

Randomness as a Resource for Design ¹

ABSTRACT

Randomness is being harnessed in the design of some interactive systems. This is observed in random blogs, random web searching, and in particular Apple's iPod Shuffle. Yet the role of randomness in design of interactive systems is not well understood. This paper reports on an empirical study examining the influence of randomness on the user experience of music listening. 113 instances of self-reporting were collected and analysed according to four themes: listening mode, content organisation, activities during listening, and affective outcomes. The analysis provides insights into how randomness is used to engender certain affective responses (such as feeling refreshed) by using various constraining techniques (such as playlists) whilst engaging in everyday activities (such as driving a car). The paper argues that randomness can be used as an innovative design resource for supporting rich and novel user experiences.

Author Keywords

Random, Design, User Experience, Digital Music, Shuffle

ACM Classification Keywords

H.5.3 Group and Organization Interfaces, H.5.5 Sound and Music Computing

INTRODUCTION

Randomness is often viewed as an undesirable phenomenon; something to be tamed and purposefully marshalled. Yet it is interesting that randomness is increasingly being harnessed in interactive products to enrich user experience. When randomness is offered explicitly as a part of a product, such as shuffling music in digital music players, some users are reporting a range of positive and even rich experiences when encountering the effects of unpredictability.

So how can it be that technology that plays on and presents unpredictability to users affords positive user experiences? What is the character of such experiences and what are their

effects on user interactions? How can we make meaningful use of randomness to enhance the design of interactive systems? In this paper, we attempt to develop an understanding of the experience of randomness in interactive systems and argue that randomness can be harnessed to enhance and stimulate richer user experiences.

HISTORY OF RANDOM

Early dealings with randomness were through activities of divination to determine god's will and games of chance such as gambling. The effects of randomness were mostly metaphysical, and understood as luck, fate or the will of god(s). In some societies, the fall of the die was a form of unbiased decision making when faced with difficult predicaments [4].

Contemporary approaches to randomness can be viewed in two broad categories. The first is where randomness is used for computational purposes; employed mechanically in the technologies of cryptography, stochastic analysis, and even digital image processing. For example, applications in cryptography use the unpredictability of randomness to strengthen encryptions [12]. Although randomness forms a core part of these applications, it is never a feature designed to explicitly contribute to user experience.

The second approach uses randomness as a creative tool, wielded by some artists to generate interest and variety in their artistic outputs. For these artists, randomness is a resource, a means to an end. Their focus is not in the mechanical generation of randomness but rather how their artistic output may contribute to the experience of the beholder.

For instance, John Cage, the influential twentieth century composer, devised what he called chance or *aleatoric* music. Aleatoric compositions consist of elements that are chosen by chance, say via dice or I Ching [18]. Similarly in 1969 Samuel Beckett wrote 'Lessness' a prose piece in which he used random permutation to order sentences. The aleatoric piece is experienced as a process that depends

¹ With apologies to Bill Gaver [11].

upon the reader's attempts to comprehend and create meaning [10].

Cage and Beckett used randomness as a creative mechanism to guide their artistic compositions. However the beholders of such works are interpreters who are not actively interacting with or directly manipulating randomness. Emerging technologies are now beginning to empower users with the ability to control randomness for their own creative and personal uses.

RANDOM - THE NEW ORDER

The effects of unpredictability are being pursued and harnessed through contemporary forms and products. We see these in photographic techniques, web blogs, music listening, and web searching.

The Lomography movement of photo taking bears the credo of "don't think, just shoot" [16]. It encourages spontaneity, close-ups, ubiquity, and randomness. This has grown to become an artistic endeavour for the masses that revolves around capturing their environment in the here and now. The movement's eighth rule (of its ten golden rules) celebrates the fact that "You don't have to know what's going to be captured beforehand – give the random in Lomography a chance. Enjoy your new way of living with random occurrence" [16].

Blogs are online journals. They typically contain reflective commentaries on issues of interest. However some blogs use random text generator to create random content (e.g. <http://www.angelfire.lycos.com/build/scriptlib/random.tmp>) *WordPress.org* offers plug-ins tools for bloggers to display a random blog on the blogger's own main page, random quote matched to the mood the author assigned to a particular blog, random banners, random witty-quotes and many others. There are even random ready-made web page designs (e.g. www.strangebana.com/generator.aspx).

