Would You Tell Spotify How You're Feeling? Exploring Acceptability and Ethics of Emotion-Regulation Plugins for Music Streaming Apps

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Over half a billion people around the globe listen to music via music streaming apps. Research shows that, for many users, these apps are tools for managing everyday moods and emotions. Music streaming apps support this goal by offering mood-based music categories and playlists. More recently, researchers have built music recommender systems that aim to support users' emotional needs by recommending songs based on their self-reported emotions. However, no studies to date have investigated whether their potential incorporation into existing streaming apps is considered acceptable or ethical by users. We conducted a *design fiction* study, in which 22 participants discussed an imagined Spotify plugin that generates emotion-regulation playlists in response to users' current and desired emotional states. Participants foresaw potential benefits to well-being, but also raised numerous ethical concerns. We contribute suggestions for mitigating these ethical concerns in the design of emotion-regulation plugins for music streaming apps.

CCS CONCEPTS • Human-centered computing • Human computer interaction (HCI) • Empirical studies in HCI

Additional Keywords and Phrases: design fiction, emotion regulation, music streaming services, recommender systems, digital ethics, well-being

ACM Reference Format:

Xanthe Lowe-Brown, Solange Glasser, Peter Koval and Greg Wadley. 2024. Would You Tell Spotify How You're Feeling? Exploring Acceptability and Ethics of Emotion-Regulation Plugins for Music Streaming Apps. Presented at the 36th Australian Conference on Human-Computer-Interaction (OzCHI 2024), Brisbane, QLD, Australia.

1 INTRODUCTION

Emotion research shows that people routinely adjust when and how they experience emotions[1] in everyday life [41]. For example, people often seek to increase their pleasant emotions when they feel sad, or try to 'unwind' (by reducing their feelings of activation or arousal) after a stressful day at work.

Music has widely been appropriated as a tool for emotion regulation [35], with a study showing that 96% of undergraduates surveyed listen to music for this reason [44]. Digital music streaming services ("music apps" from here on) have changed the music listening landscape, allowing users to access vast catalogues of music at virtually any time and place. Unsurprisingly, music apps like Spotify, with its over 600 million users [58], have been adopted for mobile emotion management [54, 82]. Vendors of music apps appear to support this listening goal, offering mood-categorised music that allows users to easily find songs that reflect a particular mood and frequently release new mood-based features. For example, in 2021, Deezer released *Flow Moods*—a feature that allows users to select their mood [motivation, chill, melancholy, focus, party, or you and me (romantic)] and receive a stream of music tailored to their listening preferences and their chosen mood [7]. However, these features are designed to match users' emotions rather than to shift their emotions towards a desired emotion; in other words, these features are not optimised to help people regulate their emotions. Recognising that music apps could better support emotion regulation, researchers have begun building technology interventions that incorporate users' current and desired emotional states when generating playlists [2, 14, 16, 34].

Incorporating these interventions into existing music apps could potentially provide millions of music streamers with a handy emotion-regulation tool. On the other hand, it may be risky, with a user-base that includes vulnerable populations, such as those with mental health conditions. Further, there has already been controversy regarding the collection of user emotion by technology platforms due to concerns related to data breaches and the manipulation of users' emotion via cyber-attacks [37]. In light of these concerns, it is unknown whether people would want to tell a music app, like Spotify, how they are feeling.

It is therefore urgent to examine the acceptability and potential impact of such a move for users, and the practical and ethical risks this might entail. In this paper, we report findings from our study that aimed to discover how users of music apps would feel if an emotion-regulation feature that responds to user emotion were added to their app. As this feature does not yet exist, we used a *design fiction* approach, creating a short video that describes a future emotion-regulation add-on for Spotify, called *MoodDJ*, based on psychology research on emotion regulation and music listening. We designed the add-on for Spotify because it is the most popular music app [18], however, *MoodDJ* is a probe that represents an emotion-regulation feature within any music app. Our design fiction video demonstrates a user inputting their current and desired emotional states and completing a short 10-item personality questionnaire, based on which a customised playlist of songs is generated to change the user's emotions in line with their goals. We showed this video to 22 participants, asking each a set of interview questions that probed for reactions related to efficacy, feasibility, acceptability, and ethical concerns.

The study addressed the following research questions:

- RQ1. What are the perceived benefits of using a music streaming service that has been enhanced for emotion regulation?

[1] We use the terms "emotion" and "emotion regulation" throughout this paper for consistency with most of the literature on emotion regulation in general, and digital emotion regulation in particular. However, we acknowledge that the same processes apply to broad dimensions of feelings (e.g., positive and negative affect) that are not necessarily elicited by or directed at specific events—a defining feature of emotions (vs. moods). Thus, much of what we term "emotion" and "emotion regulation" could also refer to mood or affect (regulation).

- RQ2. What are the perceived ethical and practical considerations of using a music streaming service that has been enhanced for emotion regulation?
- RQ3. Are people willing to use an existing music streaming service that has been enhanced for emotion regulation?

We found that participants identified a range of emotional and convenience benefits of using *MoodDJ*, but also identified risks relating to privacy, transparency, autonomy, justice/fairness, safety, dignity and identity. However, most participants were willing to trade the risks for the benefits with 82% of participants reporting that they would use the feature. We discovered that participants' motives for using *MoodDJ* included, but were not limited to, emotion regulation. We found a tension between emotion regulation as a private activity (some participants would not use *MoodDJ* around other people) versus music as a social activity (some participants would use *MoodDJ* in group settings). Our findings convey the importance of personalising emotion-regulation features such as by incorporating users' music preferences. We highlight ethical risks and, based on these, offer suggestions for designers of emotion-regulation features for music streaming apps.

2 RELATED WORK

In this section, we highlight that emotion plays a large role in technology experience, that people actively seek out technology to influence their emotions, and that HCI researchers are now designing interventions specifically to support emotion regulation. We discuss the common use of music for regulating emotions, the design of music emotion-regulation interventions, and demonstrate that music vendors may incorporate these interventions into their apps in the near future. Lastly, we discuss related work on the ethical implications of music recommender algorithms and mood enhancement technology.

2.1 Emotional impacts of technology

With the widespread adoption of smart devices, technology has pervaded daily life. Since the 2000s, HCI researchers have shown that interacting with technology has an impact on our experience of emotions [27]. However, users are not mere passive receivers of the emotional impacts of technology. People actively use technologies to modulate their emotions [71]. For instance, a recent study estimated that almost half (42.94%) of total smartphone use was spent on influencing emotions [68]. In general, the process of actively seeking to influence or change emotions is known in psychology as *emotion regulation* [30]. People may have different motives for regulating their emotions, not just *prohedonic motives* (i.e., to increase positive feelings and reduce negative feelings), but also *instrumental motives* (i.e., to achieve an outcome beyond a desired emotion, such as enhanced performance) [77]. These motives are context dependent; a person at work might seek to regulate their emotions to increase productivity (*instrumental motives*). Whatever their motive for regulating emotions, Gross [30] identified five broad categories of strategies that people can employ to regulate emotions: *situation selection*, *situation modification*, *attentional deployment*, *cognitive change* and *response modulation*. Emotion regulation is essential to maintaining well-being while negotiating the varied challenges and contexts of everyday life [19], with deficits leading to greater vulnerability to mental health conditions, such as anxiety and depression [38].

In recent years, it has become increasingly clear that, like many human activities, emotion regulation is frequently digitally-mediated. We refer to this phenomenon as *digital emotion regulation* [71]. Digital emotion regulation may, for instance, involve playing video games [81], scrolling on social media [6] or indulging in online shopping [10], with the goal of using these digitally-mediated activities to influence emotions. This type of digital emotion regulation involves

the use of technologies that were not necessarily designed for the purpose of emotion regulation. However, digital emotion regulation may also involve technologies that are purpose-built to help users modulate their emotions.

