights from Study 1. Over the two studies, we conducted semi-structured interviews with 27 Spotify search users. Our qualitative, iterative approach allowed for a deep understanding of search in music streaming to provide recommendations for music search design and evaluation.

For the purpose of this work, we focused on search in Spotify, which is available on mobile devices with a large user base and an extensive catalog of music. The Spotify search feature requires users to type into a search bar located at the top of the screen and relies on an instant search system, which updates the search engine results page (SERP) with each keystroke. The SERP features a single top result displayed prominently at the top of the screen. For some artist or genre searches, the SERP includes a carousel of relevant playlists that users can scroll through horizontally underneath the top result. Other relevant results follow, clustered according to entity type in the following order: songs, artists, podcasts, albums, playlists, podcast episodes, and profiles (of other users). In addition, users can click on a context menu for each song result, where they can save the song, add it to a playlist/queue, share, go to song radio, view the album/artist, report explicit content, or see song credits.

We learned that Spotify users had four overarching goals driving their search use: listen, organize, share, and fact

check. Moreover, users evaluated experiences with search along two dimensions: success (finding what they sought) and effort (the amount of work needed). Importantly, how participants perceived success and effort differed by their mindset, or the way they assessed the results of their query. Most often, participants approached search with a focused mindset, seeking one particular thing. At times however, participants reported searching with an open mindset, having only a seed of an idea in mind when searching, leaving them open to suggestions. Rarely, participants searched in an exploratory mindset, where they wanted to learn about a new area of music that they did not know well. The existence of distinct mindsets during music search has implications for design and evaluation. Our core contributions include:

- Identifying user goals specific to search on a music-streaming platform
- Uncovering how users themselves evaluated their music search experiences (success and effort) and identifying mindsets as a key construct that influenced how users perceived their own success and effort
- Using a deep understanding of user goals, mindsets, and evaluation in music search to make recommendations to improve the user experience of music search and propose future work in user-centric evaluation.

2 BACKGROUND AND RELATED WORK

Researchers in music psychology have put considerable effort into understanding how and why people listen to music throughout their daily lives. Researchers have found that people use music for a variety of purposes including mood regulation, self-expression, and social connection [29, 38, 42], along with more passive purposes like passing time, creating an atmosphere, or out of habit [28]. In addition, researchers have found that music listening tends to be context dependent, especially shaped by the listener's location and activity and note the prevalence of listening at home and the preference for listening by oneself for greater control over the music [28, 38]. More recent research has revisited location-based listening and device use in light of technological changes like music streaming, which allow people to listen more often and in more places under their direct control [23]. Contrary to the prediction placed by North et al. [28] that technology would increase people's passivity toward music, Krause et al. [23] found mobile device and computer music listening to be associated with active construction of listening experiences.

One theme in music-focused research within HCI and CSCW focuses on music sharing and exploration supported by these shared catalogs. From the era of peer-to-peer sharing, past research has focused on the ethics and practices of sharing and consuming music not owned by the listener [8]. In this context, the available catalog of music grew due to the

larger networks of users sharing music. Searching for music in these networks became a social practice, as users began to follow catalogs or others' searches. In work by Voida et al. [44] on organizational usage of a shared iTunes library, users explored available music within shared collections through the lens of who was sharing the music and were limited by what music was accessible to them at the time. More recently, Leong and Wright [26] observed that the rise of streaming media services and their design supported discovery of content through the ability to search and browse.

Another line of research has examined how music fits into people's lives through the lens of organizing music collections. Jones et al. studied how individuals built, maintained, and used their personal music collections (primarily CDs and MP3s) to inform what habits and preferences should be supported in the design of a digital music library [18]. Vignoli [43] explored what alternative attributes (e.g., tempo, mood, year) people would like to use to organize digital music, and found biographical information and song/artist similarity to be the most important attributes. More recently, Chamberlain and Crabtree [10] investigated how people used metadata in discovery, acquisition, processing, and organization of music. They found that people piecemealed together their own systems in ways that were often incoherent, frustrating, changing, yet ultimately usable. They concluded that these fragmented systems were ripe for improved system design.

As mentioned earlier, research in general web search has focused on user needs to address multi-domain, general-purpose search interfaces. For instance, Broder [7] defined three categories of searches: informational, navigational and transactional. Informational searches describe when a user is looking for information on a topic, while navigational searches happen when a user wants to find a specific website. Transactional searches occur with an intended action in the end, like purchasing a product or downloading content. Within the context of search in a music catalog, transactional searches (most often when a user wants to find music to play) are likely to greatly overshadow informational and navigational searches. Rose and Levinson [34] replace the concept of transactional search with a more general resource search, that can be further broken down into more specific goals. Most relevant to the present research is the resource goal to entertain, which could represent music listening.