Commercial radio operation has traditionally relied upon a degree of predictability. After all, some station's income is derived from song promotions via the repetitive play of certain popular songs several times a day [20]. Some stations are known to rotate as few as 200 songs a day. However, some radio stations in the USA are adopting the *Jack-FM format*. Boasting that they're "like an iPod on shuffle," the new stations play unusually large, iPod-style playlists of as many as 1,000 songs [9].

The open source encyclopaedia *Wikipedia* (www.wikipedia.org) offers users an opportunity to discover new and unexpected knowledge via a link to random articles on its main page. *Randomwebsearch.com* promises to "help you waste your time more efficiently", by giving users the ability to simply click a button to randomly generate a word which is then searched for on the web. *Randomwebsite.com* offers an antidote to the bored and weary web surfer by means of clicking on the 'randomlink' which will take them to a random website. Similarly, at *randomURL.com*, users encounter an eclectic collection of

random entries that the creator claims to provide a "somewhat topical view of any random bit of information that happens to appeal to the RandomURL staff at any given moment".

These examples suggest that the experience of unpredictability is capturing people's imagination. Randomness continues to be a creative tool used to generate interesting content leaving the users (or listeners) as interpreters of the output. However these examples also suggest an emergent approach, whereby randomness is given over to the users, allowing them to manipulate and interact with randomness itself. In the users' hands, randomness acts as a resource; a resource for designing their own experience.

So what is it about giving users randomness that piques their interest? Can it be intentionally incorporated into designs for meaningful and pleasurable experiences? How is this randomness experienced by users when packaged into our everyday lives?

While randomness may have been incorporated into many interactive systems, some do it simply as boredom busters. There appears to be an apparent lack of explicit understanding of the potential value of randomness to support richer experiences in interactive systems.

This paper reports the findings from an empirical study of listeners of digital music, where the use of randomness is a key component to the experience.

RANDOM LISTENING

In late January 2005, Apple released the digital music player iPod Shuffle (iShuffle). It was accompanied by an extensive publicity campaign. "Welcome to a life less orderly" it began. "The iPod Shuffle takes you on a unique journey through your music collection — you never know what's around the next tune". The promotion promised that "Random is the New Order" because "Life is Random" [2]. The campaign successfully championed the cool-factor of randomness and unpredictability. In this single consumer product, randomness is singled out as the user's resource for unique experiences.

Apart from playing music from the music library sequentially, most digital music players (e.g. mp3 player, music playing software on laptop and desktop computers) provide an alternative feature - shuffle play. Playing music in shuffle mode is neither a new phenomenon nor solely a feature of iShuffle despite the name and hype. Standard CD players have long had the shuffle mode whereby tracks of a CD can be played in a random order.

The threads of online discussions forums, blogs and other online news site about shuffle listening reveal that many other (reflective) users report positive experiences of fun, joy, thrill and even serendipity when listening to music in shuffle mode. In some cases, these experiences have caused users to rethink what they thought they knew about the

music they enjoy and to pursue new ways to reinvigorate their audio palate. How is it that a simple piece of technology designed to allow users to abdicate choice whilst generating random content affords such rich experiences?

DIGITAL MUSIC LISTENING FRAMEWORK

To help us better understand this particular phenomenon arising from shuffle listening, we propose a *Digital Music Listening Framework*. This framework is made up of four elements – listening mode, content organisation, activities during listening and affective outcomes. These elements emerged from critical insights gained through literature review and personal observations. Serving as an analytical lens to our investigation, the framework will allow us to juxtapose, compare, and contrast the various facets of users' listening to digital music holistically - giving us a sense of the elements at play which lead to the kinds of affective outcomes and rich experiences that are reported.

Foundation: listening mode - sequential vs shuffle

The first decision users make when listening to their digital audio library is the playback mode (or from the users' perspective), the listening mode. They have 2 choices - either to listen to the content sequentially or in shuffle.

This fundamental dichotomy is a logical foundation for understanding digital music listening. By using the two modes as constants, we can examine how other elements such as content organisation, activity, and affective outcomes relate to the choice of listening mode.

However it is worth noting that while at any time a user may have a preference for a particular listening mode (either shuffle or sequentially), more commonly users listen, switching between the two modes.

