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Blooming Beats: An Interactive Explainable Recommender System for Exploring Personal Music Narratives through Data Humanism Principles

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Blooming Beats

An Interactive Explainable Recommender System
for Exploring Personal Music Narratives through
Data Humanism Principles

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ABSTRACT

Recommender systems have become integral to our daily digital experiences, particularly in music streaming services. However, existing systems often reduce rich listening experiences to mere analytics, overlooking the personal narratives and contexts that make music meaningful. We present Blooming Beats, an interactive explainable recommender system that transforms a decade of personal Spotify listening data into compelling visual narratives. Grounded in Data Humanism principles, it represents songs as flower-like graphs where petals encode audio features, while connecting lines and contextual markers capture listening behaviors, personal milestones, and global events. The system enables users to explore 10 years of listening history through multiple temporal views, re-live musical moments, and generate context-aware recommendations. Through a preliminary qualitative user study, we found that Blooming Beats enables users to explore listening histories and understand recommendations in tailored and contextualized ways, demonstrating how Data Humanism can be employed to engage with personal data to enhance music recommendation explainability.

CSS CONCEPTS

Human-centered computing ~ Interface design
prototyping; Visualization; User interface design.

AUTHORS KEYWORDS

Personal Data, Music, Personal History, Data Humanism, Recommender Systems

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INTRODUCTION

Recommender systems (RecSys) have become integral part of our everyday lives, seamlessly guiding our choices (from online search and shopping to dining and events suggestions to films and music recommendations) across various digital platforms and profoundly shaping our daily web experiences [19, 34].

Their impact is especially pronounced in the domain of music streaming services, where RecSys analyzes vast amounts of data to suggest new content – songs, playlists, genres, or artists – in an effort to boost user engagement [39, 40]. However, despite the sophisticated algorithms, current RecSys largely treat data as an analytical tool, overlooking the rich contextual narratives and personal meanings that influence and enhance users' listening experiences. In turn, growing research in the design-oriented Human-Computer Interaction (HCI) called for open-ended, reflexive, and interpretive approaches to personal data (e.g., [9, 22, 31, 32]). Despite this recent HCI research shift to explore alternative interpretations of personal data (e.g., [5, 38]) and its social effects (e.g., [11, 15]), the examples of the actual designs that enable such exploration of people's life experiences are still scarce (e.g., [31, 32]).

In the context of music, users' preferences are influenced by a myriad of factors, ranging from personal milestones like birthdays to memorable experiences such as vacations and travels to significant

global events such as the Olympics or pandemics. These events shape users' emotional states and resonate through their music selections, contributing to a deeply personalized listening journey and narratives [4, 14]. Yet, conventional music streaming platforms rely heavily on black-box algorithms that generate recommendations without revealing the contextual or personal reasoning behind them. As a result, they offer only limited ways for users to understand the recommended song and explore their listening histories. While some academic efforts have attempted to address this gap, for example, by visualizing music listening histories using timelines and contextual data [6, 7], or tailoring explanations based on user characteristics [2, 28], these approaches often remain analytical and system-centric rarely support the emotional, narrative-rich engagement that personal music histories afford. This leads to create a disconnection between the vibrant, context-rich experiences of music in users' lives and the sterile, isolated way these experiences are represented.

To address this gap, we designed and developed Blooming Beats. It operates as an interactive web-based RecSys built in React and Python. The visualizations utilize D3.js for interactive data representation. Blooming Beats is grounded in six selected *Data Humanism* principles namely: design-driven data, small data, subjective data, data to depict

complexity, spend time with data, and serendipitous data. [27]. Data Humanism is a critical data visualization approach that emphasizes the human aspects of data, acknowledging its imperfections, embracing complexity, and celebrating the qualitative alongside the quantitative. Unlike conventional systems that treat data as a mere analytical resource, Blooming Beats leverages data as a fundamental design material. Adopting a design-driven data approach that foregrounds human stories, our development process included visual exploration, sketching, and iterative design. It ultimately transformed a 10-year personal music archive into a narrative-rich visualization system.

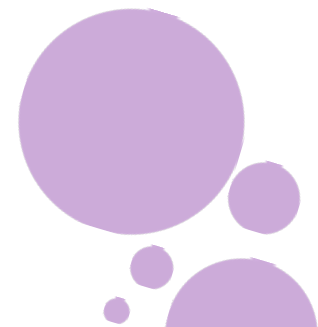
Inspired by *lived informatics* – an HCI research direction advocating for sense-making tools built around personal data archives (e.g., [9, 36]) – Blooming Beats allows users to uncover significant patterns in their listening behavior, contextualized by both personal milestones and global events. By generating transparent recommendations based on user-identified patterns and contextual moments, it fosters a personalized exploration of music. It shifts the recommendation process from a black-box algorithm to an interpretable, context-aware system that prioritizes human experience over data analytics. This approach enables users to engage more deeply with their listening histories, turning data into meaningful, story-driven experiences. We conducted a preliminary

user study gathering participants' initial reactions and feedback of Blooming Beats in fostering meaningful engagement and exploration of their personal music journeys.

In addition to presenting the system, we offer a critical reflection on how Blooming Beats compares to prior explainable music RecSys approaches, highlighting how its narrative and human-centered framing contrasts with traditionally analytical and system-centric designs.

By opening new ways of connecting with key events and everyday practices embedded in extensive music archives, Blooming Beats adds to ongoing HCI efforts to reinterpret personal data through design.