Whereas many researchers have relied on methods that go directly to the music listeners to understand needs and habits, others have approached the question by interpreting music query contents. Bainbridge et al. [2] analyzed over 500 real world music queries from Google Answers to understand how users express their music needs. They found that users typically expressed needs through bibliographic queries, using performer, title of work, or date of recording. Genre, lyric fragment, and location of the performance or

broadcast were also relatively common, while the remainder were fragmented across queries like similarity to other works, tempo, and affect. Lee [25] built on this research with an in-depth content analysis of Google Answers queries, creating a more complete taxonomy of music needs and arguing for the continual refinement of music information needs. While these studies take user input into account by analyzing their queries, they can only go so far as to infer user needs. More recently, Volokhin and Agichtein [45] surveyed users to obtain data about their intents when listening to music and what daily activities were mapped to these intents.

Despite the research described above, the music information retrieval community relies almost exclusively on system-based, rather than user-based, evaluation [16]. While there are some exceptions of user studies that directly elicited feedback from users [12, 32, 33], user-centered evaluation is far from the norm. The web search literature has put relatively more effort on user-oriented evaluation. User satisfaction [1], effort [15, 30] and usefulness [11], among others, have been proposed to capture how users experience a system.

In the present research, we studied search within a specific music-streaming platform: Spotify. The ubiquity of music listening within people's lives coupled with virtually limitless music catalogs afforded by streaming services makes it important to understand how people use and evaluate these search systems. We take a qualitative approach to ensure a deep understanding of user goals within the system and allow users themselves to describe how they evaluate it. This methodology provided rich insights to inform recommendations for design and evaluation of music search systems.

3 STUDY 1

Study 1 aimed to understand the user experience of search within Spotify to form hypotheses about user goals and the meaning of user behavior. We conducted semi-structured interviews to address three primary research questions:

(1) How and why do participants use search on the music-streaming platform?
(2) How do participants define the quality of their experience in search (i.e., a good versus bad experience)?
(3) What factors shape users' perceptions of good and bad experiences?

Method

Participants. We recruited 14 participants from the Boston area through our user base via email. We included four cohorts who varied on two dimensions: subscription type (free vs. premium) and account age (new: <1 month on the platform vs. experienced >3 months on the platform). We chose these dimensions to ensure that both subscription levels were represented in data collection as free users have certain

restrictions (e.g., free users cannot play specific tracks on demand) and we believed that search habits may evolve over tenure with the platform. Participants ages ranged from 18 to 40 and included 5 females and 9 males. In addition, we wanted to represent a range of search behaviors, so we selected participants with varying search frequency (7 - 167 searches in the month prior to the session) and average length of time per search (2.58 - 35.45 seconds per search). Participants received a $100 gift card as compensation.

Procedure. We conducted 60-minute semi-structured interviews with each of the 14 participants individually. We began by discussing music tastes and habits more broadly and then narrowed the conversation to the search function in Spotify. The discussion around search started with how participants felt about search, namely their attitudes, expectations, and preferences. We then asked participants to describe how and why they typically used search, first from their own memories and then referencing their recent search history, walking us through several specific searches. Next we asked participants to describe an experience with search that went well for them and an experience that did not go well. As they described these experiences, we probed around specific actions they took within the app as a function of the quality of their experience. We asked for additional examples of good and bad experiences until participants could not remember any more examples. Finally, we completed the interviews with a deep dive into 31 specific interactions that users can take while searching, asking if they had ever performed that action while searching and why or why not.

Data Analysis Strategy. We analyzed the data inductively with an approach based on thematic analysis [6]. Though there is an extensive literature on user motivations and experiences with search [17], we wanted to allow for new themes and insights to emerge, especially in the specific context of searching in app for music. To begin, one researcher went through all videos and transcripts generated from interviews to become fully immersed in the data and develop a cursory set of codes to be used in later phases. To preserve each participant's holistic experience, we took several passes through each participant video and corresponding transcript to document relationships between the codes within each individual. In the following phase, we carried out the coding of data using an open-coding system to allow for flexibility and refinement of codes. More specifically, we allowed for new codes to emerge if they did not fit cleanly into existing codes and for the codes to evolve if the definitions were too narrow or too broad. Once we settled on codes, we began to identify themes looking at the relationships between codes to create meaningful themes and sub-themes, which we continuously reviewed against the codes and associated data. We refined

themes as needed to account for the data. From there, we defined the themes that we identified and organized them into a coherent set that fit together to capture the experiences of the participants. Below, we describe these themes as they relate to our primary research questions.