Another point to note is the variability of 'randomness' in shuffle. One of the most widely discussed topic in newspapers, blogs and countless conversations about shuffle playback is "how random is the shuffle algorithm?" [15] Perhaps in response to this, and coupled with the popularity of shuffle listening, Apple recently released a 'smart shuffle' slider function with its iTunes v5 software which allows users to adjust the degree of randomness during playback. Thus whilst listening in shuffle on one hand entails the user abdicating choice to the machine to randomly decide the order of content playback, the user on the other hand can vary and constrain the degree of shuffle/randomness. iTunes' smart shuffle may give users a slider to constrain randomness but prior to and in addition to this, (as we shall explain in the next section), users have been using other means to affect some control and constraint on the apparent random nature of music shuffling and listening.

Content organisation

The digital music content or digital audio library usually contains set of tracks acquired by the user and stored in any

electronic format. On the most basic level, these tracks contain a certain amount of content meta-data (using ID3 tags) such as the artist name, the album, year, genre, track number, and whole bunch of other fields [13]. This makes digital music extremely pliable (unlike tapes and CDs) for sorting and organising.

Thus, we have to be mindful that users can and do exact various levels of audio content management on their audio libraries. Again there is a range in practice - from that of no user intervention to one of high user intervention. The former describes the case where audio tracks contain only whatever ID3 tags it inherited upon acquisition – usually title, artist etc. Whereas the latter, audio content with user intervention, describes content that are usually organised (and personalised) using tools provided by digital music playing software. For example, iTunes allow users to add their own behavioural meta-data such as rating (from 1-5 stars).

Most music player software allows users to group tracks to create a playlist by selecting tracks one by one. This is another form of user intervention. Playlist is a subset of the library with defined and ordered sequence of tracks to be played. An even more involved user intervention is the creation of smart playlists. Smart playlist (smartlist), through the use of iTunes, is a playlist which follows a set of logical filtering criteria. It may work on including (or excluding) certain attributes based on the meta-data [21]. For instance, a user may specify a smartlist with all 80's pop track, rated 3 stars and above and which were played within the last 2 months

Ratings, playlists and smartlists are products of increasing user intervention of their audio library. These groupings are meaningful subsets of the larger audio library and can be viewed as user-constrained content.

Since the act of listening draws directly on the content, a fundamental structure of this conceptual model must reflect the relationship between the mode of listening and the audio content. Following from our discussion about user intervention in constraining content, it follows that regardless of listening mode, users can draw from 2 different types of audio content – constrained content and unconstrained content. A person listening in shuffle can shuffle within a genre or from a rated playlist. This listener draws from constrained content. Similarly a person listening sequentially within artists or a smart playlist is also drawing from constrained content. Conversely, a user who listens in shuffle or sequentially drawing from the entire audio library, without relying on any 'constraints', is drawing from unconstrained content.

Activities during listening

There are times when the main activity during listening is the act of listening itself, e.g. when a user has just acquired a new album or a new track and is keen to listen to it. There are also occasions when someone may just want to relax

and listen to a specific album or track. However, more often, listening forms an accompaniment to other activities [5]. It appears that by listening to music when doing something else an individual may feel that he or she is more efficient and dynamic [1].

Certain kinds of activities might suit a particular listening mode or might influence a user to adopt a particular listening mode. Listening to music as an accompaniment might suit shuffle mode more while sequential listening more likely when listening to a new album. However there are also other types of activities during listening which we need to consider such as when we are working on a paper, playing computer games or even entertaining at a dinner party.

Not only does content affect listening modes (as discussed earlier) but certain types of content – i.e. how the content is able to be organised and able to be constrained may lend itself better to certain activities during listening. Thus activities undertaken during listening are an important element in our conceptual model, adding another dimension to the relationship with the two previous elements- listening mode and content organisation.

Affective responses

It is undeniable that music listening results in affective responses [19]. Affect refers to the conscious subjective aspect of feeling or emotion. So it is not surprising that users report affective outcomes from listening to their audio content.

However, the relationship between the listening modes and users' affective response needs further explication. Different listening modes may produce certain (and possibly different) affective outcomes. For example, the feelings of surprise and refreshing are closely associated with the unpredictability of shuffle listening. However some users may be apprehensive about shuffling listening, finding it to be jarring and unpleasant. Similarly those who listen to their audio content sequentially may find the predictability comforting whilst others avoid it because it is dull and unappealing.

