MSc in Cyberpsychology

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A study of the effect of music on memory when presented to a person and the emotions it can evoke

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Abstract

Internet users can avail of a range of music services that allow them to listen to any genre spanning decades of performances. The providers of the service have access to data tracking usage patterns and preferences. A simple telemetry between this data and the demographic data provided as part of signing up to the services provides a wealth of insights into the user. These insights coupled with the knowledge that music acts as a memory retrieval trigger and that these autobiographical memories are associated with specific emotions, gives the service providers some very insightful data on their customers. This research looked to establish the effect of music from the past on memory when presented to a person and the emotions evoked. The findings indicate that there is an effect in that the memories retrieved can be vivid and that associated emotions are varied.

Introduction

Social media platform providers such as Snapchat, Google and Facebook to name but a few, offer services that allow for the user of the service to be presented with activity from their past use of the platform. Examples of this include:

- Snapchat memories and flashback – allows users revisit images they have saved as memories, retrieving photos and videos from that date on a different year. If a user has held onto that content via Memories, it will automatically be generated as a story so that it can be shared.
- Googles Rediscover this day – Google Photos revisit images shot on the same date in previous years. Google present it based on the idea that if a user has a lifetime's worth of photos and videos in one place, they will have lots of memories to look back on. Notice that they say memories not photos to look back on.
- On this day from Facebook – Revisit Facebook posts including images on the same day in previous years.

Music streaming platforms do not provide similar services based on a specified date in the past, i.e. what a user of the service played or listened to previously or based on a specific date. Similarly, what was popular at specified times in the user's life. The teenage years, Van Campen, C. (2014) states this time in a person's life is when autobiographical memories are most vividly formed.

The rationale for this research proposal is based on the observation that streaming platforms have not produced a similar point in time musical retrieval service. This combined with the observation that there is academic evidence of the impact of music on episodic memory and its impact on emotions, gives rise to the question could music provide a similar impact if presented at a specified point in time relevant to a user? Would a targeted personalised piece of music evoke autobiographical memory and how would this manifest in an emotional change for the user involved? The following literature review will further evidence of this rationale.

Literature Review

This literature review explores literature relevant for consideration of the hypothesis that a targeted personalised piece of music would evoke autobiographical memory and manifests as an emotional change for the listener. The review considers memory, music, emotion and then all three combined, starting with memory.

Memory

Memory can be described as a process by which humans manage and maintain information, over time, Matlin, M.W. (2005). Memory can be thought of as having three elements sensory memory, short term memory and long-term memory. For this literature review the focus will be on long term memory.

Long term memory is the memory that humans hold over a long period of time. It includes facts, figures, experiences and skills, it can be broken into two elements explicit and implicit, both of which have sub elements. This paper will focus on sub elements of explicit memory known as autobiographical and episodic memory. Autobiographical memory is the term given to a person's ability to remember events from the past where they were involved in the making of the memory, that is they were an actor in making the memory, Conway, M. A., & Pleydell-Pearce, C. W. (2000). They are similar to and work in conjunction with episodic memory.

Episodic memory is the term given to a person's ability to remember events or things that have happened in the past, by consciously retrieving them. It allows a person re-experience a past event specific to a time and place. It is often associated with semantic memory which is the ability to recall facts and general knowledge. Episodic memory can be thought of as personal to an individual but not about the individual – for example a person may recall someone's name and their last interaction with them, this is episodic memory. Episodic memory came to the forefront of academia with the renowned research with patient HM first seen in Scoville, W. B., & Milner, B. (1957). Endel Tulving, Tulving, E., & Murray, D. (1985), coined the phrase episodic memory when he was working on understanding the differences between knowing and remembering. Conway, M.A. (2008) discusses episodic memory as having fourteen characteristics grouped under the heading of content, function, brain basis and phenomenology. Phenomenology is the research around how humans create experiences, it is the premise that reality for humans is based on how humans understand and

perceive their reality via their consciousness. There is a phenomenology of episodic and autobiographical memory and it varies if memories are vivid or dim, emotionally still relevant and intense or hold no emotional sway with a person. Humans most personal memories are defined by their phenomenology that is there vividness or intensity, Sutin, A. R., & Robins, R. W. (2007). And it is this area of memory experiences that this paper focuses on.