Our work offers the following contributions: 1) present a novel visualization approach that makes music listening data more personal and interpretable while maintaining analytical rigor, 2) show how contextual layers can enrich data exploration, enabling users to connect their music choices with life experiences, 3) provide insights for designers working on human-centered data visualization systems, particularly using Data Humanism in the context of music recommendation.





DATA HUMANISM BEYOND THE NUMBERS

Data Humanism is a critical data visualization approach introduced by information designer Giorgia Lupi in 2017 [27]. This approach marks a considerable paradigm shift in how data are visualized, placing a strong emphasis on human experiences and narratives rather than solely on analytics. At the heart of Data Humanism is the belief that data are not just numbers but data are reflections of real life—snapshots of human behaviors, knowledge, and experiences that deserve to be represented with care and depth. Lupi advocates for embracing the complexity of data, moving beyond conventional standards, and consistently integrating context to ensure that visualizations are not only informative but also deeply meaningful. By acknowledging that data are as imperfect as the humans they represent, Data Humanism allows for the creation of personalized data visualizations that resonate more profoundly with individuals. This approach challenges traditional data practices and encourages designers to think creatively about how data can tell a human story.

Data Humanism has demonstrated its versatility and considerable impact across diverse domains. In environmental

science, this approach has made climate change data more relatable by linking global environmental patterns to individual personal experiences, thus enhancing public engagement and understanding [12, 13]. In the realm of RecSys, the principles of Data Humanism have improved the transparency of point-of-interest recommendations by fostering the creation of better human-centered user requirements, making these systems more intuitive and responsive to user needs [2]. Educational institutions have also embraced Data Humanism, which has provided deeper insight into learner growth patterns [42]. This approach encourages a more engaging and transparent exploration of educational data, utilizing storytelling techniques to illustrate these insights and make them more accessible.

The successful application of Data Humanism across these fields underscores its ability to transform complex data into approachable and meaningful experiences, emphasizing personal narratives and contextualization to reach and resonate with various audiences.

Music holds a uniquely personal place in human experiences, making it an ideal subject for Data Humanism. Songs blend with our memories, mark significant life events, and accompany us in our daily routines [17, 18]. Despite the deeply personal nature of music consumption, current visualization techniques often diminish these rich listening narratives to mere analytical summaries focused on play counts, timestamps, and genre classifications [5, 6]. Although these visualizations provide some informative value, they do not capture the emotional and contextual dimensions that fill music with meaning for listeners. This shortfall becomes apparent in features like Spotify's annual Wrapped, which, despite being eagerly awaited by users, predominantly offers statistical aggregations of listening data. Its attempts at personalization, such as categorizing listeners into quirky groups like 'Pink Pilates Princesses,' only scratch the surface. These efforts are derived from algorithmic patterns that do not truly reflect personal context or convey the deeper significance of music in listeners' lives.

Researchers have sought to move beyond purely analytical approaches in representing music experiences. Baur et al.'s

seminal work, 'The Streams of Our Lives [4],' marked an early attempt to contextualize listening histories by integrating Last.fm data with personal photos and calendar entries. While this method acknowledged the role of music in people's daily lives, it still treated songs as isolated units. Crucial aspects of listening behavior – such as whether users completed songs, skipped them, or played them repeatedly – were overlooked. Additionally, the system failed to capture important contextual factors that profoundly shape music experiences, like whether a song was played during a birthday celebration, on a national holiday, or as part of someone's daily commute.

Personal listening data can be used to design meaningful interactions, as demonstrated in the work of Wirfs-Brock et al. [44] on voice assistant music experiences. Through a design workshop with Spotify listeners, they explored how *silent data* - logged listening behavior that is rarely exposed to users - could enhance voice interactions. The findings revealed that personal listening data was not merely information to be shared, but a catalyst for deeper music exploration, fostering introspection and encouraging behavior change. The authors noted that data visu-

TRANSFORMING LISTENING HISTORIES INTO NARRATIVE ARTIFACTS



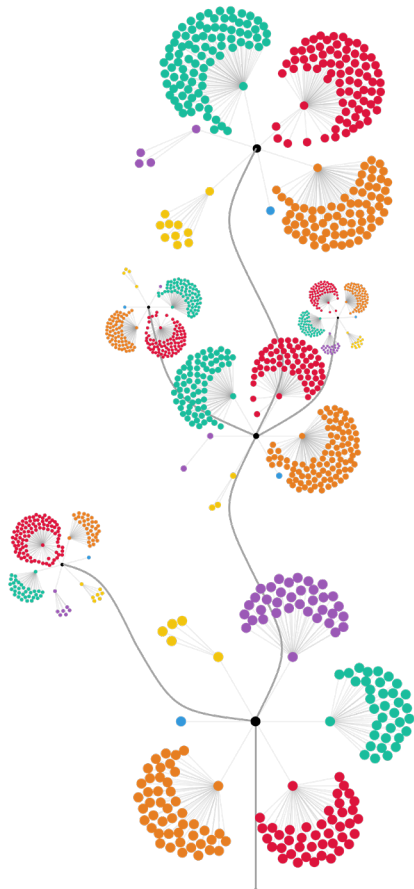
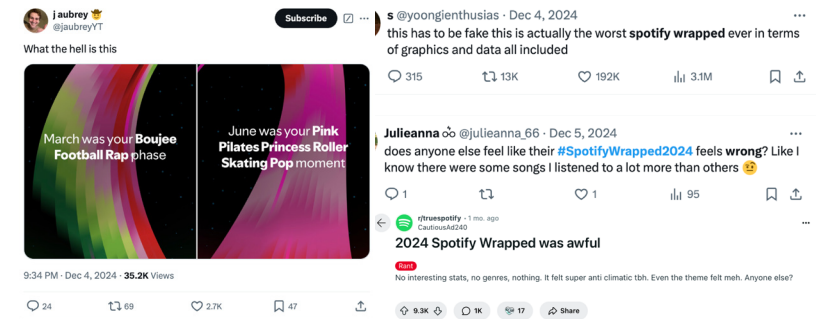
alization could help users develop new ways of articulating their music preferences and histories, creating a richer vocabulary for discussing their listening experiences.