Apart from mapping the relationship between the modes of listening and affective outcomes, we also need to consider what influence constraining audio content might have on the relationship. It appears that the different ways in which audio content is constrained in conjunction with listening mode may produce certain affective responses from the users. For example, some users may feel more surprised and refreshed when they shuffle from their audio content indiscriminately instead of simply drawing only from constrained content such as specific playlists or genres.

Finally, the type of activity carried out by the user during the listening may also colour the affective outcome. For instance, shuffling from an energetic gym-playlist may invigorate and focus the listener during some mundane gym activities.

Summary

There are four key elements to our digital music listening framework – listening mode, audio content organisation, activities during listening and affective responses. It takes into account the intricate relationships of these four elements and in turn provides a key to understanding users' experience of randomness during shuffle listening. The approach to constructing this lens is consistent with McCarthy & Wright's urge to view different aspects of human experience as a 'unity' [17]. They in turn are faithful to Dewey's pragmatist's approach towards understanding experience; whereby experience is seen to be more than just personal and behaviour, more inclusive than knowledge, as it encapsulates sensory, emotional and the intellectual. In fact for Dewey, experience is an irreducible totality of people acting, sensing, thinking, feeling and making meaning [8].

INVESTIGATION

Aim

Informed by our conceptual model, we focus our study of the experience of digital music listening in shuffle, using the following guiding questions:

- Does listening in shuffle lead to better experiences?
- In what ways do listening to constrained audio content influence the quality of the listening experience?
- How do activities undertaken during shuffle listening influence the quality of the listening experience?

Data collection and sources

The data consists of 113 distinct pieces of self reporting. The major data source is a very active discussion board, *ilounge.com* (formerly *ipodlounge.com*), where we gathered 88 distinct short posts (and some replies) ranging from a few sentences to a few short paragraphs. Other sources include 8 article length personal reviews from online web magazines (such as *wired*, *eyeonmac*, *macnewsworld*), 7 online news sources (such as *guardian*, *subtraction*) and finally, 10 full blog entries which are longer personal reminiscences or critiques on the shuffle device as well as short replies to some of these blog entries (such as *cityofsound*, *womanathome*, *mushrush*, *gunson*).

We used a data analysis tool (NVivo) to carry out a thematic analysis [3]. The data were annotated and coded according to objects of interest, such as 'shuffle listening', 'sequential listening', and 'mixed listening'. We then combined and catalogued related codes into sub-themes. For example, since those codes mentioned earlier were deemed related, they were grouped under the sub-theme of 'listening mode'. In gathering all the sub-themes to obtain a comprehensive view of the information, it is easy to see a pattern emerging. We then analysed our data using the four elements of the digital music listening framework - Listening Mode, Content Organisation, Activities during Listening, and Affective Outcomes.

RESULTS

Listening mode

The foundation of the conceptual model starts with listening mode. The analysis of the total 113 instances shows that users report being committed to either one form of listening or the other (table 1). There are 14 users who indicate a definite preference to listen to music sequentially.

"[I] almost never [shuffle], I prefer to listen to an entire album or several albums from the same artist." (#1)

On the other hand, there are 91 users who prefer to listen in shuffle.

"I like nothing better than to load up all of my very favourite songs, in all the different genres, and set it on random." (#95)

There are eight users who report liking to mix their listening mode.

"I listen to it both ways." (#10)

"[I listen to] Shuffle when I know the order of the playlist ... [and I listen] straight when I want to listen to album." (#13)

For users who provide reasons for their listening preference, explanations range across various factors including what kind of activities they are doing during listening, their mood/motivation at the time, and how it makes them feel at that time. These will be explored further in later sections.

Content organisation

As explained in our framework, users can organise their music libraries using genre, artist, album etc. Users can use grouping tools such as playlists and ratings to exact further constraint on their libraries.

The data reveals that while most users (74) don't actively constrain their libraries, about a third of the users (39) employ a variety of ways to do so (table 1).

| | | content organisation | | |
|---------------------|------------|----------------------|---------------|-----|
| | | constrained | unconstrained | |
| preferred listening | shuffle | 22 | 69 | 91 |
| | both | 4 | 4 | 8 |
| | sequential | 13 | 1 | 14 |
| | | 39 | 74 | 113 |

Table 1. Preferred listening mode (shuffle or sequential) and organisation of music content (constrained or unconstrained)

We see that when listening in shuffle, it is much more common for users to draw from unconstrained content. This means that users shuffle from their entire audio library without any constraints.