Music

Scherer, K., Zentne M. (2001) discuss that music is a very powerful cue to recall memories and that the person becomes aware of them again. They indicated that this should not come as a surprise as music is often associated with important life events for example a marriage ceremony. Following on from this association of music, memory and emotions Van den Tol, A., & Ritchie, T. D. (2014) research looked to link how humans draw on certain types of music to evoke certain types of feelings. They found that participants in the research who selected music by themselves evoked sad rather than happy music. In addition to this they found that familiarity of self-selected music is linked to liking, aesthetic value, meaningfulness, intensity of emotional response, vividness of mental imagery, and detail of the memory. It is with this in mind we will move to reviewing the literature on emotions.

Emotion

Emotion can be challenging to define according to Mulligan, K., & Scherer, K. R. (2012), however it can be generally thought of to consist of feelings, behaviour, physiological change and cognitions. It always occurs in a context which influences it. It provides a person with information about their interaction with the world around them. Emotions can be thought of as a state of mind, which Hockenbury, D. H., & Hockenbury, S. E. (2007), state have three elements or components. The first is a that a subjective experience has occurred, the second that there is a physiological response and the third that there is a behavioural response. Emotions tend to have a limited time span, Izard C. E. (2009). Paul Ekman, Ekman, P. (1992), identified six basic emotions being anger, disgust, fear, happiness, sadness, and surprise. Plutchik, R. E., & Conte, H. R. (1997), identified eight emotions, which he grouped into four pairs of polar opposites (joy-sadness, anger-fear, trust-distrust, surprise-anticipation). Mohn, C., Argstatter, H., & Wilker, F. W. (2011) conducted research which leveraged that of Vieillard et al. (2008). Whereby Vieillard et al. (2008) carried out three

experiments to study if participants could determine the basic emotions identified Ekman determined, by listening to musical excerpts. Mohn, C., Argstatter, H., & Wilker, F. W. (2011) took this research and studied participants emotions in relation to how they emotionally reacted when presented with musical excerpts unknown to them. They concluded that the results suggested that the six basic emotions are detectable in musical stimuli, and that the ability to do so does not seem to be influenced by musical experience. They also concluded that personality traits did not impact this ability.

There is a body of work in the neuroscience area where researchers are looking at the physical traits found in areas of the brain which modulate when studying music and emotion. Areas such as the amygdala, nucleus accumbens, hypothalamus, hippocampus, insula, cingulate cortex and orbitofrontal cortex are seen to modulate under neuroimaging when music evokes emotion. This is found in Koelsch, S. (2014) work. Ter Bogt, T. F., Mulder, J., Raaijmakers, Q. A., & Nic Gabhainn, S. (2011) research divided music listeners in to low, medium and high usage groups. After questions each group expressed emotional reactions to the music listened to. The impact of the volume of usage was greater in the high usage group however all groups indicated that the use of music to elicit positive emotional reactions did occur. The age range of the participants was from children to adults. This research coupled with that of Koelsch, S. (2014), provided some insights that indicate people who listen to music have both physical and psychological reactions to what they listen to. These reactions develop over time and, as Saarikallio, S. (2011) put it, as adult years develop, a link strengthens between musical experiences and a person's history. This is coupled with their growing understanding of music's power and increases their likelihood to use musical material as a tool for emotional control and their self-identity. This link is counteracted by the shrinking of the hippocampus and the wearing down of a person's myelin sheath. Which makes for an interesting mix of building a psychological stock of musical memories balanced against a physical deterioration in how to access these.