Results

How did participants use search on Spotify? Participants viewed search as a high-control method for navigating to music. The typical search journey was as follows: participants typed into the search bar, evaluated the top result, at times clicking on artist or other pages in the process, and ended when they found what they sought, gave up, changed their minds about what they wanted, or got distracted.

Participants mostly focused on the top result for most searches and would often refine or reformulate queries until the top result was a suitable match. When this strategy failed, they would either scroll through the SERP or click through other pages to navigate to what they wanted (e.g., go to an artist page to find a specific song).

Bibliographical queries were most common amongst our participants, in line with previous research [2, 25]. Specifically, artist was most common, followed by track, album, genre, activity, mood, decade, or a combination. These queries did not always match the exact content participants wanted to find. Artist in particular was used as a catch-all that could be a proxy for track, album, genre, activity, mood, or decade.

Participants evaluated their search results through sight first, reading and determining if the result was accurate. At times, however, sight was not enough. Then, participants would evaluate through sound, listening to a snippet of a song to determine if it matched what they wanted to find.

During more difficult searches, participants would typically try other strategies until they found what they wanted. They would give up the search if they felt they had exhausted the strategies they knew (often concluding that Spotify did not have what they wanted) or time constraints (self-imposed or otherwise) led them to abandon in that moment.

Why did participants use search on Spotify? Participants described many reasons for using search, which we coded into four overarching goals: listen, organize, share, and fact check.

Listen. The most common goal by far that participants described was listening to content. Every participant talked about this goal as a very common use of search. The goal to listen emerged in many forms, for example background listening, activity-specific listening, trying recommendations from friends, preparing for a concert, and keeping up with current music. While this goal was described in many different capacities, all descriptions were unified by the intention to initiate or continue a listening session.

FOCUSED MINDSET One specific thing in mind	OPEN MINDSET A seed of an idea in mind	EXPLORATORY MINDSET A path to learn

SUCCESS PERCEPTION

Binary	**Non-binary**	**Unknown**
● Don't find it ● Find it	● Nothing good enough ● Good enough ● Better than good enough	● Difficult for users (and us) to assess success of exploration in the moment

EFFORT TOLERANCE

Low tolerance	**Medium tolerance**	**High tolerance**
● Quickest/easiest path to success is important	● Willing to try some things out ● But still want to get to their goal efficiently	● User's intention is to be active in the discovery process ● Effort is expected

Most Common ◄———► *Least Common*
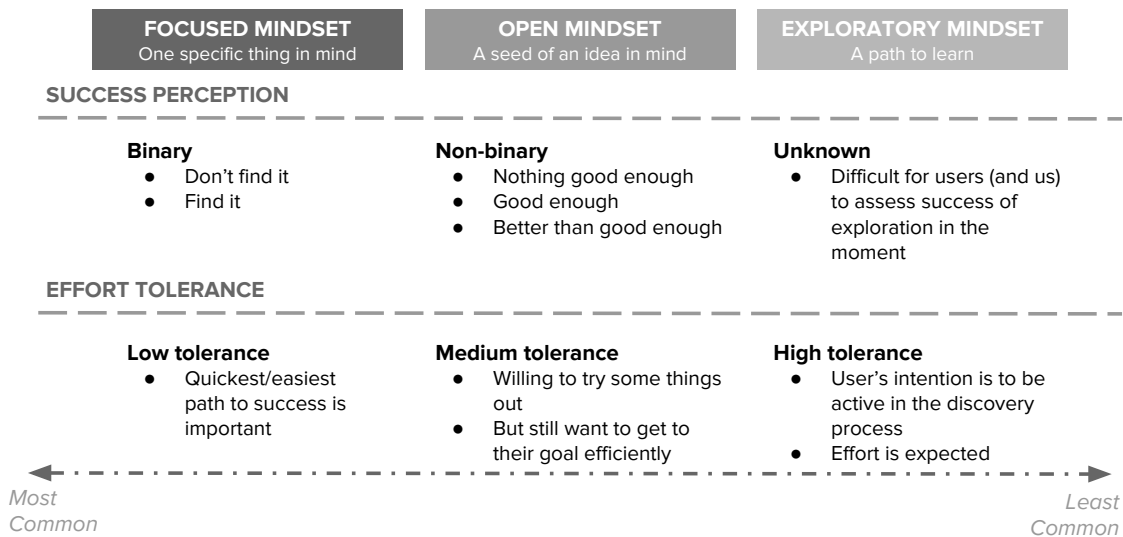
Figure 1: Study 1 identified three mindsets with which users approach music search: focused, open, and exploratory. Mindsets influence users' perceptions of success and tolerance for effort in a search task.