The potential of music metadata as an input design material for storytelling is further exemplified in Odom and Duel's OLO Radio project [30, 32]. Their work demonstrates how listening history metadata can be transformed from mere timestamps and track listings into rich, physical temporal narratives. By constructing a physical radio that allows users to explore their music history across different time-frames (year, month, time), the authors leveraged metadata to create meaningful connections between songs and personal experiences. Their approach, which embodies the Data Humanism principle of using data as design material, embraces complexity through multiple temporal views and transcends standard visualization techniques with

their unique physical interface. Their follow-up project 'Queue Player', drawing upon slow technology paradigm, explores the social aspects of music listening experiences across space, time and tempo [33].

Inspired by their research, Blooming Beats adopts similar temporal filters to support **slow data exploration** [36]. It allows users to examine their listening behavior through three different lenses - day, week, and month - facilitating introspection, reflection, and contemplation with personal music listening (meta)data archives.

The 2024 Spotify Wrapped faced significant backlash after replacing its beloved human-curated insights with AI-driven analytics. While users still received basic listening statistics, the removal of shareable features like genre deep-dives, city-based listening patterns, and musical auras eliminated the social connection that made Wrapped a cultural phenomenon: raw data alone isn't enough—it's the human touch that transforms statistics into meaningful, shareable insights that bring music fans together.



FROM ASCETIC NUMBERS TO RICH STORIES

Converting music listening data into visual narratives presents specific challenges and opportunities that traditional data visualization approaches often struggle to address. Our approach builds upon the Data Humanism visual manifesto, adopting six of its core principles [27]. In particular, our design approach utilizes the **design-driven data** principle, which emphasizes a design thinking process throughout the data handling stages. Richards [35] elaborates on this principle, describing it as selecting an inspiring design for the visualization first, then seeking data that can approximate, but not exactly replicate the chosen design. The design-driven data approach contrasts with traditional data-driven design approaches, allowing the prioritization of creativity, narrative, and human understanding from the early stages of development. Moreover, while designing the data visualizations, we incorporated principles like **small data** and **subjective data**,

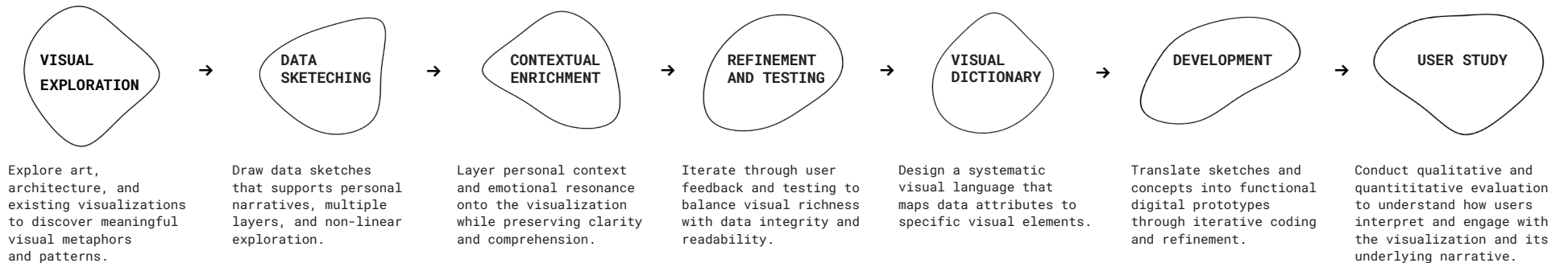
focusing on individual-level narratives that bring personal stories to the forefront. Additionally, principles like **data to depict complexity** and **spend time with data** guided our approach of overlaying contextual and qualitative factors while encouraging readers to engage in **serendipitous data** exploration, uncovering deeper insights and connections.

In what follows next, we describe the ways how we designed and developed the Blooming Beats, focusing on the key design decisions related to its visualization system using a personal 10-year music listening archive.



DATA HUMANISM-DRIVEN APPROACH

Drawing from Lupi's multi-layer storytelling approach [26] and insights from her formal studio¹, we developed and implemented a seven-stage Data-Humanism methodology. Moving systematically from visual exploration through user study to create visualizations that balance personal narrative, accessibility, and analytical integrity.