2.2 Design of technology interventions for emotion regulation

A subfield in HCI research investigates the design of technology interventions specifically to support emotion regulation due to the importance of regulating emotions to mental health. Slovak *et al.* propose three key considerations in designing a technological intervention to support emotion regulation: (i) making theory-informed decisions about the delivery mechanisms of the intervention; (ii) considering how emotion-regulation support is provided (experiential vs. didactic); and (iii) when/where support is provided (on-the-spot vs. offline) [70]. Experiential support refers to allowing users to apply an emotion-regulation strategy without a specific set of instructions, whereas didactic support involves delivering explicit instructions to users about how to regulate their emotions. Emotion-regulation support can be provided offline, in specific contexts such as training programs, or on-the-spot, as required in everyday life (e.g., slow breathing interventions to help drivers deal with stress [3, 52]). Emotion-regulation interventions can be designed for clinical populations to support mental health conditions or for the general population, by integrating interventions within existing apps used daily.

2.3 Music and emotion regulation

A common motivation for listening to music is to manage everyday emotions (e.g., to improve one's mood or to relax) [35, 55]. There are different music-based strategies one can employ such as focusing on song lyrics to feel solace or listening to sad music to discharge negative emotions [64]. With the digitisation of music catalogues (e.g., iTunes) and the rise of music streaming apps (e.g., Spotify, Apple Music), people now have access to music anywhere, anytime, making it easier to use music for emotion regulation when needed in daily life.

It is therefore unsurprising that multiple researchers are exploring the design space for music streaming emotion-regulation interventions that recommend music based on users' current and/or desired emotional state [2, 14-16, 46, 76]. Researchers such as Helmholz *et al.* have designed and evaluated *Moosic,* which uses Spotify's API to recommend 20 songs based on users' reported current mood and genre selection, and then plays these songs in a random order [32]. De Prisco *et al.* designed and evaluated *Moodify*, a music recommender system that retrieves a music recommendation from Spotify based on users' current and desired mood [16]. Given that personality is related to listeners' music preferences and emotional responses to music [26, 45, 61], researchers have also proposed collecting information on users' personality [25, 67] to influence recommendations.

Music apps are entering the emotion-regulation space. Looking at the world's largest music app, we can see the increasing pace with which new emotion-related features are being released (Figure 1).

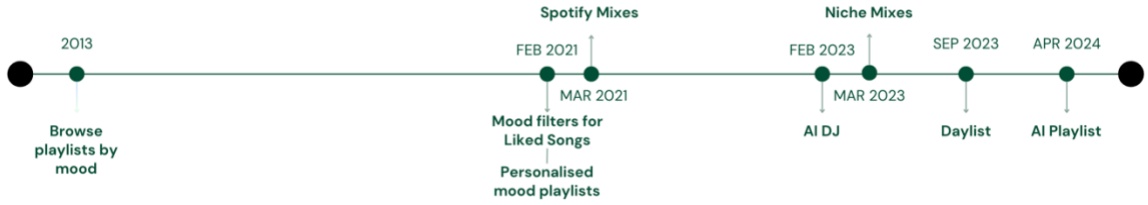

Figure 1: Timeline of the release of Spotify emotion-related features

In 2023, Spotify released *AI DJ*, which creates sets of music based on users' music taste and provides commentary in-between by an AI voice model called "X" [57]. Upon opening the feature, "X" welcomes users with greetings such as "Hey, what's up, it's your DJ X, hope you're doing alright." In the same year, Spotify released their *niche mixes*, personalised playlists to match any mood or situation (e.g., *angry break up mix*) [59]. Next introduced was *daylist*, a dynamic playlist that updates songs to reflect users' changing listening behaviour and "ever-changing moods" throughout a typical day [60]. Most recently, in April 2024, Spotify released the *AI Playlist*, allowing users to create playlists based on text prompts. One such recommended text prompt is "help me get pumped up with fun, upbeat, and positive songs" [56]. In the near future, it seems likely that users will be explicitly telling Spotify how they are feeling [56], as many are already doing with Apple's Health app [42, 50].

There is emerging research that explores user acceptability of providing emotion data to Spotify. In a study with 200 participants, 40% were neutral and 23% were receptive to the idea of telling a Spotify chatbot how they are feeling and then receiving music suggestions [46]. However, participants desired control with 69% favouring the ability to deactivate or activate the chatbot. While this study quantitatively determined the acceptability of providing Spotify with emotion data, the ethical risks of such a move remain unknown. It is therefore urgent that research investigates the potential benefits and risks to ensure ethical deployment of such technology, which will be accessible by millions of users.

2.4 Ethical risks

While the ethical considerations of emotion-regulation features for commercial music apps are unknown, here we outline related research on music apps, mood enhancement technologies and self-care apps.

2.4.1 Ethics of music apps.

Music apps control the music that is recommended to users via their music recommender algorithm. The ethical issues of these algorithms have recently been interrogated in terms of their fairness, diversity and transparency [65]. The issue of *fairness* relates to inequities in gender representation in music recommendations, the differing quality of recommendations for users depending on their demographics and popularity bias; the algorithm favouring popular music which may prevent users from discovering non-mainstream or lesser-known artists [21, 24, 65]. The issue of *diversity* relates to diverse teams developing AI/recommender systems and diversity represented in the recommended artists [65]. The issue of *transparency* extends to the murkiness of how the algorithm recommends music, resulting in users desiring more transparency [22].

The collection of users' data by big tech companies has become a topic of recent concern with the discourse around the monetisation of data (*surveillance capitalism*) [84] and recent data security breaches affecting millions of people [79]. Liz Pelly [53] has labelled Spotify as a "Big Mood Machine," that offers a large catalogue of mood-based playlists, subsequently stores copious amounts of data on our moods based on the music we choose to stream, and then uses the data for targeted advertising and profit. Braun [8] concurs, positioning Spotify as a "surveillance capitalist firm", suggesting that the company aims to capitalise on users' data to control their behaviour, promote paid subscriptions, and deliver targeted ads [8]. With these commercial factors at play, we need to understand the ethical risks of incorporating an emotion-regulation intervention into these apps that explicitly asks for users' emotions.

2.4.2 Ethics of mood enhancement technology.

Research on the ethics of mood enhancement technologies that collect and process emotion data reveals key ethical issues [37]:

1. *Justice*: All users may not have equal access to the mood enhancement technology due to social or financial position.
2. *Identity*: Mood enhancement technology may influence users' identity, for example, if privacy settings are not turned on, allowing others to access private information, or by indirectly influencing users' personality.
3. *Autonomy*: User autonomy may be influenced, either negatively (e.g., by spurring the user to act differently if the technology is broken), or positively (e.g., by empowering decisions to enhance their mood).
4. *Dignity*: User well-being may be enhanced, but there are negative risks introduced such as the stigmatisation of feeling sad, the discrimination of "unwanted" emotions or cyber attackers manipulating users' emotion which compromises mental integrity.
5. *Privacy*: Risks regarding the collection of emotion data such as data breaches, which may result in detrimental consequences such as coercion.
6. *Safety and prevention of harm*: Balancing user autonomy with safety measures and interfering only with user freedom when the harm significantly outweighs the benefits.

Related research on self-care apps [17] also suggests possible risks such as users becoming dependent on self-care apps (*dependence*), unauthorised agents gaining access to datasets of users' sensitive information (*privacy*), and vendors providing self-care apps initially for free but then persuading users to shift to paid versions (*monetisation*).

In summary, while we have highlighted that research is investigating the ethics of music apps and the ethics of mood enhancement technology, the interplay between these technology genres remains unexplored. Therefore, the current study seeks to uncover ethical issues that may arise when emotion-regulation features are incorporated into music apps.