Organize. The next most common goal that participants described was organizing content. Twelve of the 14 participants talked about using search for organizing content, but they typically said that this goal happened less frequently than the listening goal. More specifically, organizing refers to using search to grow and structure their own collection, so they can more easily locate that content in the future. Participants spoke of using search to organize their collections through adding tracks to playlists, saving tracks to their library, and following artists and playlists.

Share. Much less common, participants indicated that they used search for sharing music. Five participants reported that they would occasionally use search to find music to pass along or look up a friend's profile, so they could stay up to date with their playlists and listening. Participants fulfilled these goals by sending tracks to friends (typically via social media or messaging) or following their friends' profiles.

Fact check. The least common goal that emerged was using search to gather information. Two participants reported using search to check their own knowledge about a track (e.g., determining if they could identify a song played on a TV show), gather information about an artist, or learn about upcoming concerts nearby. This goal was not associated with any action beyond searching and maybe clicking on an entity page (e.g., an artist or album page).

How did participants define the quality of their experience in search? Participants described their experience with search along two dimensions: success and effort.

Success. Success was perceived as relatively straightforward to participants, meaning they were able to find the content they sought. This could manifest as one specific artist or track that the participant was looking for, as it was for P10: "*I always have something in my mind when I search, right? And I always expect that the exact something.*" Alternatively, if there was no specific content in mind, they wanted a relevant decision set, as it was for P2: "*If I'm doing really a broad search, like Bollywood, I am expecting it to give a broader set of results... like current movies or 90s Bollywood.*" This distinction poses a challenge for search, making it unclear whether to surface content that is an exact match versus content that matches the spirit of the query. Conversely, participants described a failed search as one in which they were unable to find the content they sought. Typically this was interpreted as the content missing from the catalog, but sometimes left participants wondering if they had searched the right terms, as described here by P13: "*The worst is when I want to listen to a song or album and it's not there. Sometimes I can't tell if it's not there or I just can't find it.*"

Effort. Though participants were most concerned with finding the content they sought, they ideally wanted to get there with minimal effort. Ideal search experiences were characterized by easy access with limited reading, typing, scrolling, and clicking needed to arrive at the right content. This desire was summarized nicely by P11: "*A good experience would be having popular or relevant results be very obvious to me and be very easily accessible, no having to type or click or scroll through too many different screens or things to get to exactly what I want.*" High effort searches were more prevalent for participants who searched for albums or playlists they

themselves had made, as that type of content was typically not featured prominently on the SERP. Most of the effort-based frustrations revolved around needing to take more actions than expected to locate the desired content. However, several participants noted effortful experiences even after they found the content they sought. More specifically, when participants with a listening goal listened to a song from the SERP, the platform continued the session by playing the next song on the SERP rather than a song related to the song selected. This forced participants to exert extra effort to continue their listening session. For organizing goals, three participants noted that adding to a playlist required extra effort and was unintuitive from the SERP, as this action is only available through the context menu.

What factors shaped how participants perceived success and effort? While success and effort were dimensions that every participant used to describe their search experiences, exactly how participants perceived these dimensions differed systematically. More specifically, when participants described individual search sessions, they differed in their mindset, or how they evaluated search results. Three distinct mindsets emerged from the interviews: focused, open, and exploratory.

Focused mindset. Most often participants described their search experiences in terms of navigating to a single, specific entity, like an artist, track, or album. P12 described this mindset clearly: "*Usually I'm pretty focused when I use Spotify. Generally, I have an artist or band in mind that I'll search for.*" In a focused mindset, participants knew the exact entity they wanted to find before they began searching and tended to type track name, artist, or album name as their queries.

When searching with a focused mindset, participants considered success to be binary; they either succeeded in finding what they sought or they failed. In terms of effort, they had low tolerance, wanting to get to what they were looking for with minimal scrolling, clicking, and time. Every participant discussed several instances of focused mindset searching.

Open mindset. Most participants reported that at times they searched for content with no specific thing in mind. Instead, they typed in a seed of an idea of what they felt like listening to and were open to suggestions. That is, when they began the search, they did not know what exact entity they wanted to find. For example, P4 described this when searching for music to listen to while to working out: "*A lot of those searches are workout based... usually I just put in 'cardio running' and find a bunch of them and preview some of them to see if it looks like my type of music and then go for it.*" While activity or genre queries were the most typical for open mindset searches, sometimes participants used artist as a proxy to find relevant music suggestions.