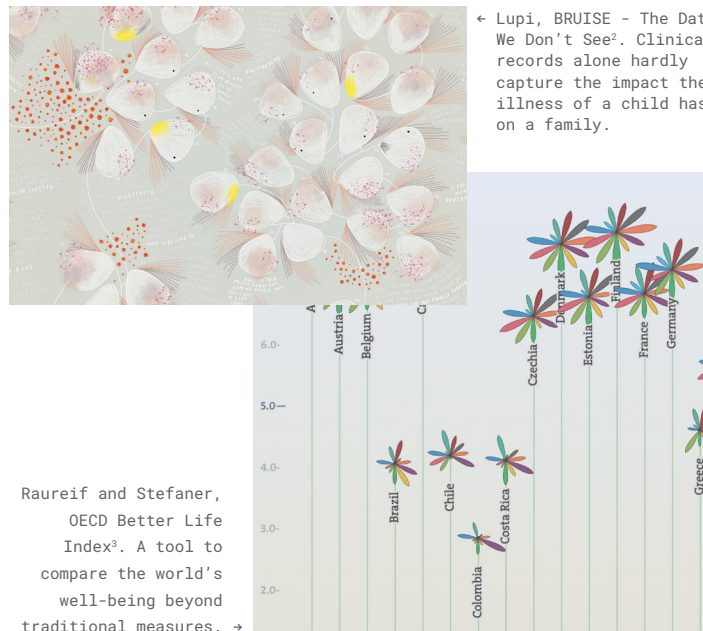
DATASET

Our dataset comprises 202'988 songs representing one user's ten years of listening history, obtained through Spotify's official data request system. Each song includes metadata provided by Spotify's API, characterized by 14 features ranging from fundamental attributes (e.g., tempo, key) to higher-level descriptors (e.g., danceability, valence). These features are derived through Spotify proprietary models, which use audio signal analysis to extract high-level characteristics from each track

Through an iterative feature selection process that combined correlation analysis and user feedback from participants, we identified six key features that proved most meaningful for visualization and analysis. The selected six features are: *Danceability* (measure incorporating tempo, rhythm stability, and beat strength), *Energy* (measure of intensity and activity in the track), *Valance* (degree of musical positiveness), *Instrumentalness* (absence of vocal content), *Speechiness* (presence of spoken words), and *Acousticness* (presence of acoustic instruments). These features were then normalized on a scale from 0.0 to 1.0, where higher values indicate a stronger presence of that characteristic.

¹<https://medium.com/accurat-in-sight/the-architecture-of-a-data-visualization-470b807799b4>

1 VISUAL EXPLORATION



We initially focused on exploring and examining successful data visualization projects that relate to Data Humanism and/or music visualization. The goal of this exploration was two-fold: (i) to study how personal data can be transformed into personal visual narratives and (ii) to understand how to represent temporal patterns in music-listening behavior.

In 'Dear Data,' Lupi and Posavec collected daily data about their lives, like how they spend their day or how many times they give or received a compliment, to create hand-drawn visualizations on postcards that later would be sent to each other [28]. Drawing inspiration from the 'Dear Data' project, we recognized that effective personal data visualization must balance data representation with narrative potential that considers both, context and personal detail.

5 VISUAL DICTIONARY OF BLOOMING BEATS

Day Context, highlights significant dates in the life of the listener. These could be major personal events like birthdays as well as global events like national holidays or the Olympics. This layer of contextualization helps users understand how their musical preferences align with important moments in their lives, providing deeper insights into the emotional and cultural significance of their music listening habits.

Each song takes the form of a flower-like graph composed of six distinct colored petals, one for each audio feature. Hovering reveals the song title, artist, genre, and precise audio feature values.

Single-Event Context, highlights a specific moment within a day that is particularly memorable. This finest level of contextualization helps preserve the intimate moments when music becomes particularly meaningful, allowing users to relive and reflect on these experiences through visualization.

Range Context, captures the extended periods of activity that span multiple timestamps. This layer encourages the users to explore how various activities can influence listening patterns, providing insights into the interplay between daily routines and musical choices.

01.08.2024 Sun, National Day

Morning Motivation

Study session for exams




Songs features

- Acousticness
- Danceability
- Energy
- Valence
- Instrumentalness
- Speechiness