3 METHOD

We used a design fiction approach to gauge participants' reactions to a fictional feature for music apps, called *MoodDJ*, that represents the incorporation of emotion-regulation features into music apps that we foresee. While some existing software aims to match music to users' emotions, *MoodDJ* aims to change users' emotions. We used Figma to create a low-fidelity prototype of *MoodDJ*. We then created a fictional promotional video that introduced the feature. We showed this video to 22 participants and conducted semi-structured interviews with each, to understand their perceived benefits and concerns around using this feature, their perceptions of ethical risks, their willingness to use such a feature for emotion regulation, and when and where they imagine they might use it. We analysed the interview transcripts using thematic analysis [9]. The study was approved by the University of Melbourne's Human Research Ethics Committee.

This section describes our methods, participants and fictional prototype in detail.

3.1 Design fiction

Design fiction is used in HCI research to probe for critical feedback on speculative technology designs [39, 48] and as a world building activity to initiate discussion of possible futures [13]. First proposed by Sterling [74], design fiction research has used materials such as physical artefacts, narratives, scenarios and prototypes to prompt individuals to critically speculate about future contexts, about how it might be to use an imagined technology in everyday life, and about ethical concerns and social impacts of a future technology [23, 49, 66, 75, 83]. For example, Seberger *et al.* used scenarios followed by interviews to understand people's reactions to privacy-related issues raised in several apps [66], while Coulton *et al.* used a crowdfunding video and comic strip to visualise a future where an *Empathy Engine* SDK can be incorporated into apps to facilitate emotional interactions between computers and humans [13].

For the current study, we made a two-minute video that depicts a user interacting with *MoodDJ* to represent a near future where emotion-regulation features exist within music apps. The video was designed to resemble a Spotify feature advert (e.g., AI DJ introductory video [57]), matching its neutral to positive tone to "provide a…tangible entry point to the world" [13]. The video prompted participants to reflect on whether they would use this feature in everyday life and any concerns they might have around using it. Participants saw a user entering data about their personality and their current and desired emotional state, after which *MoodDJ* generated a playlist that would help the user attain their target emotion.

3.2 User Interface of *MoodDJ*

While *MoodDJ* is a fictional technology, the design of its user interface was informed by psychology theory and the existing functionality of the Spotify API, to resemble a real feature. We now explain the interface presented to participants in the video scenario.

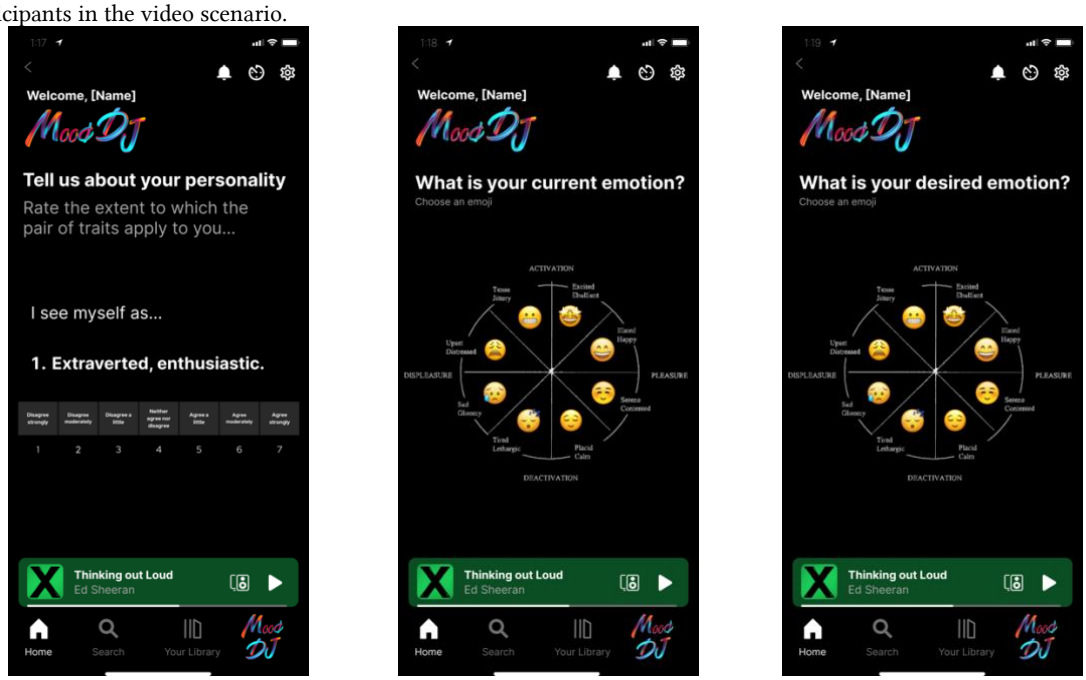

Figure 2: User interface of *MoodDJ*. Personality measure (*left*), current (*middle*) and desired emotion (*right*)

Our video depicted a Spotify user logging into their account and then being prompted by *MoodDJ* to answer a series of questions designed to assess their personality as well as their current and desired emotional states (Figure 2). For *MoodDJ*, we chose to use self-report to capture users' emotion and personality information as there is ongoing debate around whether reliable inferences about someone's emotion can be made from facial recognition or biometric data [4, 69]. *MoodDJ* used the Ten Item Personality Inventory [29] (Figure 2), a validated measure of the Big Five personality dimensions [12] and a realistic UI component since Onori *et al.* propose using the 44-item Big Five Inventory in music recommender systems [51]. For our brief design fiction video, we used a shorter questionnaire.

In line with other interventions [14, 33], *MoodDJ* users input their current and desired emotions using an Affect Grid that maps onto Russell's circumplex model of affect [62]. This model conceptualises emotional experiences as varying

along two dimensions: arousal (level of energy from deactivated to activated) and valence (from unpleasant to pleasant) [63]. The Spotify API uses this theoretical model of emotional experience, distinguishing songs by valence and energy [20]. We added emojis to the Affect Grid to make it easier to understand, following recent research [78].

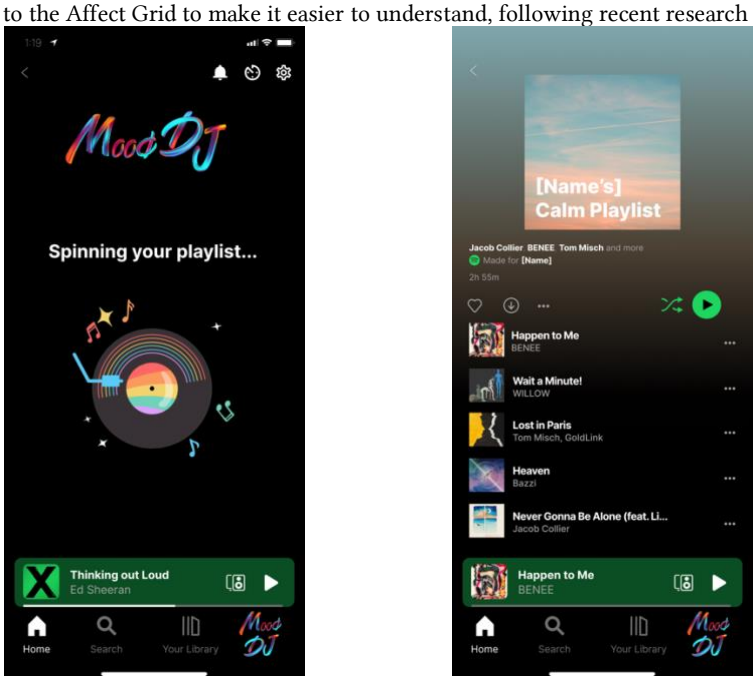

Figure 3: *MoodDJ* playlist generation

Once the user answered these personality and emotion questions, *MoodDJ* generated a playlist to help them shift their emotional state (Figure 3). The playlist consisted of five songs chosen based on the user's listening history and following the *iso principle*, a method of emotion regulation used in clinical and non-clinical contexts [31, 73]. Using this principle, the playlist started with two songs that matched the user's self-reported current emotion, with subsequent songs moving closer to the user's desired emotion. In our video, the fictional user reported feeling tense (😬) and wanting to feel calm (😔), and therefore, the playlist moved from tense to calm music. By comparison, other proposed emotion-based music interventions (e.g., *Moosic* [32]) do not incorporate a validated method of ordering songs in playlists.