Unlike with focused mindset searches, when searching in an open mindset, success was not binary. Rather, search

results could provide varying levels of success: a great recommendation, a good enough recommendation, or no recommendations that were worthwhile. Also distinct from focused mindset searching, effort was a more expected and tolerated aspect of the search experience for open mindset searches, as characterized by P6: "*I don't necessarily think there's bad search but sometimes you do you have to kind of go through a few playlists or a few albums to really find the one.*" While 11 of the 14 participants described at least one instance of searching with an open mindset, they all reported searching with a focused mindset more often.

Exploratory mindset. A final and rare mindset uncovered through our interviews was the exploratory mindset, which was defined by using search to more deeply learn about a specific area of music. P8 described an example of this mindset: "*I've had an interest in French rap... so there's one artist I know, his name is Stromea. So, I'll find his song but then I don't really know where to go from there. This is all completely uncharted territory for me... I can play these but I wouldn't know where to go from here.*" In the exploratory mindset, participants tended to type genres or artists.

While searching in an exploratory mindset, participants were uncertain if their searches were successful in that moment because they did not know enough about that area of music to be sure they had found what they were seeking. Therefore, they could get a sense of whether or not they liked the content they found, but liking the content was orthogonal to success in this mindset. Rather, success meant finding content that was a strong representation of the music they were trying to learn about, and participants did not have the necessary knowledge to feel they could make that evaluation. This was fundamentally different from the evaluation of success in the open mindset, which tended to be based on liking the content. In terms of effort, participants tended to be very tolerant of effort in this mindset because they anticipated needing to try out a variety of content. Two participants reported exploratory mindset searches and neither searched in this way often, as they felt that search was a difficult tool to use in this mindset. Figure 1 provides a summary of how success and effort perceptions differ by mindset.

Importantly, we found mindsets and goals to be distinct constructs, as they could exist in any combination. For example, across the interviews, we uncovered distinct instances where an organize goal was approached with a focused, open, or exploratory mindsets. That is, when making a playlist, participants could be searching for specific pre-determined tracks (focused mindset), tracks that fit the general vibe of the playlist (open mindset), or tracks from a genre that was new to the participants (exploratory mindset).

Additionally, we found that mindsets did not appear to be a simple individual difference, as many participants described different mindsets across searches. P11 summed this switch

up nicely: "*When it's really crucial that I am like, 'I need to find this right now,' and I kind of want it to be very exact, and there's other times where I don't kind of care what it pulls up and I am just kind of looking for whatever, so in those times, I want it to kind of give me what it thinks I want, really.*"

Study 1 uncovered mindsets as an important construct to understand how participants experience and evaluate searching on our platform. We designed Study 2 to expand and deepen our understanding of mindsets within search specifically and on our platform broadly.

4   STUDY 2

Study 2 was as a second phase to deepen our understanding of the mindset framework that came out of Study 1. First and foremost, we wanted to learn more about mindsets as they apply to search. In addition, we were also interested in understanding if and how mindsets are relevant for finding content more generally. In particular, the aim of Study 2 was to better understand the perceptions of success and effort for different mindsets in search. The secondary aim was to explore mindsets from a broader perspective. Thus, the research questions of Study 2 were:

(1) How do search behaviors and perceptions differ across mindsets?
(2) How stable are mindsets for individuals across time?
(3) How are mindsets related to navigating to content more generally?

Method

Participants. We recruited 13 participants from the Boston area through our user base via email. Because we wanted to more deeply understand mindsets, we built cohorts meant to capture participants with different propensities toward each mindset. Based on the results of Study 1, we determined that focused mindset may be related to track and album searches, whereas open mindset may be related to playlist and genre searches; we did not have enough information from Study 1 to confidently relate the exploratory mindset to any particular entity. We used entity click to define four different interview cohorts: Focused, Open, Mixed, and Ambiguous. Participants in the Focused cohort had over 65% track and album clicks, participants in the Open cohort had over 65% playlist and genre clicks, participants in the Mixed cohort belonged to neither of the above groups and had less than 25% artist clicks, and participants in the Ambiguous cohort did not fall under any of the above definitions and likely had mostly artist clicks. These definitions were approximations and sample sizes within each small. Thus, while cohorts helped us to represent a range of search users, we do not compare directly between cohorts in our findings. Our total sample consisted of 13 participants with 5 females and 8 males, ranging in age from 20 to 44. Participants received a $100 gift card for their participation.