Music, emotions and memories

The combination of music, emotions and memories is in some ways intuitive in that the musical cue triggers both memory and the associate emotion. Janata, P., Tomic, S. T., & Rakowski, S. K. (2007) suggest that musical excerpts can act as a stimulus for evoking autobiographical memory, one of the significant memories evoked being that of nostalgia. They do point out that while the evidence is there for this suggestion there is no way of measuring the vividness of the memory when compared to the original experience, they established a trigger not the quality of the result of the trigger.

This is further supported by Barrett, F. S., Grimm, K. J., Robins, R. W., Wildschut, T., Sedikides, C., & Janata, P. (2010) where they found that if a song was autobiographically salient to a listener it evoked or elicited a range of positive, negative and mixed emotions. They do point out that their research sample was limited in demographical nature and similar to that research carried out by Janata, P., Tomic, S. T., & Rakowski, S. K. (2007) there was no measure of vividness in place.

In their paper on music and autobiographical memories Belfi, A. M., Karlan, B., & Tranel, D. (2016) expand on Barrett et al (2010), they found that the emotional connectedness to the music once its evoked memory was stronger than that of a recognised known famous personality. They concluded that the nature of autobiographical memory gave more personal context for participants where photographs triggered explicit memories, which supported the belief that music is better suited to evoke vivid autobiographical memories.

Despite the significant body of work in the areas of episodic memory, emotions and the impact of music on both, there are some limitations of the studies completed. Studies have found that people are emotionally sensitive to music, examples include Krumhansl, Carol L (2002) and Salimpoor, V. N., Benovoy, M., Longo, G., Cooperstock, J. R., & Zatorre, R. J. (2009). When musical stimuli are presented memories are evoked. Some studies have allowed participants to choose familiar and unfamiliar musical stimuli. These have generated specific emotional results, in particular emotions of nostalgia. Using unfamiliar musical stimuli is an attempt to deal with the complication that at the point that when triggering memories using music as a cue some of the memories are involuntary in nature as indicated by McDonald, D. G., Sarge, M. A., Lin, S. F., Collier, J. G., & Potocki, B. (2015).

Laukka, P. (2007) puts forward the hypothesis that for elderly persons using music is not only a way to while away hours in a passive manner, but it is used by them as a source of

satisfaction when looking back at their lives through memory and is deemed as an important psychological tool for aging successfully. Elderly people listening to music reported positive emotions, as opposed to when they were not something as they went about everyday life. When looking at musically evoked autobiographical memories Halpern, A. R., Talarico, J. M., Gouda, N., & Williamson, V. J. (2018) found that memories in young adults where indeed vivid and elicited high emotional responses. They also indicated that a musical cue when combined with or compared with other cues such as dining created cues of similar significance. The significance of music over a person's lifetime is well described in Strong, C. (2011) book on Grunge and memory when she described the term collective memory to describe how people look back at the era of Grunge and how it is now described.

Focusing on the voluntary retrieval of memories using music Rochette, C. & Miranda, D. (2016) looked at music evoked autobiographical memories (MEAMs) and they established a music evoked memory orientation scale designed to assess the phenomenological characteristics of MEAMs, this is called the music evoked memory orientation scale (MEMOS). This scale is a combinate of memory experience, emotional regulation, time perspective, subjective happiness, symptoms of internalising, self-esteem, nostalgic tendencies and personality traits. They found that music might have three overarching functions: regulation of arousal/ mood; self-awareness; and social relatedness. And they concluded that MEMOS in future research could provide further insights about the way people experience MEAMs and how it relates to their emotion regulation, time perspective, and mental health in everyday life.

However, studies found and reviewed have not presented participants with musical stimuli that is directly relatable to specific points or dates in time in the participants life, irrespective if the memories triggered are voluntary or involuntary. This research paper proposes to do this given this gap in the literature reviewed. By doing so, the paper presents the participants emotions and evoked memories and as measured and analysed.

The question posed by this research is can musical stimuli played for a specified point in time in an individual's past act as a cue to generate episodic or autobiographical memory retrieval and the emotions associated with these memories?