Music-based emotion-regulation plugins like *MoodDJ* can be situated within Slovak's [70] framework for designing emotion-regulation interventions. *MoodDJ* is designed to help users navigate emotions that arise in daily life and can thus be considered a form of *response modulation* (modifying an already existing emotion). It offers support that is experiential (rather than didactic) and on-the-spot (i.e., helping users deal with emotions as they arise). Slovak names these "implicit on-the-spot" interventions. *MoodDJ* is *user-initiated* (i.e., users have to identify that they need emotion-regulation support and open the plugin). It operates at a *discrete point* rather than offering ongoing support.

3.3 Participants

We recruited a sample of 22 participants. This number was based on guidelines of sample sizes for qualitative interview studies in HCI [11]. 68% of the sample were 18-34, 27% were 35-54 and 5% were 55 or older. This is representative of

music streaming users, as 62% of Spotify users worldwide are 18-34 years old [80]. Participants identified as male (50%) and female (50%).

We used snowball sampling [43], recruiting participants via advertisements on Twitter, LinkedIn, Facebook and the University of Melbourne student portal and staff newsletter. Inclusion criteria were (a) aged over 18 years, (b) living in Victoria, Australia, (c) regularly use a music streaming service, (d) no current mental health diagnosis, and (e) able to provide written consent. Individuals with a current mental health diagnosis were excluded from this study, as the risk of experiencing distress when being interviewed about emotion regulation was deemed to outweigh the potential benefits for this population. The majority of participants were university students or office workers (Table 1).

Table 1: Participant information

Participant ID	Gender	Age range	Ethnicity	Occupation
P1	Male	18-34	East Asian	Student
P2	Male	18-34	South Asian	Student
P3	Female	18-34	Mixed Caucasian/East Asian	Student
P4	Female	18-34	East Asian	Student
P5	Male	35-54	White/Caucasian	Designer
P6	Male	35-54	White/Caucasian	Academic
P7	Female	18-34	South Asian	Student
P8	Female	18-34	South-East Asian	Office Worker
P9	Female	35-54	White/Caucasian	Office Worker
P10	Female	18-34	White/Caucasian	Office Worker
P11	Male	55+	White/Caucasian	Office Worker
P12	Female	18-34	East Asian	Student
P13	Female	18-34	White/Caucasian	Student
P14	Female	35-54	East Asian	Student
P15	Male	35-54	White/Caucasian	Manager
P16	Female	18-34	White/Caucasian	Office Worker
P17	Male	18-34	South-East Asian	Student
P18	Female	18-34	White/Caucasian	Academic
P19	Male	35-54	White/Caucasian	Student
P20	Male	18-34	White/Caucasian	Office Worker
P21	Male	18-34	White/Caucasian	Educator
P22	Male	18-34	White/Caucasian	Office Worker

3.4 Interviews

The first author conducted semi-structured interviews with each participant via Zoom (length 24 to 53 minutes). First, participants watched the design fiction video. The interview questions then prompted participants to reflect on their willingness to use the feature, when/where they might use it, which emotions they might use it to deal with, the likely effectiveness, perceived concerns and benefits of the feature, ethical concerns in relation to data collection and privacy, and their existing use of music to influence their emotions (summarised in Table 2 - please refer to Appendix for the full list of questions). We used Beard and Longstaff's *Principles for Good Technology Design* as inspiration for our interview questions [5]. The first author recorded all interviews using Zoom's recording function, discarding the video component immediately following interviews.

Table 2: Overview of interview questions

Area of focus	Example questions
Acceptability/usability	1) Would you be interested in using this feature to control, regulate, or manage your emotions in this way? How often and in what kind of situations? 2) Which emotions do you think you would use this feature to help you deal with?
Perceived effectiveness	Reflecting on the situations you would use this feature for, do you think it would work?
Perceived concerns and benefits	How do you feel about Spotify's algorithm changing your emotions?
Ethical concerns	1) How do you feel about Spotify collecting your personality and emotional state data? 2) Tell me about any privacy concerns you may have about who will see your personality and emotional state data?
Music emotion regulation	1) What do you think of the idea of listening to music when you want to change your emotions? 2) Can you tell me about how you are currently using your music streaming service to manage or shift your emotions? Do you use any specific features such as your own playlists or Spotify's mood playlists?

3.5 Thematic Analysis

Interviews were transcribed verbatim including non-verbal utterances such as laughing when they contributed to the meaning. We used a thematic analysis methodology to analyse the interview transcripts, taking both an inductive and deductive approach.

- (Phase 1) Familiarisation of the data began at the transcribing phase, as the first author dedicated time to carefully reading, correcting the transcripts and making notes on observations.
- (Phase 2) Using the *Delve* software, the first author deductively coded 22 transcripts based on the research questions on a semantic level, to understand participants' perceived benefits and risks of an emotion-regulation feature, and their willingness to use it in daily life. Example codes included "data privacy", "harmful misuse" and "accessibility/convenience." Three authors then worked through two transcripts inductively to explore the underlying (latent) meanings from participants' responses. Example codes include "stigma concerns" and "I am different." The first author then followed this process to inductively code the remaining transcripts.
- (Phase 3) The authors categorised the codes to form themes through multiple discussions.
- (Phase 4) We then reviewed these themes and ensured that each excerpt of text was situated within appropriate themes and that the theme made sense in terms of the whole data set.
- (Phase 5) The refinement of the themes continued with the writing phase. We then ensured that the themes had appropriate names.

Finally, we wrote up the results of the thematic analysis.

4 FINDINGS

The study aimed to analyse users' reactions to a future emotion-regulation add-on for music apps that incorporates users' emotion and personality information. Analysis of the responses yielded four themes, which are detailed below and supported by indicative quotes from participants.

4.1 Theme 1: "The positives far outweigh the negatives": the creepiness-convenience trade-off [47]

Participants identified several ethical concerns of using *MoodDJ*. We have categorised these concerns using labels based on the ethical issues of music recommender systems [65] (transparency, fairness) and mood enhancement technology [37] (privacy, autonomy, justice, safety, dignity, identity) outlined in Section 2.4.

4.1.1 Perceived ethical risks.

Privacy. Well-established privacy concerns around mood enhancement technology also translated to emotion-regulation features within music apps. Participants had specific concerns around emotion and personality data being used for targeted advertising and profit, being shared with third parties or other Spotify users, or being tracked and incorporated in their end-of-year Spotify Wrapped or Spotify profile. Due to these data privacy concerns, P10 wanted their emotion data to be de-identified or not recorded. Concerns around *MoodDJ* being hacked also surfaced:

> "The biggest concern is that…it's hacked…and large groups of people are put into a particular mood…potentially it becomes like a cybersecurity target for certain regions if one country tries to attack another one." [P21]

Nine out of 22 participants were not entirely comfortable providing Spotify with their emotion and personality data:

> "I think the creepy factor would be too high for me…like, 'no I'm not telling you how I feel.' There's already enough surveillance going on that's reading your emotions. I'd be really wary of a company like Spotify who are owned by record companies and trying to make money." [P19]

Transparency. Some participants described only using *MoodDJ* if they knew how their data would be used or shared, highlighting the need for transparent data privacy policies. P6 fears "information asymmetry" where users might be unaware of how their data is being used:

> "When it's owned by a corporation…it's not really your data…who knows at an aggregate level what's happening…they can still make upper-level decisions about what music to promote and what to put on the algorithm like we get that illusion of choice. It's information asymmetry." [P6]

Autonomy. In relation to this underlying distrust of commercial apps, participants desired autonomy over their *MoodDJ* usage and music recommendations. For several participants, their use of *MoodDJ* would be contingent upon having control over how and when they used it: "as long as I am the one who is asking Spotify to change my emotions…holding the steering wheel while Spotify does the driving" [P2]. P21 raised the importance of having agency over choosing their desired emotion because "there's those ethical things that come up…if that choice is taken away." When listening to music outside of *MoodDJ*, participants were concerned about *MoodDJ*'s algorithm unknowingly manipulating their emotions, highlighting the need for a feature that deactivates *MoodDJ* and its algorithm:

> "The most likely one is…you don't realise that this algorithm is running in the background changing your mood into something which is better for Spotify [chuckles] rather than better for you and that would probably be the main reason why I would probably never use it [laughs]." [P21]

Many participants desired autonomy over changing the music chosen by *MoodDJ*, as half of participants had concerns about *MoodDJ* serving up disliked or inappropriate music. Others were worried that *MoodDJ* would select music with

associated negative memories or that it would incorrectly analyse the emotions of songs (e.g., for an upbeat song with sinister lyrics). As such, participants suggested a feature to skip songs that have personal meaning or that are disliked.