Procedure. We conducted 60-minute semi-structured interviews with each of the 13 participants individually. The interview consisted of three phases: discussion on how they find music on Spotify (talking about their behaviors, habits, preferences), deep-dive into past search usage, and a task completion exercise where participants performed one focused, one open, and one exploratory search. The deep-dive into past search usage was a sorting task, where we presented participants with several of their past searches. For each participant, we selected up to 9 searches from the two weeks prior. Participants saw a summary of the actions they took within each search, which included the query along with any significant changes to it (e.g, adding or deleting long strings) and entity clicks. We asked participants to classify their searches into three different categories: "I knew exactly what I wanted" (focused search), "I was open to suggestions" (open search), and "I was exploring a different kind of music" (exploratory search). Participants were encouraged to guide the interviewer through their reasoning while they classified their searches. At the end, we asked participants to use Spotify to: "find something when you know what you want" (focused mindset), "find something when you have a seed of an idea in mind, but are open to suggestions" (open mindset), and "find something when you are exploring a different kind of music" (exploratory mindset). If their go-to behavior was not search, we followed up with asking if and how they have used search for the given scenario.

Data Analysis Strategy. We used a deductive approach to generate insights, using the mindsets framework from Study 1 to serve as a lens through which to examine the data from Study 2. First, two researchers assessed the sorting task and re-sorted the searches they judged to fit better in a different category based on participants' thought processes during classification. The researchers reclassified 22 of the total 103 searches, meaning participants mostly understood the sorting task well, as their thought processes about the search typically matched their classification. Next, one researcher created a template for taking detailed notes that was derived from the frameworks (success, effort, mindsets) generated in Study 1 and allowed us to retain a holistic and in-depth understanding of each participant. To complete the template, the researcher watched the interview videos, read the transcripts, and looked through the sorting task using codes generated from Study 1. This coding system focused on success and effort in search, and mindsets in search and beyond. While we primarily used existing codes, we also allowed for new codes, especially when interpreting data around stability of mindsets and applicability of mindsets more broadly than search. We also allowed for refinement of codes, especially

revisiting definitions of success and effort by mindset. The emergent themes are described below.

Results

How did search behaviors and perceptions differ across mindsets? Descriptions of search usage aligned closely with the initial mindsets framework. Through the card sort exercise, we were able to take a more in depth look at the prevalence of each mindset, the corresponding search behaviors, and perceptions of success and effort within each query.

Search behaviors and mindsets. Participants searched most often with a focused mindset. Of the 103 search sequences we presented to 13 users, 61 were classified as focused (59.22%), 26 as open (25.24%), 8 as mixed (focused/open; 7.77%), and 3 as exploratory (2.91%); participants couldn't recall conducting 5 of the presented searches (4.85%).

Furthermore, we uncovered two factors for differentiating mindsets: entity click and query length. In particular, for focused searches, most entity clicks were track (26), followed by artist (16), playlist (11), and album (7). In contrast, for open searches, most entity clicks were artist (10) or playlist (8), followed by genre (4), track (2), and radio (2). Importantly, artist clicks signified a different search target for focused compared to open mindsets. Artist clicks in a focused mindset meant participants wanted to find one specific entity by that artist, whereas in an open mindset participants were open to finding multiple entities from the artist. In addition, focused search queries tended to be longer than open search queries. A Mann-Whitney-Wilcoxon test revealed a significant difference between the focused (median = 8) and open (median = 7) query length, W = 556, p = .02. We did not have enough data to draw inferences about exploratory searches.

Perceptions of success and effort across mindsets. As in Study 1, we found perceptions of success were different in focused and open mindsets, and participants were unable to judge success in an exploratory mindset. Participants considered focused searches successful as long as they got what they sought, regardless of effort. In open mindsets, success was more related to listening experience than search experience. Participants considered an open search successful if they found relevant content, but they perceived it as a great experience if they found content they really liked. Interestingly, we observed mindsets change within a search session, so participants sometimes became open to a "wrong" result following an effortful and unsuccessful focused search. Though these participants were unable to find the content they initially wanted, they sometimes considered these searches successful anyway.

Further supporting Study 1 findings, perceptions of effort differed between focused and open mindsets (data on exploratory mindset were scarce). In particular, focused and open mindsets differed in which behaviors they perceived to be effortful. These differences seemed to stem from differing expectations around when participants believed effort would be likely or necessary. When searching in a focused mindset, participants expected queries would need to be precise, and thus tended to be somewhat tolerant of effort while typing. That is, participants did not mind some level of refining queries, involving character deletion, addition, or both, or refining the query with help from Google (e.g., using Google to search for lyrics to find the track name and then return to Spotify). Beyond typing, however, they did not expect to exert much effort, as they expected an accurate top result. Therefore, in a focused mindset, participants tended to be less tolerant of behaviors like scrolling, clicking, viewing, and listening, and any lower rank click was perceived as effortful. In contrast, when searching in an open mindset, effort was relatively more expected while considering search results, rather than while typing queries. Participants expected to look at more than one result to find what they wanted (and at times even welcomed this process), and thus were often relatively more tolerant of scrolling, clicking, viewing, and listening while searching in an open mindset.