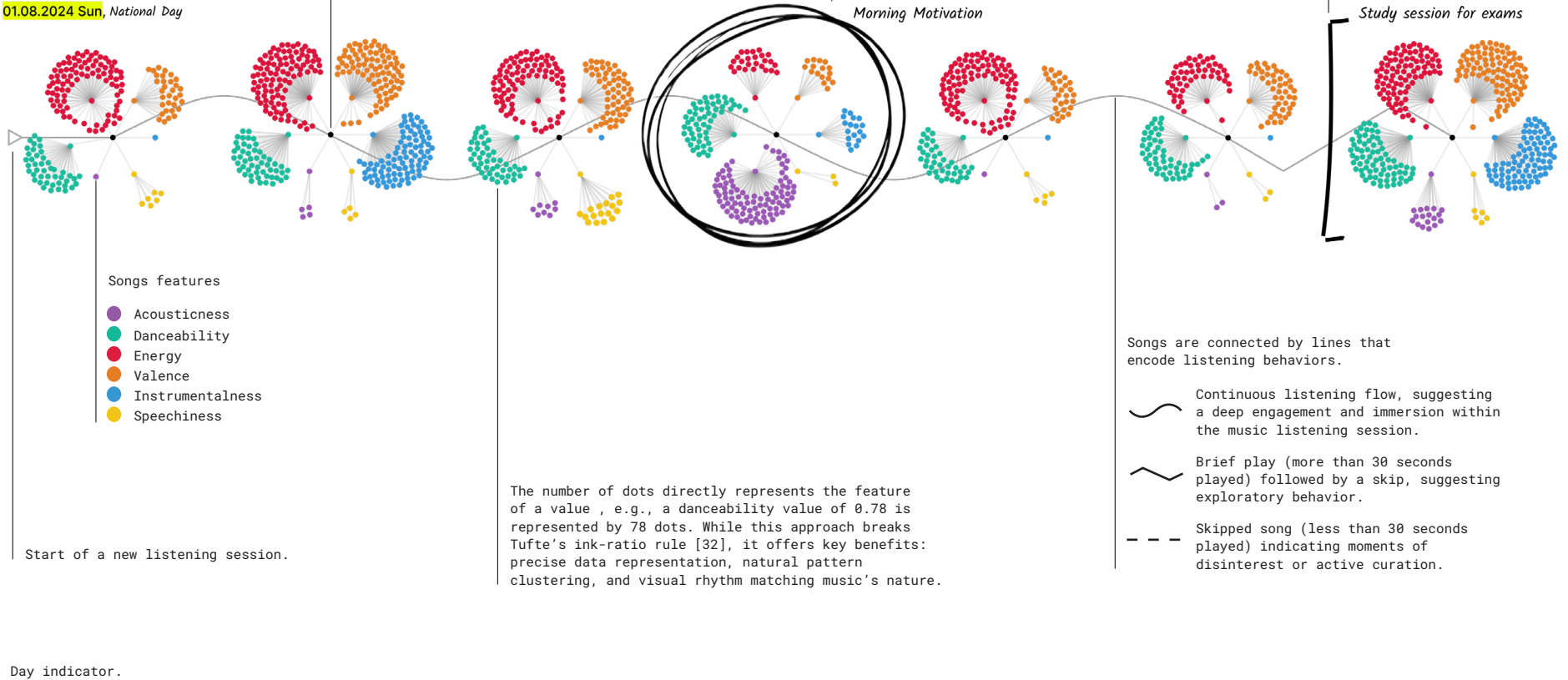
Start of a new listening session.

The number of dots directly represents the feature of a value, e.g., a danceability value of 0.78 is represented by 78 dots. While this approach breaks Tufte's ink-ratio rule [32], it offers key benefits: precise data representation, natural pattern clustering, and visual rhythm matching music's nature.

Songs are connected by lines that encode listening behaviors.

-  Continuous listening flow, suggesting a deep engagement and immersion within the music listening session.
-  Brief play (more than 30 seconds played) followed by a skip, suggesting exploratory behavior.
-  Skipped song (less than 30 seconds played) indicating moments of disinterest or active curation.

Day indicator.



TRANSPARENT SONGS RECOMMENDATION

By leveraging our visual dictionary (always accessible as a legend in a side panel by clicking the question mark button in the top-right corner), we create explanations that are both meaningful and personally relatable, transforming abstract algorithmic decisions into visual narratives. Users can generate recommendations by selecting any songs from their listening history.

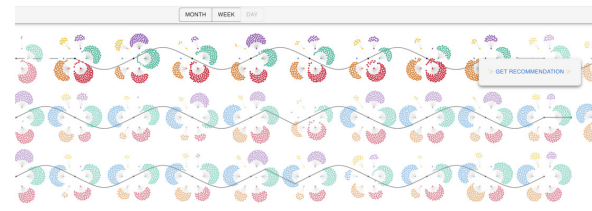
The system employs a content-based approach using weighted feature aggregation. Selected songs contribute to an aggregated representation based on two factors: listening completion percentage and genre frequency. The algorithm combines the weights of these two factors to create a target profile. It then calculates similarity distances between this profile and all database songs using Euclidean distance.

The main component employs a comparative visualization approach, overlaid with two versions of the flower graph: one showing the aggregated features of selected songs (border only) and another showing the features of the recommended song (filled). This visual dialogue between past and potential future listening choices facilitates a deeper understanding of the relationship between their selections and the system's recommendations. To support different levels of engagement with the recommendation process, we provide multiple layers of explanation that accommodate diverse users' needs and preferences when interacting with the system.

The interface also highlights three

key metrics that narrate the story behind each recommendation: *Recommendation Impact*, reflecting the overall similarity score; *Genre Impact*, indicating the influence of musical genres; and *Amount Listened Impact*, measuring the extent to which songs were played. These metrics are presented both numerically and through simple visual encodings (bar charts), allowing users to engage with the recommendation logic at their preferred level of detail.

This integrative method demystifies the recommendation process and also enriches users' interaction, making each recommendation a reflection of personal history and new music discovery.



Selection of a sequence of songs based on a visual pattern. The selected songs present high levels of energy (red dots) and danceability (green dots).

APRIL 2022

vocal content. Values above 0.5 are intended to represent instrumental tracks, but confidence is higher as the value approaches 1.0.

Valence: A measure from 0.0 to 1.0 describing the musical positiveness conveyed by a track. Tracks with high valence sound more positive (e.g. happy, cheerful, euphoric), while tracks with low valence sound more negative (e.g. sad, depressed, angry).

Line Encodings
Wondering why a song has ended? Our line encodings help you figure that out.