Justice/Fairness. The potential biases of *MoodDJ*'s music recommendations, inequal effectiveness for users and distributive justice were concerns raised by participants. P20 highlighted the concern of the algorithm biasing popular music: "I can totally see [Spotify] using that to push certain emotions that link to artists that they've got deals with…and suddenly everyone's listening to Taylor Swift." Some participants were worried about the potential for *MoodDJ* to benefit some users more than others based on individual differences such as music preferences:

> "My music taste is a lot more eclectic...I could see that span of emotion being more possible in my music taste than in hers." [P18]

Distributive justice was also a concern; certain populations not being able to access or use *MoodDJ* (e.g., older adults who might have difficulty using technology and recognising how they want to feel).

Safety. Participants expressed several safety concerns, for example, becoming dependent on, or addicted to, *MoodDJ* for emotion regulation. P21 stated: "It could be the prelude to a cyberpunk dystopia...sort of speculative future...where people are plugged into a machine to get them into a productive mindset." Relying on a machine for emotion regulation would be risky, as users might not always have access to the internet or a working phone. Due to safety concerns around an algorithm that can regulate emotions, P21 addressed the need for an auditing process to ensure that music apps are using the algorithm ethically.

Participants also had concerns for other users' safety, for example, vulnerable users misusing the feature to ruminate or become depressed: "For children or teenagers, it might be concerning…if it…gave them new tools to reinforce negative emotions" [P5]. P22 suggested that users who have remained in a negative state for an extended period could be provided with links to support services. Some participants were concerned about influencing others' emotional states if playing *MoodDJ* via a speaker, which could be considered an indirect form of *digital emotion contagion* [28].

Dignity. Consequences for the mental dignity of users also arose in terms of the potential stigmatisation of negative emotions that features like *MoodDJ* might cause if users were prevented from shifting their emotions in a negative direction:

> "I don't think the idea is to completely rid ourselves of negative emotions...you could take Xanax all day and you'd not feel stress…but…it's okay to feel regret or shame or sadness…as part of a healthy well-being. And if we do not allow those emotions...What would society end up like? We wouldn't know how to deal with some of those emotions." [P6]

Identity. Some participants were worried about their identity being impacted by the algorithm analysing their emotion data collected via *MoodDJ* to diagnose their mental health status:

> "You gather enough data and you're going to be able to make some well-educated assumptions about someone's mental health…I think that that's really where I start to get concerned. It's that loss of control of…my private image and how that could be used to exploit me in the future or…worst case scenario, start to steal identity." [P18]

This emotion data being sold to third parties would have negative consequences for users' identity, especially if trying to secure a rental property, for example (P1).

4.1.2 *Perceived benefits.*

On the other hand, participants perceived key benefits related to convenience, accessibility and enhanced emotional well-being, as P14 summarises, "It's an easy and accessible tool basically to have in your mental health toolkit." In terms of convenience, participants felt that *MoodDJ* would reduce the labour required to search for songs or curate playlists, which would be especially helpful when they do not know what songs they want to listen to, or do not have the energy to manually find songs. Some participants commented on the benefit of *MoodDJ* being integrated within a popular music app, which would be accessible to many people. Several participants commented on *MoodDJ*'s potential mental health benefits for both users with mental health diagnoses and users who navigate everyday emotions:

> "I think one of the innovative things about this particular proposal is that it doesn't just keep you in one mood, but it offers to transition you between moods...it could be quite proactive for your mental health." [P6]

Other participants felt that *MoodDJ* would improve their current Spotify experience by using science to create their emotion-regulation playlists. This perhaps lead P2 to believe that *MoodDJ* could be an effective alternative to medicine:

> "So instead of being forced to rely on medication...therapies like this could actually help them regulate their emotions." [P2]

4.1.3 *The trade-off.*

Although the ethical risks raised outnumber the benefits, 18 out of 22 participants reported that they would probably use *MoodDJ*, suggesting that some participants would trade the creepiness or uncomfortableness [47] for the usefulness of an emotion-regulation feature:

> "I don't feel entirely comfortable, but it wouldn't be enough for me to not try out the feature just out of curiosity." [P3]

> "From my standpoint, I feel like the positives far outweigh the negatives at this point." [P13]

This can be explained by the phenomenon of the creepiness-convenience trade-off, which represents "people's willingness to accept the downsides of a technology that invades privacy for the sake of its benefits" [47]. The fact that participants would be willing to trade the numerous ethical risks raised conveys the gravity of the potential positive impact that an emotion-regulation feature could have for millions of music streamers.

4.2 Theme 2: "Let's put *MoodDJ* on": the tension between music as a social activity and emotion regulation as private activity

There was a dichotomy between participants who would not use *MoodDJ* around other people and those participants who explicitly stated that they would like to use *MoodDJ* socially in group settings. Participants who were uncomfortable listening to *MoodDJ* without headphones or around others were concerned with the stigma attached to regulating emotions: "There's probably a little bit too much stigma and individualisation [chuckles] of responsibility for emotional regulation in our society to be just outwardly doing that [laughs]" [P21].

We also found that preferences for using *MoodDJ* privately would change depending on the individual's mood, as P4 stated, "When I'm feeling very sad or just want to regulate my mood, I don't want anyone else to hear." In this context, some participants would also not want other users to know that they are feeling sad from their public profile or labelling *MoodDJ* playlists with words such as "depressed mix." Therefore, P22 suggested an incognito feature:

> "If there's a feature like if I've selected the dissatisfied mood or deactivated moods…don't share that…giving a bit of control to the user, that's where I'd probably feel a bit more comfortable with those social features."

On the other hand, some participants discussed socially motivated reasons for using *MoodDJ*, for example, to change a group's emotions (P6) or regulating emotions with their partner (P13):

> "People could use it at parties…to transition the party from small talk…to something a bit more loud to the dance floor." [P6]

> "When I'm with my boyfriend…and I was like, 'Oh, let's put *MoodDJ* on' that might be cool." [P13]

However, for those who were socially motivated to use the feature, there were also contexts in which participants would prefer to regulate negative emotions privately, reinforcing this stigma around feeling negative emotions. For example, P22 would feel comfortable using his *MoodDJ* in a group setting for happy emotions, but probably not for sombre emotions.

4.3 Theme 3: "The variety of ways you could use [*MoodDJ*]" include, but are not limited to, emotion regulation

Participants described a myriad of contexts in which they would use *MoodDJ* (see Table 3). P6 states, "[*MoodDJ*] offers to transition you between moods. So I find that really interesting in the variety of ways you could use that." We found that participants' potential reasons for using *MoodDJ* map onto Tamir's [77] taxonomy of emotion-regulation motives, since participants would not only use *MoodDJ* to change their emotions (i.e., for hedonic reasons – where the primary goal is to attain a desired emotional state), but also to attain goals beyond a desired emotion such as productivity and social relatedness (both instrumental motives). However, some participants reported other reasons for using *MoodDJ* not related to emotion regulation, for example, to find new music to listen to.