Conversely, when listening sequentially, it is more common to draw from constrained content. These users exert choice and control over what they listen to, either by choosing an album or individual tracks.

"If I am lying in bed relaxing and want to hear a particular album, then I don't use shuffle or if I have just purchased an album, then also no shuffle." (#10)

"I don't like shuffle - I'd rather take the time to position the songs well in a playlist on the computer." (#53)

For the eight users who listen in both shuffle and sequential modes, when they do listen in sequential mode, all of them draw only from constrained content. The single user who listens sequentially unconstrained has not created a playlist but listens alphabetically.

Those who constrain their musical content, use a various techniques. Table 2 shows in detail how users in different listening mode draw from the different constrained content. The popular form of constraining mechanisms are the playlist (most common for shuffle listening) and constraining by album (most common for sequential listening)

| Constraining technique | Shuffle | both | Sequential |
|------------------------|---------|------|------------|
| Playlist | 13 | 2 | 2 |
| Album | 3 | 7 | 8 |
| Rated list | 2 | | |
| Smart list | 3 | | |
| Genre | 4 | | |
| Artist | 1 | | |
| Direct Choice | | 1 | 3 |

Table 2. Type of constraining techniques for each listening mode. (Some users report using more than one technique)

When listening to albums sequentially, users often choose to listen to the ordered tracks of albums.

"I mostly listen to full albums straight." (#18)

When listening to playlists sequentially, users often choose to listen to them in the order they were created.

"Straight, when I want to listen to playlists that have an order I've created." (#13)

On the other hand, users who listen in shuffle appear to draw from audio libraries which have been constrained in a more varied manner. In addition to playlists, constraining techniques include the use of content meta-data (e.g. genre, artist, albums) as well as more specialised tagging with behavioural meta-data such as playlists, rated playlist and smartlist.

"Even on the playlists that I create ... I tend to listen to those on shuffle mode." (#3)

“(the iPod) is loaded with 3 smart playlists, least played, most played and newest added. I listen to these in shuffle mode.” (#16)

“I use shuffle within a genre or playlist.” (#29)

“Shuffle used when I know the order of the playlist/album.” (#13)

“Most of the time I will listen to one artist and shuffle the songs.” (#34)

However, by far the most popular way (69) users report listening to is to listen in shuffle from their entire audio library – unconstrained.

“I shuffle it in with the rest of my music.” (#18)

“I have 3900+ songs on my iPod and I do play it on shuffle.” (#21)

“I always shuffle all the songs on my 6 gigabyte iPod mini.” (#26)

Activities during listening

Information regarding the activities carried out during listening was less apparent. Some users report that they listen to music as their focal activity. But mostly, the data suggests that the music listening is an accompaniment to other activities.

Relationship to listening mode

When inspecting the relationship between activities and listening mode, the data reveals that when users want to relax and listen to music, and when the listening itself is the focal activity, then sequential listening is their choice. That is the only activity reported in conjunction with listening sequentially.

“If I am lying in bed relaxing and want to hear a particular album...” (#10)

On the other hand, the data shows that shuffle listening is adopted across a wider variety of activities and is always used as an accompaniment to other activities. In our data, nobody reported choosing to listen in shuffle when the focal activity is the act of listening itself. Shuffle listening features highly when accompanying driving.

“When I am in the car, it’s on shuffle mode.” (#3)

“I especially like it [shuffle] in the car.” (#49)

Other activities accompanied by shuffle listening include exercising, travelling, doing housework, concentrating on other things such as playing computer games, working on a paper, etc.

“That is why shuffle is perfect for the gym; it’s random and you can just enjoy the moment and the short distraction the music provides you.” (#25)

“Shuffle...when I’m doing yard work or something where I may want hours upon hours of continuous music.” (#20)

While the above examples show shuffle listening accompanying activities which doesn’t demand too much concentration, shuffle is also used to accompany activities which demand complete concentration, such as working on a paper or playing computer games.

“If I’m working on a paper, shuffle usually makes an appearance...” (#25)

“When I play ThinkTanks, I run iTunes in the background with Shuffle on.” (#76)

It appears that by abdicating choice through shuffle the user can have access to continuous music without having to make an effort or find the time to choose what to listen.