Methodology

Design

The design for this study was a fixed design using an experimental approach supported by the use of the positive and negative affect scale (PANAS) as compiled by Watson, D., Clark, L. A., & Tellegen, A. (1988). This comprises of two mood scales, one measuring positive affect and one measuring negative affect. There are thirteen descriptors for positive and negative effects. The descriptors are ranked using a five-point Likert scale. This scale is proposed as a way of establishing the emotions of participants in the proposed experiment. The proposal generated quantitative data based on the relationship between the independent variable being musical stimuli, and the dependent variables, being the autobiographical memories evoked and their associated emotions.

The experiment procedure was as follows:

Part 1 – Participants received a screening communication from myself (the researcher) identifying them as a potential candidate for participation in the proposed experiment. This communication requested consent from the potential candidate to take part. They were asked for their date of birth as part of this screening email. They received all subsequent email from the researcher's IADT college email account.

When participants consented, they then received an invitation to participate in the research. This was completed using a survey tool from SurveyMonkey. This invite consisted of:

- A second invite to the participant
- Detail of the study title
- Detail of what the research entailed from a participant perspective.
- Request for consent to proceed with the next step in the research.

Part 2 – Once participants confirmed a willingness to take part, they moved to the next part of the survey and partook in the two elements of the experiment process. The experiment process was as follows:

Participants were brought to the first section of the experiment titled 'Images for you to look at'. Here the participants were shown the cover of Time magazine based on their date of birth from when they were 15, 20 and 25. Once the participant looks at all the images, they were then asked to complete a first PANAS scale questionnaire. Once the first questionnaire was

completed the participant was then brought to a second section of the experiment titled ‘Music for you to listen to’.

Here the participants were presented with three pieces of music popular in the billboard charts from specific dates based on their date of birth from when they were 15, 20 and 25. Once the participant listened to all pieces of music, they were then asked to complete a second PANAS scale questionnaire, identical to the first but based on the music they heard. The participants were then be asked to go through a debrief and submission section of the survey. In summary for each participant there were two completed questionnaires. One identifying emotion based on the digital image and one using the musical stimulus.

Participants

For the proposed study, there was a target of forty participants from various organisations that the researcher is involved in, these included:

- Family members
- Members of a local Hurling and Camogie club
- Members of a local Rugby club
- Work colleagues of the researcher
- Members of a local bridge club
- Students from the researcher’s college

The participants were acting as volunteers on an individual basis and not as representatives of the organisations mentioned above.

They were all asked to take part in the study. Contact was made initially and followed up by email as previously detailed.

Participants were all required to be over the age of eighteen. There was no specified maximum age for participants. An objective of this sample, a convenience sample, was to ensure that the age ranges of the participants will allow for the inclusion of the maximum of three pieces of musical stimuli. Prior to the research the researcher did not know the dates of births of the proposed participants, however sampling based on the activities within each target group demographic it was hoped that the musical stimulus will mean that three samples will be applicable to at least one third of volunteer participants.

Materials

Materials for participation in the experiment was as follows

- Each participant was asked to indicate their consent to participate in an initial communication using WhatsApp or email. This requested that they provide the researcher with the individuals date of birth. This indication was required to be completed in advance of the experiment to allow for the participant to partake in the experiment section of the survey.
- Each participant was a recipient of a participation information sheet detailing what the experiment will involve. This information sheet was received by the participant in soft copy as part of the survey tool being used.
- Each participant was required to complete a consent form as part of the survey. Once completed they were then able to participate in the rest of the survey – the demographic, experiment and debrief sections.
- In the demographic section participants were requested to provide information regarding their sex, level of education, preferred genre of music and the experiment section. Each participant received two copies (via survey monkey) of the PANAS questionnaire to complete. For the questionnaire there was a section of questions specific to the images and the musical stimuli.
- Each participant was fully debriefed after the completion of the second questionnaire and it was then returned to the researcher. Each participant was thanked for their participation and the experiment was closed.
- The questionnaires used are included appendix a of this paper.