Interestingly, participants more frequently described using *MoodDJ* to regulate their experience of arousal – i.e., how deactivated/fatigued versus activated/awake they felt – than the valence (i.e., how pleasant or unpleasant they felt). For example, P6 described using *MoodDJ* to shift from: "pleasant and activated to pleasant and deactivated. I would use that if I've had…a party or if I've had a good night and it's time to relax, settle down before I go to bed." One possible reason for this is that regulating valence may be less socially acceptable: for example, P20 explained that he would be happier to tell someone that he was using *MoodDJ* to get 'pumped up' for work, than to deal with anxiety. Although using music to change one's experienced arousal/activation is theoretically consistent with emotion regulation, some participants did not classify it as such. For example, P2 described his current use of music to regulate his arousal level and that he does not classify this as emotion regulation:

> "If it is in the morning, then I put on something that helps pump up for the day. If I am going back home, I would put on something more softer, which would…just help me unwind…So I wouldn't say if I'm using it to regulate my emotions, more like I'm using my emotions as a guidance point on…which kind of music I would listen to." [P2]

Table 3: Motives for using *MoodDJ*

Emotion-regulation motive (Tamir, 2015 [77])	**Motive for using *MoodDJ***	**Examples**	**Quotation**
Hedonic (changing one's emotions with the goal of attaining a desired emotional state)	Emotion-focused	To maintain emotions To purge emotions To improve emotions To get pumped up To relax	"If I'm super stressed out…I'd maybe turn to something like that to…bring me back down and probably get to that deactivated state." [P1]
Instrumental (changing one's emotions in service of a different goal, e.g., social, productivity)	Productivity reasons	To focus and enhance concentration at work	"I could use this feature to bring myself back to that place of being calm and focused so that…I can be productive." [P2]
	Social reasons	To entertain guests at a dinner party/colleagues at work To get in the mood to socialise To soundtrack a social situation To transition a party from small talk to dancing To regulate emotions with close friend/partner/work colleagues To deal with loneliness	"If I was at home with my partner and we were both feeling a bit sluggish and we wanted to get energised, maybe we'd use it together." [P10]
	Other reasons	To find new music For curiosity For exercise To create emotion-encoded memories	"I probably would use that when I needed new music to listen to…that fitted…what I wanted to get out of music at the time" [P5]

When asked which quadrant of Russell's circumplex model of affect that they would use *MoodDJ* to deal with, most participants commented that they would use *MoodDJ* to deal with unpleasant feelings, either deactivated (e.g., sad) or activated (e.g., stressed; see Figure 4).

> "Likelihood of using this feature would be higher when I'm feeling unpleasant because…if you're in pleasant state you would want to continue in that state." [P2]

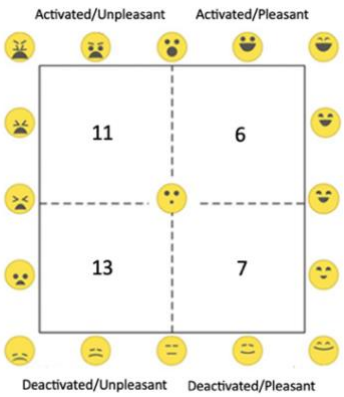

Figure 4: Number of participants who would use MoodDJ to deal with emotions, classified by quadrant of the circumplex model of affect

4.4 Theme 4: "I might be a weird music user": Importance of personalisation in an emotion-regulation feature

Participants said it was important that *MoodDJ* chooses music in alignment with their music preferences and that this would influence whether they tried out the feature or continued using it.

Participants desired agency over whether music used for emotion regulation is new versus familiar, and over the ratio of new to familiar songs, as well as whether the music is instrumental or has lyrics. P1 viewed genre as an important choice:

> "I can also imagine that other people have different ways of reaching positive states…some people probably want to put on soft low-fi, or soft classical music, and other people would probably want heavy metal. And so if there's a way to let people do that and not just universally go: here is a Lo-fi happy beats playlists." [P1]

Participants wanted to be able to provide feedback on the music selected through features such as a thumbs up/down button, to rate how well Spotify understood the emotions of songs. They wanted the ability to tell Spotify why they disliked a song, or that it was not right for the current situation, and to tell Spotify to never select a particular song again. Some wanted to control the duration of playlists depending on how much time they have for emotion regulation, e.g., 20-minute versus one hour playlist.

Participants commonly talked about their own music listening as being weird or different from others. This highlights the importance of personalisation for a music emotion-regulation feature. For example, some participants expressed that they prefer to maintain rather than change their emotional states: "I might be a weird music user…I just use it to keep a mood the same rather than to change moods usually" [P6]. This caused some participants to question the purpose of *MoodDJ*:

> "The reason why I think it wouldn't work so well for me is…I'm the kind of person who just likes to sit in their emotions for a bit…I don't always like dealing with things straight away." [P1]

As an alternative to *iso principle* playlists, participants suggested incorporating an emotional gradient feature that allows users to select the speed/gradient of the transition from current to desired emotion.

5 DISCUSSION

The incorporation of emotion-regulation features into music apps has the potential to improve the psychological well-being of millions of music streamers. Emotion regulation is an essential skill to support well-being and listening to music for emotion regulation is already a common activity. However, the implementation of music-based interventions for emotion regulation within commercial music apps brings a range of risks that may not all be apparent to designers and vendors. Our findings suggest that people would largely welcome an emotion-regulation feature were it incorporated into their music app, anticipating well-being benefits, but that they also hold ethical concerns.

5.1 RQ1: Perceived benefits of using a music app that has been enhanced for emotion regulation

Many participants foresaw that using *MoodDJ* as an emotion-regulation tool could enhance their well-being. Furthermore, they anticipated convenience in having the tool built into a music app that they already use, and a saving of time and effort in playlist-creation. Participants felt that *MoodDJ* was science-based, and highlighted possible benefits for clinical and non-clinical populations. These findings align with earlier research involving a Spotify chatbot [46], where participants foresaw enhanced emotional self-awareness and an enriched Spotify experience.

5.2 RQ2: Concerns regarding a music app that has been enhanced for emotion regulation

Participants expressed ethical concerns which align with prior research on the established ethical issues of music recommendation algorithms [65] (fairness, transparency) and mood enhancement technologies [37] (justice, identity, autonomy, dignity, privacy and safety).

5.3 RQ3: Willingness to use a music app that has been enhanced for emotion regulation

82% of participants (18 out of 22) reported they would use an emotion-regulation feature in their music app, which suggests that while concerns were many, they were outweighed by perceived benefits. This contrasts with earlier research that found that 23% of participants were willing to use a Spotify chatbot that suggests a playlist based on users' self-reported emotion [46]. This higher willingness to use *MoodDJ* could be attributed to its personalised emotion-regulation playlists, curated each time the user opens the feature, compared to the chatbot's pre-generated playlist suggestions.

As we discussed earlier, participants expressed motives for using *MoodDJ* that map onto Tamir's [77] taxonomy of emotion-regulation motives. These include hedonic motives (e.g., prohedonic motives such as feeling better or contrahedonic motives such as wanting to cry), in addition to instrumental motives (e.g., seeking to improve performance or enhance social relatedness). However, participants more frequently talked about changing their emotion along the arousal dimension of Russell's circumplex model of affect (i.e., how activated or deactivated they feel). This suggests that psychology frameworks may not perfectly describe all of the phenomena that occur in digital intervention contexts.

We now discuss how the findings contribute to the design of future emotion-regulation add-ons for music apps.

5.4 Designing ethical emotion-regulation plugins

We summarise the ethical risks raised by participants to yield recommendations for designers and vendors who are building emotion-regulation features for commercial music apps. Table 4 outlines the categories of participants' perceived ethical concerns, applying labels established by prior work on the ethical issues of music recommender systems [65] (transparency, fairness) and mood enhancement technology (privacy, autonomy, justice, safety, dignity, identity) [37]. Our suggestions for designers are guided by participant responses.