How stable were mindsets for individuals across time? Overall, we found that mindsets in search were stable for some participants, but most often varied within participants between sessions, and occasionally shifted within a single session. In particular, some participants reported doing only focused searches, but we found no such singularity for open or exploratory searches (though a sample this size cannot rule out the possibility). Those who consistently searched with a focused mindset tended to do so out of habit, reporting that they always searched that way or they were unsure how to use search differently. However, the majority of participants classified searches in more than one category, meaning they shifted mindsets between search sessions. Shifting mindsets between sessions could be related to the context in which they conducted the search. For example, some participants reported conducting focused searches when they were alone and wanted to hear something stuck in their head; others reported more open searches during parties, where they wanted to play background music. Lastly, there were instances of participants shifting mindsets while searching, which could be related to the effort and success of the initial search. The only shifting pattern we observed was from focused to open mindset, which happened after two different types of searches. It was most common after a participant had an effortful and unsuccessful focused search. That is, sometimes when participants did not find what they wanted, but still wanted to listen to content, they would become more open to accepting different results, hoping it may lead them to music they would enjoy. Shifting mindsets also happened occasionally after a successful focused search. For example,

after successfully finding a specific song, participants would become more open to related content.

How did mindsets relate to navigating to content more generally? We found that participants tended to use different avenues to navigate to content depending on their mindset. In focused mindsets, participants reported using search most often, specifically to find tracks, artists, albums, or their own playlists. In open mindsets, participants most often reported going to their library to access their own playlists or saved music. This was often seen as easier than searching because it did not require participants to have a fully formed articulation of what they wanted in order to find relevant content. Finally, looking for music in an exploratory mindset was rare, so some participants reported they did not use Spotify in that way. Those who did most frequently used Browse, which is a function that allows users to view playlists classified according to genre; discover tracks, albums, or artists; or play Top Charts by country.

5 DISCUSSION

Music streaming is the most current technology for listening to music and curating music experiences, and adoption of this technology continues to grow. A large part of the appeal of music streaming is that it affords people access to a catalog of music that is beyond what was previously feasible in size for most people with local physical and digital storage devices. The vastness of this catalog makes surfacing the content non-trivial. Search is an intuitive and effective way to put control in the hands of users, and it is therefore crucial to understand how and why people use this system so that we can design the best search platform for their needs.

The present research sought to understand how and why people search on Spotify and to characterize what makes a good versus a bad experience from the user's perspective. Previous work has studied people's goals with music more broadly through rich, qualitative methods [18, 22, 29, 37, 42] or more specifically through analysis of music web search logs [2, 25]. The former lacks the specificity to translate directly to search in music streaming, and the latter lacks input from the users themselves, relying heavily on inference. Our approach aimed to fill this a gap in our understanding of search in music streaming through qualitative methodologies. We uncovered four overarching goals of search in music streaming: listen, organize, share, and fact check. The querying strategies for achieving these goals (i.e., the queries that participants type) did indeed align with previous work [2, 25]. However, the present work builds on that knowledge by demonstrating that knowing the query contents alone is not sufficient for inferring the user's goal nor for inferring the specific content they want to find. Instead, goals were related to the action that participants took after the query

(e.g., streaming or adding to a playlist), while the specific content they sought was obscured by the prevalence of proxy searching, typically using artist names as a proxy for finding a variety of content, including track, album, genre, etc.

We also studied how users evaluate search in music streaming, digging into what they consider to be good and bad experiences with search. We found that participants evaluated search on the dimensions of success and effort. While these dimensions are not new for search evaluation [15, 47], we validated and defined what these dimensions mean from the user's perspective. Importantly, we found mindset, or the user's approach to evaluating search results, to affect how users perceived success and effort. A focused mindset search was characterized by a binary perception of success and low effort tolerance. An open mindset search was characterized by a gradient perception of success and relatively higher effort tolerance. An exploratory mindset search was characterized by uncertainty of success and the highest tolerance for effort, as participants went into this search with an expectation that they would need to guide the experience.

In our second study, we found that participants often searched in different mindsets, and occasionally changed their mindset while searching. This observation aligns with previous work showing that people can change their information problem, searching, and personal knowledge while using search [39]. Thus, when studying, designing, and evaluating search, it is important to keep in mind that rather than being static, search is a dynamic process which involves change in the users themselves.

Finally, we found that mindsets were relevant to finding music on the platform more broadly than search. Participants reported using different navigational features within the app as a function of their mindset. They most commonly reported going to search with a focused mindset, their own library with an open mindset, and Browse with an exploratory mindset. This aligns with previous research that showed exploratory searches in an online library may be better supported outside of search and elsewhere on the platform [24].