- This is the encoding for a FLOW (the whole song was listened). Because of Spotify's auto-play function, most of the time, the next song gets played automatically, once the previous song is done.
- This is the encoding for a SKIPPED song, if the song was only listened for a couple of seconds and the user actively decided to play a different song, the song is considered as skipped.
- This is the encoding for a STOPPED song. The user actively decided to stop the song/the session.
- This is the encoding for jumping to the NEXT song. While semantically being similar to 'skipped', this type considers the current song as being partially actively listened to (i.e. not skipped) and the user actively decided to switch to the next song.

Personal & Global Context

04-04-2020 Days with important context are highlighted in this way

Sometimes, important context spans over multiple timestamps (e.g., multiple days). This is how items belonging to the same

Side panel serves as a legend to decode the visualization, allowing users to understand the meaning behind different patterns and metrics.

Selection

good 4 u
Olivia Rodrigo - SOUR

Heat Up
Demi Lovato - ROOMSKEY

Waking On Sunshine
Katrina & The Waves - Katrina & The Waves

Genres

Importance of pop: 38.89%

Importance of house: 22.22%

Importance of other: 11.11%

Importance of indie: 11.11%

Importance of UNKNOWN: 9.98%

Recommendation

The Sun
Parovoz - The Demon Diaries

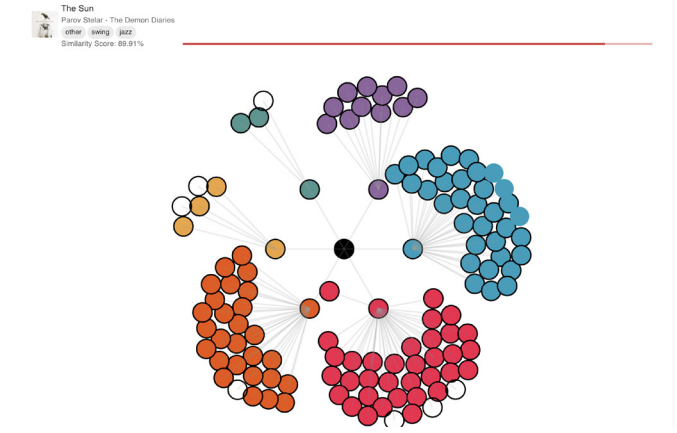
The Sun feat. Graham Candy
Parovoz - Clap Your Hands

Me And I
MØN - Super Trouper

Mystery Train - New Mono to Stereo Mix
Chris Presley - Chris Presley: New Mono to Stereo Mix

Stay (Don't Go Away) (feat. Raye)
David Guetta - Stay (Don't Go Away) (feat. Raye)

List view of the selected songs and recommended ones. Under each selected song, its impact on the recommendation is displayed. Each recommended song presents a similarity score between the recommended song and the overall selected ones.



Visual explanation of why a specific song is recommended. The flower of the selected recommended song is overlaid on an selected-song-aggregation flower. When the recommended song does not fully match the aggregation of the selected song, the dots are empty (as in the case of energy - red dots). Viceversa, more dots without strokes are added (as in the case of instrumentality - blue dots).

FROM MUSICAL LISTENING DATA TO HUMAN STORIES

This usage scenario demonstrates how Blooming Beats enables meaningful connections through music data visualization. We follow two fictional users: Sarah, whose listening data is being explored, and Alex, who discovers Sarah's musical journey through Blooming Beats interface.

SARAH'S MUSICAL JOURNEY

Sarah's Christmas week listening patterns reveal three distinct phases: First, her early-week sessions show extended periods of instrumental, danceable music with low speechiness - suggesting focused study sessions. The visualization reveals strong danceability combined with high instrumentalness, indicating her preference for rhythm-driven background music while studying. As Christmas Eve approaches, her "Get Ready" phase shows brief, high-energy listening sessions with frequent switches, reflecting holiday preparation activities. This fragmented yet energetic pattern suggests Sarah moving between tasks while maintaining an upbeat atmosphere. During Christmas Eve, labeled "All Day Christmas," Sarah's music shifts to extended sessions of acoustic, uplifting holiday tunes, likely soundtracking celebrations. The continuous play patterns and increased acousticness paint a picture of ambient holiday music filling her space.



ALEX'S DISCOVERY EXPERIENCE

Alex explores Sarah's musical journey through Blooming Beats' visualization interface. Through the platform's flower metaphor, which compares audio features, genre influences, and listening patterns, Alex can understand the context behind each song choice. The interface reveals not just what Sarah listened to but why and when these songs held meaning for her. When Alex recognizes familiar patterns in Sarah's music journey, such as the focused study sessions or pre-Christmas excitement, these moments become opportunities for personalized discoveries. If Alex is also a student, they might find value in Sarah's carefully curated study playlists. If instead Alex is preparing for their own holiday celebrations, they might discover new festive music through Sarah's 'All Day Christmas' listening behavior.

These recommendations transcend typical music matching, instead creating bridges through shared human experiences. The data becomes a medium for connection, allowing users to discover music not just based on similar audio features but through the resonance of shared moments and contexts of other (stranger) users.

QUALITATIVE ANALYSIS

Analysis of responses to open-ended questions revealed key insights into music listening behaviors and the potential value of personal music visualization systems. The findings highlighted the deeply social nature of music discovery and consumption, with all participants mentioning *offline influences*, such as family, friends, and events, as a primary source for finding new music. These social interactions often carried emotional weight, suggesting that recommendations are more meaningful when anchored in shared contexts. *Online interactions*, including radio and streaming platforms with their algorithmic recommendations, were noted as supplementary resources.