Table 4: Suggestions for designers of emotion-regulation plugins for music apps

Ethical principles	Suggestions for designers
1. Privacy	• De-identify emotion/personality data to ensure user anonymity • Disable sharing of emotion/personality data with third parties • Secure plugin to prevent unauthorised agents hacking the algorithm • Disable advertising when the plugin is in use • Disguise the plugin in the interface design • Make the listening sessions "incognito" to prevent sharing of data with other users • Do not display emotion data on user profiles • Password-protect the plugin
2. Transparency	• Explain to users how the plugin will collect, use, store and share their emotion/personality data in plain language • Explain to users how the plugin's algorithm works in plain language
3. Autonomy	• Ensure users have control over their usage of the plugin and selecting their emotional trajectory

	• Include a deactivation feature that allows users to listen to music as normal outside the plugin and that deactivates the plugin's recommender algorithm • Include skip function that allow users to skip songs that are disliked/inappropriate • Enable users to provide feedback on songs chosen by the plugin • Include customisers to allow users choice over the length/music for each emotion-regulation playlist
4. Justice/Fairness	• Select a diverse range of music for emotion-regulation playlists centred on user well-being • Ensure users will equally benefit from their use of the plugin • Ensure fairness of accessibility
5. Safety	• Warn vulnerable users about the risks of using the plugin to ruminate • Include links to support services in the interface design • Employ third party auditors to regularly verify the ethical use of the emotion-regulation algorithm • Explain appropriate situations to use the plugin with headphones versus speakers to ensure user safety • Encourage alternative emotion-regulation strategies to prevent dependence on the plugin
6. Dignity	• Ensure design does not stigmatise emotions • Do not prevent users from shifting their emotions in certain directions
7. Identity	• Ensure the algorithm does not analyse users' mental health • Include privacy settings that allow users to disable sharing their use of the plugin with other users

5.4.1 Privacy.

We have identified many risks associated with the collection, use and security of emotion and personality data by an emotion-regulation plugin, in alignment with prior research on mood enhancement technology [37]. As participants suggested, this data must be de-identified by music apps to protect users. We recommend for this data to only be recorded to help ensure users' mental well-being, which we will elaborate on in Section 5.4.5.

It is known that music apps (e.g., Spotify) share usage data with advertising and marketing partners [72]. Our participants emphasised that they would not want their *MoodDJ* data to be shared with third parties, highlighting the need for designers to implement policies to prevent this. Further, the security of the plugin is paramount to prevent unauthorised agents from hacking the data or manipulating users' emotional states with malicious intent. Protecting users' privacy and autonomy is vital. This data being leaked publicly could also lead to detrimental impacts for users' identity, which we will explain in Section 5.4.7.

As emotion-regulation plugins should be centered on user well-being, it is important to protect users' emotion and personality data from being used for targeted advertising, as participants perceived this as discomforting. We recommend for all advertising to be deactivated once users open the plugin, regardless of whether they are free or paid users, as advertisements would also interrupt their emotional journey.

Participants' concerns around the stigma of emotion regulation have important implications for interface design. Emotion-regulation playlists should not be distinguished from regular playlists by labelling them with emotion-related words. Listening sessions should be "incognito" so that other users are not aware the feature is being used. The plugin should not broadcast users' current or desired emotions to other users, and should be password-protected so that someone picking up the phone or sharing the account cannot access their emotion-regulation playlist history. The plugin should not use voice commentary (as in Spotify's AI DJ [57]) that can be overheard by other people.

5.4.2 Transparency.

The established ethical issue of transparency in music recommender systems [22] also applied to emotion-regulation plugins for music apps. Transparency regarding how emotion and personality data will be collected, used and shared is

important, as this would be a determining factor as to whether some participants would use such a plugin or not. Participants suggested for this information to be explained to users in plain language.

It is also important to explain how the algorithm of an emotion-regulation plugin chooses music for emotion-regulation playlists. This transparency would lead to more trust, as we saw an underlying distrust due to the current murkiness of how music recommender algorithms work.

5.4.3 Autonomy.

Users must be guaranteed control over their usage of emotion-regulation plugins and their emotional trajectory, corroborating the importance of autonomy in mood enhancement technology [37].

The inclusion of a deactivation function that allow users to deactivate the plugin and listen to their music app as normal is important. This function should also deactivate the plugin's recommender algorithm to ensure that users do not receive emotion-based music suggestions outside of the feature. This aligns with Marques's [46] finding that 69% of participants wanted to have the option to deactivate a Spotify chatbot that recommends playlists based on how they are feeling.

Users must always be in control of selecting how they are feeling/want to feel and have the autonomy to skip songs chosen by the plugin that are disliked, inappropriate to their current situation or that bring up negative memories. We recommend that such a skip button should replace a skipped song with an alternative that fits the order of the emotion trajectory and would ask for feedback to learn from its inappropriate recommendation.

Participants desired agency over music chosen for emotion-regulation playlists. Optional customisations for playlists were suggested by participants including the genre/s of music, duration, ratio of new to familiar songs and choosing instrumental versus lyrical songs. Participants stated that these factors change depending on their emotion and context at the time of listening. Participants also wanted to control the speed at which they move from their current to desired emotion through a gradient function. We will elaborate on the risk of including such a function in Section 5.4.5.

5.4.4 Justice/Fairness.

Music recommended by an emotion-regulation add-on should not show "popularity bias", akin to a normal music recommender algorithm [21]. Participants did not want their emotion-regulation playlists to be biased towards popular artists that have deals with the music app. We recommend that commercial factors that may influence music recommendation outside of the plugin should be deactivated when the plugin is in use to ensure that the songs chosen are the best fit for users' well-being.

Justice for users, in alignment with mood enhancement technology [37], is important to manage in the design of emotion-regulation plugins to ensure that all users can fairly reap the benefits. As research suggests with music recommender algorithms [21], it is important to ensure that the plugin benefits users equally. There was concern that emotion-regulation plugins might work more effectively for users with broader music preferences that reflect a wider range of emotions. Therefore, solutions must be in place to ensure that all users can experience every emotion trajectory no matter their music taste. The plugin must be designed to ensure maximum accessibility. We recommend designing a simple interface like *MoodDJ*'s that allows users to easily input their emotions through emojis, which are a universal language and might be more approachable for users who have difficulties recognising and expressing their emotions.

5.4.5 *Safety.*

Participants raised multiple safety issues when imagining using an emotion-regulation plugin, highlighting the need for the careful design of safeguards. First, participants were concerned that vulnerable users may use the plugin to prolong negative feelings. In this case, we recommend that emotion-regulation plugins should warn vulnerable users of the potential risks of their intended use. We suggest that personality data could be used to identify vulnerable users, as Neuroticism, for example, is a personality dimension known to confer heightened vulnerability to mental health conditions [40]. Therefore, users high in Neuroticism could be warned if they select a negative emotion for both their current and desired feelings [40]. As suggested by Kamenjasevic [37] in reference to mood enhancement technologies, user autonomy must only be interfered when the risks outweigh the benefits. We recommend integrating a list of country-specific support services into the design of emotion-regulation plugins for emergencies, and as suggested by a participant, to share these services with users who have continuously reported feeling negative.

To further ensure user safety, an auditing process was suggested by a participant whereby a third party could regularly check that the music app is implementing the algorithm ethically and not for commercial gain.

In alignment with ethical issues of self-care apps [17], we found concerns related to dependence (becoming reliant on a plugin for emotion regulation). Emotion research suggests that healthy emotion regulation entails having a broad repertoire of emotion-regulation strategies [1, 36]. Relying on technology for emotion regulation could be risky if users' phones are not working or they do not have access to the internet. Therefore, an emotion-regulation plugin needs to educate users on alternative methods of emotion regulation, for example, going for a walk in nature or talking to a friend. It should encourage users to make an educated decision as to whether using an emotion-regulation plugin is the right fit for their current situation.