Relationship to content organisation

From the data, we also observe that except for a few instances, most shuffle listening when accompanying other activities draws from unconstrained content – i.e. listening from the entire audio library. Of course as users also shuffle from constrained content, particularly during activities such as entertaining and at times when it seems that music could be used as a mood-setter.

“Playlists for when I’m entertaining or when I want to play music of a specific mood or genre without confining me to just one band or album.” (#20)

The content is almost always constrained during sequential listening reserved for activities such as directed listening, relaxation and for listening to an album.

Affective outcomes

Not many users reported on their affective responses as a result of their listening. However for those who did, a range of emotions and sensations are reported (table 3).

| | | content organisation | |
|--------------------------|------------|-----------------------|---|
| | | constrained | unconstrained |
| Preferred listening mode | shuffle | surprise appealing | enjoyable arresting thrilling ephemeral playful refreshing surprise fun jarring |
| | sequential | satisfying | (none) |

Table 3. Preferred listening mode, content constraint and the resulting affective outcomes

Relationship to listening mode

Generally, users who listen in shuffle report a wider variety of affective outcomes arising from their listening when

compared to those who listen sequentially. A commonly reported affect is the fun from the surprise.

“When songs I may have forgotten about randomly popped up as a result of shuffle, thus giving the surprise or delight... always cool and refreshing to trip across a great song that you haven't heard in a long time.” (#21)

Another is the arresting thrill of coincidence.

“The weird thing is that the randomness of songs seems to start talking to you and making marvellous coincidences.” (#111)

The unpredictability allows for playfulness and unique discoveries.

“I love to guess who the artist is in the first few seconds.” (#85)

“Shuffling is actually ace. Without it, I would never have felt the unique tingle when Fairport Convention suddenly turned into Kanye West, or been delighted at the segue of AC/DC into MIA. Shuffling makes the old sound new.” (#27)

On the other hand, the affective responses reported by users of sequential listening mainly centre around a sense of satisfaction from knowing what is to be played or being in charge.

“I usually use playlists, so I can go with the music I'm in the mood for.” (#5)

To them, there is also a sense of musical satisfaction when listening to a complete album sequentially.

“The whole is greater than the sum of its parts, U2's The Unforgettable Fire, Joshua Tree, and Achtung Baby are an entire music narratives, if one listens to these albums from start to finish they feel somewhat like a "Rock Opera.” (#1)

Relationship to content organisation

Although shuffling from both constrained and unconstrained audio content can result in positive listening experiences (table 3), there appear to be more varied positive affective outcomes when shuffling from unconstrained content. Furthermore, there are some subtle differences in the types of affect.

Users do still report enjoying the feelings of surprise despite shuffling from content in which they have personally constrained.

“I listen to this on random all the time and I'm always surprised how much I enjoy listening to this particular playlist. I could imagine being pretty happy with the shuffle if I used it to play a select group of favourites.” (#80)

It is also appealing because users get to enjoy the element of playfulness from the unpredictability of shuffle while

avoiding the potential for the occasionally jarring and unsettling effects.

“The shuffle function would mean a lot more to me if the songs playing were handpicked by me. After all when you're listening you don't want to hear the worse tracks. So shuffling a "top rated playlist" is far more appealing as you like all the songs and do not come across anything which feels a little out of place.” (#15)

Occasionally some users do report negative affective outcomes when shuffling from content which are unconstrained.

“When I want to hear something I haven't heard in awhile, I'll usually shuffle by genre because it's less jarring. If I'm on a rap list, Dave Matthews band won't suddenly make an appearance.” (#46)

However, reports of affective outcomes from shuffling of unconstrained content have tended to be much more varied and intense.

“I want my life on Shuffle. I don't want to know what's coming next. I want to anticipate it. I want the surprise and the unadulterated joy that comes with it” (#93)

They are rich experiences, which opens up to possibilities for new discoveries and serendipity.

“Sometimes the random effect delivers a sequence of music so perfectly thematically 'in tune' that the sense that iTunes just knows is quite unsettling.” (#94)

“It's kind of like an unexpected conversation with somebody at school, or work. You see them every day. Might not have had a real conversation in YEARS! But, suddenly, by chance, NOW you're engaged. And it's so HEADY! I mean you know them, but not like THIS! Suddenly you see them through NEW EYES!” (#108)

These rich experiences are beyond simple emotions of how it makes the users feel. At times, the experience is transformative, causing users to re-examine their beliefs about and understanding of their favourite music, and to establish a new way to experience music changing preconceived ideas and even practice.