We discovered an interesting pattern, which was present across all our participants, around music-memory associations. The participants reported forming strong connections between songs and memories,

Drawing upon research through design tradition in HCI [46], we conducted an initial exploratory study to understand if our visualization approach could sensibly bridge algorithmic recommendations with personal music narratives. The aim of our preliminary user study was not to statistically validate the results but to collect qualitative insights into how users might engage with Blooming Beats as a technology probe [16].

We recruited four participants through purposive sampling from diverse academic backgrounds (economics, social sciences, and computer science) to explore varied perspectives on music

but the nature of these connections varied widely. Some participants recounted specific associations with life events, such as concerts or important milestones, like in the case of P2: “Yes, I tend to associate a lot of songs to memories because it helps me remember important times in my life.” Others described more abstract connections, linking songs to ideas or sensations, such as the sea or summer, as P3 put it: “Yes, blue as the Italian sea [. . .] several songs from my youth running in clubs.” Still, others associated music with people in their lives, reflecting deeply on personal and social dimensions. These narratives suggest that users assign layered, subjective meaning to their listening history, which current RecSys interfaces often fail to surface but it is available in Blooming Beats.

Despite these strong associations, 3 out of 4 of our participants did not actively track or document these connections. Only one participant (P1) deliberately maintained these associations, confirming: “They are important to me.” When asked about how they tracked these associations, the majority mentioned relying solely on their memory,

if at all. One participant reported using playlists, but these were often informal and not systematically maintained, as the effort required was described as overwhelming, as in the case of P2: “Playlists which represent stages of life [. . .] but doing it for everything is exhaustive.” One participant noted only using the general playlist “Favorite songs” for loose organization, while another mentioned relying on Spotify Wrapped to reduce the burden, clarifying, “This is what I use Spotify Wrapped for.”

Participants’ feedback while interacting with the various levels of contextualization, also revealed varied approaches to music sharing. Participants demonstrating different levels of contextualization not only while listening but also when sharing songs. Specifically, three levels of sharing-contextualization were identified: a) High contextualization: “Always I want my friends to know why I care about a song and why they should care too.” b) Moderate contextualization: “Contextualize only with some simple explanations.” c) No contextualization: “No context.”

When asked about their experiences

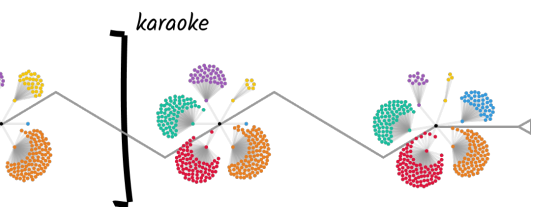
engagement. This small-scale, focused sample aligns with exploratory design research practices where depth of engagement takes precedence over statistical power [41].

Participants interacted with Blooming Beats through the authors’ personal computers. The task participants were asked to perform was to explore the listening history of a stranger user, identify a pattern they related to, generate recommendations, and use the explainable recommendation view to understand the recommendation output.

with recommendation systems on platforms like Spotify or Apple Music, participants provided mixed responses. Some reported never feeling confused by a song recommendation, while others admitted to occasional confusion or skepticism, with P4 participant stating: “I trust recommendations but not fully.” When asked how they believed these platforms generated recommendations, participants offered largely superficial explanations, demonstrating a limited understanding of the underlying technical processes. Stressing that they did not seek deep technical detail, but they would value knowing the reason behind recommendations in a human-understandable way similarly to how recommendations are explained in Blooming Beats.

These findings highlight the potential value of providing transparent and accessible explanations to enhance users’ trust and comprehension of the RecSys. In particular, it highlights a missed opportunity for design more explainable, narrative-driven interfaces that make algorithmic logic relatable and trustworthy.

COMPARISON TO OTHER EXPLAINABLE RECOMMENDER SYSTEMS



DISCUSSION & FUTURE WORK

Our work explores how personal music data can be visualized and recommendation explained through a Data Humanism [27] lens to create meaningful and engaging user experiences. Our findings reveal key opportunities for technology to enhance music experiences. The participants expressed strong desires for features that capture memory associations with music and enable flexible sharing of

Prior research in music RecSys, visualization, and explainability has predominantly focused on analytical purposes rather than human-centered applications.

Dias et al. [7] introduced a timeline-based interface to review listening histories. This approach emphasized statistical summaries, surfacing behavioral patterns through time, but offered limited support for personal or narrative engagement. Similarly, Baur et al. [4] visualized music histories in relation to contextual cues such as location or media, but the resulting designs remained relatively static and exploratory, rather than reflective or story-driven.

Other works have explored the role of personalization in explaining music recommendation through visualization and interaction. Millicamp et al. [29] demonstrated that personal characteristics

these personal narratives (prior research discussed similar social sharing needs of personal narratives in the very different context of sharing physical artifacts [10]). This suggests that visualization systems could support effortless documentation of personal context and memory triggers, potentially through automated tools that reduce manual input burden. Additionally, the varied approaches to music sharing highlight the need for customizable levels of contextualization, which would allow users to adjust the depth of their personal narratives when sharing them with others.

Blooming Beats demonstrates how these technological opportunities can be

like musical sophistication and openness significantly influence how users perceive recommendation explanations. However, these systems still operate within a model that sees users primarily as decision-makers, focused on processing information to validate or reject recommendations.