Similarly, to avoid *digital emotion contagion*, plugins should include a guide on when to use listening modes (e.g., to use headphones when around others) and to prompt users to reflect on how their use of the add-on might influence the emotions of others.

5.4.6 *Dignity.*

Participants highlighted the risk of a plugin designed to improve well-being reinforcing stigmas around feeling negative emotions were it to prevent certain emotional trajectories. Stigmatisation of emotions is also an ethical risk identified in mood enhancement technologies [37]. In the interface design of emotion-regulation plugins, it is important to respect users' dignity by not preventing certain trajectories, however, to warn vulnerable users who intend to ruminate as stated in Section 5.4.5. To prevent stigmatisation of negative emotions, we recommend for plugins to include a video tutorial showing different use cases, not just a negative to positive emotion trajectory. The video could include a user choosing to shift their emotions from a deactivated positive state (e.g., calm) to an activated negative state (e.g., tense) to prepare for a football game, for example. It is important to prevent stigma surrounding users who may choose to feel negative emotions, whilst also ensuring their safety.

5.4.7 *Identity.*

Intertwined with privacy issues was the negative impact that sharing of emotion data could have on users' identities. This risk was also identified in mood enhancement technologies [37]. Participants were concerned about an emotion-regulation plugin diagnosing their mental health based on their emotion data, and the consequences for their public image were this information exploited. Therefore, it is paramount for music apps to prevent algorithmic diagnosis of user mental health, and to ensure that emotion and personality data remains private. Furthermore, there must be privacy

settings included in the design of an emotion-regulation plugin to prevent emotion information or usage data being broadcast to other users, which may influence perceptions of one's identity due to the stigma around emotion regulation and feeling negative emotions that participants implied.

5.5 Limitations and Future Work

We acknowledge limitations in our study design. First, the participants recruited were mostly in the 18-34 age bracket and were either university students or office workers living in a large city in an industrialised country. These relatively young, tech-savvy participants might be relatively more inclined to use music apps, and to be attuned to issues in digital ethics. Future research should explore whether our findings generalise to other occupations, ages and cultures. We nominated Spotify as the platform within which our fictitious feature was embedded; it would be interesting to see if perceptions change when participants imagine a different vendor. Our design fiction study examined reactions to a low-fidelity prototype and could not assess responses to working software. The ethical risks outlined in this study are responses to a design fiction video and therefore future work should conduct longitudinal in-the-wild studies with working software to verify and expand upon these findings.

6 CONCLUSION

Designers and researchers are already exploring how to enhance music apps to support emotion regulation. However, the benefits and risks of doing this are currently not well understood. We contribute the first empirical study of people's reactions to a proposed feature, embedded within a music app, that incorporates users' personality and emotional state information and creates playlists to support emotion regulation. Participants anticipated convenience and well-being benefits, but also ethical concerns around privacy, transparency, autonomy, justice/fairness, safety, dignity and identity. We contribute suggestions to help designers and vendors mitigate ethical issues that arise in the design of emotion-regulation features for commercial music apps.

ACKNOWLEDGMENTS

We are grateful for the valuable feedback received from reviewers and all participants who volunteered their time to participate in our study. This research is supported by the Australian Commonwealth Government and the Centre for AI and Digital Ethics at the University of Melbourne through a scholarship awarded to Xanthe Lowe-Brown.

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APPENDIX

Table 5: Interview questions

Area of focus	Interview questions
Acceptability/usability	This feature is designed to help you regulate, or manage, your emotions. An example of emotion regulation is that, if you might be feeling tired and want to feel energised before work, so you might use this feature to help you gradually shift to feeling energised. Or, if you are feeling anxious before a test and you want to shift to feeling calm, you could use this feature to create a Spotify playlist to help shift your mood from anxious to calm. 1) Would you be interested in using this feature to control, regulate, or manage your emotions in this way? How often and in what kind of situations? 2) Are there situations where you would not want to use it? Prompt: For example, at work when you're trying to concentrate? 3) How do you usually listen to music on your streaming service. For example, with headphones or using a speaker? 4) Would you be more likely to use this feature with headphones or without? 5) Would you want other people to hear the songs you are playing, such as housemates or work colleagues? 6) How would you feel about using this feature around other people? For example, on public transport? 7) Imagine someone sitting next to you while you're using the feature and saying, "Oh what's that?" How would you feel telling other people that you were using this emotion-regulation feature? We can think of feelings as being pleasant (i.e., positive/good) or unpleasant (i.e., negative/bad), and activated (i.e., aroused/awake) or deactivated (i.e., passive/sleepy). These feelings can be represented using a grid, a sort of "map for feelings," which I will show you now. Moving from left to right, the horizontal dimension represents how pleasant you are feeling, from very unpleasant (left) to very pleasant (right). Moving from top to bottom, the vertical dimension represents how awake, alert, or aroused you feel, from very active (top) to very passive (bottom). This two-dimensional grid can be divided into four quadrants: the top-right quadrant contains feelings that are pleasant and activated (e.g., excitement, joy, enthusiasm); the bottom-right quadrant contains pleasant and deactivated feelings (e.g., calm, relaxed, serene). In the top-left quadrant, you'll find feelings that are unpleasant and activated (e.g., anxious, stressed, angry); whereas feelings in the bottom-left quadrant are unpleasant and deactivated (e.g., depressed, sluggish, dejected). 1) Which emotions do you think you would use this feature to help you deal with? 2) Is there a specific quadrant of emotions that you'd be most likely to use this feature for? 3) What is the likelihood of using this feature when you're feeling pleasant emotions versus when you're feeling unpleasant emotions? 4) What is the likelihood of using this feature when you're feeling deactivated versus activated?
Effectiveness	1) Reflecting on the situations you would use this feature for, do you think it would work? 2) Now I'd like you to think about someone you know well, perhaps a family member or friend, who is a different age, has a different taste in music, or whose personality is quite different from yours. How do you think this feature would work for that person? 3) Where would you want this feature to choose music from? (For example, would you want Spotify to choose music from your most listened to songs, songs included in your own playlists or new music that you have never listened to before?) 4) What would you want to be able to do if it chose music that you didn't want to listen to at that time?

Perceived concerns and benefits	1) How do you feel about Spotify's algorithm now changing your emotions? 2) What would be the potential benefits of using this feature? 3) Would this feature have any impact on your overall well-being? Why or why not? 4) What are potential concerns that you may have around using this feature? Prompt: Can you imagine anything going wrong when using the feature or any negative side-effects? Prompt: Do you think it would motivate you to listen to music more, or use Spotify more? Is this a problem?
Ethical concerns	Spotify already collects data about you, including the music you listen to and your music preferences. But this new feature will also ask you to answer questions about your personality traits and your current and desired emotional state. 1) How do you feel about Spotify collecting your personality and emotional state data? Prompt: Why are you ok with it? Prompt: What if Spotify used the emotional state and personality data that they collected about you and others to target music to other people to get them to use Spotify more and, as a result, make more money? How do you feel about this? Why? Prompt: Why are you not ok with it? 2) Tell me about any privacy concerns you may have about who will see your personality and emotional state data? 3) Tell me about any concerns you have about Spotify using this data to help you shift your emotions? 4) Based on your concerns, would you want to see any changes to the feature before using it, e.g., privacy features or a disclaimer about where your data is stored and how Spotify uses your data?
Music emotion regulation	1) What do you think of the idea of listening to music when you want to change your emotions? 2) What kinds of emotions do you think music helps you deal with? 3) What kinds of emotions do you think music doesn't help you deal with? 4) Can you tell me about how you are currently using your music streaming service to manage or shift your emotions? Do you use any specific features such as your own playlists or Spotify's mood playlists? 5) How important is listening to music to support your overall well-being?