“After years of listening to music constantly, I've suddenly got a whole new way of experiencing it.” (#96)

“I advise people with larger collections (mine runs to 33,552 tracks) to try it, it will unlock riches you never knew.” (#99)

DISCUSSION

Shuffle listening is a popular way to listen to digital music. Beside the practical consideration of not having to make an effort to decide and choose the music, our investigation suggests that the randomness of shuffle listening also offers positive user experiences. It appears that while shuffling results in richer user experiences when compared to sequential listening, shuffling from the entire audio library

(unconstrained) results in more intense and richer user experience such as serendipity when compared to shuffling from constrained content. This may be because when shuffling from constrained content such as a playlist, users feel that they are more directly responsible for placing the song there to be drawn. On the other hand, if a random track ‘magically’ underscores the prevailing mood or the lyrics of a song just ‘happens to’ speak directly to the listener at that moment while shuffling from unconstrained content, then the user encounters this as a ‘happy coincidence’ or serendipity [14].

Our analysis points to the important duality between randomness and constraint. Even though shuffle listening connotes randomness; the constraining of audio content is in fact constraining randomness. Furthermore the process of constraining randomness (e.g. playlists genres etc.) affords users the ability to indirectly manipulate the likelihood of pleasurable affective responses (e.g. thrilling, playful etc.). The mappings and relationships between random listening, content constraints and affective responses are not well understood. However over time with appropriate design and suitable tools, it may be possible for users to fine-tune a random configuration that is likely to lead to a positive individual experiences.

Of course the process of constraining has caveats, such as the size of the audio library. An audio library may be too large and may not lead to any richer experience, and in fact could have detrimental effects on the experience.

The main limitation of this investigation is that the data which informs our analysis are limited to self reports and online sources. Thus the data may reflect a skewed segment of the general population (e.g. gender, age, technical proficiency, personality etc.). The use of some online mediums such as discussion boards may also mean that users’ descriptions can be fragmented, tend to be short, clipped and may lack richer and more detailed descriptions. On public discussion boards, peer consensus and influence may also colour and sway the respondents’ views.

Nevertheless, we established valuable insights into the influence of randomness on the experience of listening to digital music. Like all data, self reports are flawed; however they may still offer significant insights into personal activities and emotions that can be distilled through careful analysis.

Whilst our digital music listening framework is a useful lens in the analysis of self reporting data, the framework may need further refinement for investigations which involve notions of social interactions and social contexts of music listening.

Music is a powerful auditory mnemonic device [7], which can evoke memories lucidly, with each “... *track like an aural postcard*” (#96). Thus when encountering randomness during music listening, users exercise their natural and creative urges for interpretation [6]. This

enables users to locate, extract and frame a particular aural memory within their history of memories and relate this to a new situation meaningfully.

Analytical frameworks of User Experience, such as that recently proposed by McCarthy & Wright [17] provides a useful platform to understanding and explaining the process of sense making, however the role of randomness is at best indirect. This paper attempts to get closer to understanding how randomness can be harnessed as a resource to give rise to these rich experiences. Our conceptual model of listening experience has allowed us to isolate the various elements and how they inter-play during listening.

CONCLUSION

Just like ambiguity [11], randomness can also be a resource for designers of interactive systems. As designers of products and services are drawn to designing for meaningful user experiences, there is a need to explore new ways of achieving this. We are proposing that randomness is one such potential resource for designing rich user experiences. Using randomness in design also resonates strongly with McCarthy & Wright’s view that in this complex, changing world, marked by ambiguity, design is always for potential, for what is already becoming [17]. So we should treat each user of interactive systems as a source of creative potential, who comes to the interaction with a rich history of experience that engages with the technology in a dialogue about what the technology is and could be and what the person is and could be. This involves the designer giving to the user a design which is *unfinalised*, allowing users to play into their potential [17].

Through qualities such as unpredictability and discontinuity these creations force a passive audience into a co-participant. To make sense of this unpredictability and discontinuity, they draw upon their own biographies and histories; their hopes, fears and expectations and in order to bridge and complete the work; i.e. to attempt to finalise the experience.

Whilst this approach to unfinalisability sets the stage for conditions in which rich user experiences are more likely to occur, it does not imply that we can determine these experiences through design. From our analysis, a key to supporting these rich experiences may be to design means for the user to constrain the randomness.

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