These approaches reflect an implicit prioritization of system performance and user comprehension metrics over the experiential and contextual dimensions of music engagement. Explanations are typically framed to clarify why a recommendation was made, often using genre-based logic or item similarity, but rarely explore why it matters to the user's broader personal context [1].

In contrast, Blooming Beats challenges these conventions by framing recommendation explanation not just as a transparency mechanism, but as a

realized through contextual visualization. By integrating personal, temporal, and global contexts into music data visualization, our tool transforms algorithmic recommendations into meaningful narratives. The flower metaphor successfully bridges data-driven insights with human experiences, enabling users to explore patterns while maintaining emotional connections to their music. This approach suggests that future music visualization systems should consider context not just for memory association but as an additional data dimension that enriches sharing experiences and creates opportunities for connection between users, in line with prior work [11].

storytelling opportunity. It integrates personal, temporal, and emotional context to foreground users' life events, routines, and emotional states as core to how recommendations are perceived and interpreted.

This marks a shift in how listening histories are conceptualized. Rather than treating them as passive traces of behavior or optimization targets, Blooming Beats reclaims them as narrative material. Users are not just reading system logic but reinterpreting their own data as part of ongoing personal stories. This contributes to a growing body of HCI research that critiques rationalist, model-centric interaction paradigms. It supports systems that embrace ambiguity, memory, and subjectivity as essential elements of meaningful user experience.

Our implementation of Data Humanism principles offers broader insights for personal data visualization. The design-driven approach and the focus on small, personally meaningful datasets rather than large-scale analytics deemed promising in generating engaging user experiences. By emphasizing individual stories over aggregate trends, the visualization created opportunities for deeper personal reflection and potential connections between strangers through shared musical experiences. This suggests that Data Humanism approaches can successfully bridge the gap between algorithmic recommendations and human narratives,

making data exploration more meaningful and socially engaging.

Several limitations should be considered when interpreting these findings. The relatively small participant sample (N=4) is not meant to be generalizable for entire population, though it provided initial contextual insights into a more human-data interaction with Blooming Beats following research through design methodology [46]. Participants interacted with pre-populated stranger data rather than their own music history, potentially affecting engagement levels and personal connection to the visualization. Users' inability to upload their own data prevented the exploration of long-term engagement patterns and personal data curation behaviors. Lastly, in this prototype, the annotations—such as “exam periods” or “trip to Japan”—were manually provided by the user whose Spotify history we visualized, as a proof of concept to explore how such contextual data could be layered meaningfully. In a future iteration, such annotations could be supported through system prompts,

user-added notes, and context-aware suggestions that detect patterns or significant periods in the user's listening behavior. However, these limitations align with our focus on gathering preliminary human insights about the approach rather than establishing generalizable patterns.

In our future work, we aim to address these limitations while building on the promising aspects of contextual music visualization. A primary direction involves developing a more sophisticated contextual intelligence system that can automatically detect and suggest potential annotations based on listening patterns. In our future studies we will include larger and more diverse participant groups, enabling statistical analysis of engagement patterns and preferences.

Additionally, we plan to implement personal data upload capabilities so participants can interact with their own music histories rather than pre-populated examples. This approach would provide deeper insights into how personal connection to the data influences engagement

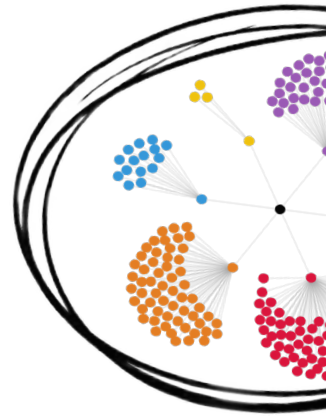
with the visualization system and the types of narratives users construct around their own listening behaviors.

Investigating how shared musical contexts might facilitate connections between strangers represents an exciting direction for extending this work. Could visualization systems like Blooming Beats support the creation of micro-communities based on contextual similarities rather than just genre preferences? Future research in this area might also explore whether shared contextual patterns provide more meaningful foundations for music-based social connections than traditional taste-matching approaches.

Finally, the principles and approaches developed for music visualization could extend to other domains of personal data, such as reading histories, physical activity, or financial behaviors. These cross-domain applications might investigate whether consistent visualization metaphors across different data streams could help users recognize connections between seemingly unrelated aspects of

their lives.

Through these future directions, we aspire to transform algorithmic recommendation systems into more meaningful, narrative-rich experiences that honor the deeply personal nature of music in our lives and create new opportunities for connection and reflection aligning with Data Humanism.



CONCLUSION

We presented Blooming Beats, an interactive explainable recommender system that transforms music listening data into meaningful narratives through Data Humanism principles. By representing individual songs as flower-like visualizations and connecting them through listening behavior patterns, our system enables users to explore their music histories while understanding recommendation logic.

Our implementation of Data Hu-

manism principles—small data, data to depict complexity, and spending time with data—demonstrates how personal data visualization can bridge algorithmic recommendations with human experiences. The preliminary user study revealed promising directions for future work, including automated context generation and scaling to larger datasets. While our current implementation focuses on music listening data, the approach could extend to other

domains of personal data visualization. Through the application of Data Humanism principles, personal data can evolve beyond analytics to become a medium for storytelling and shared understanding.

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