Design Recommendations

Our analyses revealed several ways in which the design of our search system was misaligned with the habits, mindsets, and goals of our users. We use these misalignments to form recommendations to improve the design of the search system and experience of the user.

Autosuggest. The current search system relies on instant search, which populates a new SERP with a new top result for each keystroke. Our studies revealed that participants usually ignored everything but the top result, in practice using it as a single option autosuggest. Autosuggest would reduce typing effort and typing errors and allow the system to gain a more complete search query before returning a SERP. This would

also allow for a more cohesive SERP experience that revolves around a complete query rather than a partial query.

SERP layout and content. Our analyses demonstrated that most of the SERP was often ignored, in large part because the contents reflected only a partial query rendering many results irrelevant. Autosuggest would remove that problem and create opportunities to map the layout to search mindsets. More specifically, we learned that most searches occurred in a focused mindset, so the top of the SERP would include the closest match entity, alongside directly related entities based on the user's past listening or popularity. Below the top content would be content designed to map to an open mindset, specifically playlist or album recommendations that relate to the query. The content presented at the bottom would map to the exploratory mindset, inferring a relevant genre from the query contents and providing a set of playlists to guide the user through an exploration of that genre. To make this layout more concrete consider an artist search, which is the most common query type. The top (focused) section would include a link to the artist page, followed by the songs that the user has listened to most by the artist, or if the user has no listening history with that artist, the artist's most popular songs. The middle (open) section would include playlists or albums featuring that artist, again taking user habits into account. More specifically, participants in our studies often demonstrated a propensity toward album vs. playlist and we could use those habits to inform which entities we prioritize. Finally, the bottom (exploratory) section would take the genre of the artist and populate with playlists that represent specific niches within that genre, allowing the user to guide themselves through a genre exploration.

Facilitating the most common goals. Participants in Study 1 described listening to music and organizing music as their most common goals. However, the current search platform did not optimize for those two goals. More specifically, when participants listened to music from the SERP, the next song to follow was simply the next song on the SERP, which participants found to be a disjointed listening experience. To better facilitate the very common listening goal, we suggest that after playing the selected song, the system shifts to playing other songs by the same artist, with special preference to songs that users have listened to more frequently, else popular songs by that artist. In terms of organizing goals, when participants wanted to add music to a playlist, the actions required were not intuitive or simple, as they needed to click the context menu and locate the option to add music to a playlist. We suggest making a separate, top level interaction to facilitate adding to playlist.

Limitations and Future Directions

Our results may be limited in their generalizability. The samples in our studies were chosen to be representative of the users on our search platform, but were limited in size and all were current residents of the same location, which may introduce bias into the findings. Therefore, insights should be interpreted with caution, and future quantitative work should pay attention to generalizability. Our design may have also suffered from social desirability. We emphasized to participants the researcher's distance from product and design teams and the importance of negative feedback in improving our platform. Nevertheless, participants had mostly positive attitudes, and it is possible that their good experiences may have been exaggerated compared to other users.

Furthermore, it may be difficult for users to accurately judge success and effort in search. In particular, previous work showed that users are not good at judging the amount effort it took them to complete complex search tasks [36]. For those reasons, we chose to focus specifically on the user's perception of success and effort. Further research should investigate the relationship between perception of success and effort and objective measures of success and effort.

The present research focused heavily on understanding how users evaluate their search experience on our platform. Future work should leverage this understanding of user evaluation to put into practice for metric development, specifically considering how to best operationalize success and effort from the user's perspective. It would also be important for metric development to be able to infer the searcher's mindset, as we have uncovered the ways in which mindset relates to perceptions of success and effort. This would allow for more fine-tuned metrics that capture how users themselves experience and evaluate search in music streaming.

Finally, we believe the mindset framework may be valuable to explore more broadly in leisure recommender systems, where users must navigate a vast catalog that contains a mix of familiar and unfamiliar content (e.g., movie, TV, audiobook, etc.). While the present work looked exclusively at music streaming, future work should explore other domains to understand if and how mindsets are relevant more broadly.

6 CONCLUSION

Our work aimed to understand how and why users search on a music-streaming platform, placing an emphasis on how they evaluated their experiences. We found that searchers had four overarching goals: listen, organize, share, and fact check. Regardless of their goal, they evaluated their experience along the dimensions of success and effort. Their perceptions of success and effort were influenced by the mindset with which they approached their search. We then made recommendations for the design of search for music streaming and provided suggestions for future work that applies our findings to building search metrics and understanding other leisure recommender systems.

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