Apparatus

The researcher used the website www.time.com to source the image stimuli for each participant. The image stimuli were stored on a shared drop box area for access by the participants as part of the survey tool survey monkey using a link to the area.

The researcher collated three images (resulting in nine images in total) of Time magazine covers that were available at the following dates for each participant

- Month of birth plus fifteen years
- Month of birth plus twenty years
- Month of birth plus twenty-five years

The researcher used the website playback.fm/birthday-song-uk

to source the music stimuli for each participant. The music stimuli were sourced from spotify.com, converted to mp3 files using sidify music converter and stored on a shared drop box area for access by the participants as part of the survey tool survey monkey.
The researcher then collated up to three number one songs that were number one at the following dates for each participant

- Date of birth plus fifteen years
- Date of birth plus twenty years
- Date of birth plus twenty-five years

These songs were the musical stimuli used to play for the participant. The songs were all played by the participant as instructed by the researcher as part of the survey instruction in the ‘Music for you to listen to’ section. Each song was restricted to exactly three minutes in length.

In summary while each participant received a personalised survey based on their age, the questions asked were the same for each participant. An example of the survey received can be seen in appendix a.

Results

Demographic Variables

As part of the research carried out there were 42 participants split 13 female and 29 males. All participants with the exception of 3 identified their ethnicity as white, the 3 who did not identify themselves as Asian, see table 1.

Table 1
Ethnicity

		Gender		
		Female	Male	Total
Ethnicity	White	11	28	39
	Asian	2	1	3
Total		13	29	42

The majority of participants held bachelors level education being 57.1%, followed master level at 23.8%. Participants were requested to indicate their preferred genre of music as part of the information they provided Rock, Alternative/ Indie and Pop genres were identified as the most popular with the group.

Table 2
Genre

		Gender		
		Female	Male	Total
Genre	Alternative / Indie	2	8	10
	Blues / Jazz	1	0	1
	Country	0	1	1
	Dance	1	0	1
	HipHop/Rap	1	4	5
	Pop	6	4	10
	Rock	0	11	11
	R&B / Soul	2	0	2
	Other	0	1	1
Total		13	29	42

42 participants meant that 378 images were created and were viewed 378 minutes of music was listened to. Details of demographic variables can be found in the appendix a. The demographic variables were captured as part of the research, but they were not used as part of the main analysis.

Main Analysis

The hypothesis tested in this research indicate that there is a noticeable difference between memories and emotions generated using music as opposed to other media in this case images when represented to participants from points of time in the participants past. The following results detail the findings of the research.

In order to validate this hypothesis a paired sample t test was used to evaluate the data captured as part of the research carried out. The paired sample t test was conducted using a confidence interval percentage of 95%, that is a p-value of 5% was used. Before providing details of the paired sample t test a reliability test was completed using the Cronbach alpha. The score calculated can be seen in table 3 below and the PANAS scale Cronbach Alpha score was 0.845, indicating a good guide of reliability for using the data collected.

Table 3

Cronbach Alpha score

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.845	0.852	30

The results of the paired samples t test are shown in the following tables 4 to 6.

Table 4 shows the paired samples statistics showing a higher mean calculation for the memories retrieved and the emotions evoked with music 3.0238 and 1.8498 respectively over that of those generated with images of 2.1667 and 1.5201 respectively.

Table 4

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	MusicMemMean	3.0238	42	1.09852	0.16950
	ImageMemMean	2.1667	42	1.06877	0.16492
Pair 2	MusicEmotionMean	1.8498	42	0.55156	0.08511
	ImageEmotionMean	1.5201	42	0.45104	0.06960

Table 5 shows the paired samples correlations shows the bivariate Pearson correlation coefficient (with a two-tailed test of significance) for each pair of variables entered, both memories retrieved, and emotions evoked. The N score is 42 indicating no missing values on the test

variable. The memory retrieved correlation is positive 0.199 with a level of significance of 0.206 and the emotions evoked correlation is positive 0.349 and a level of significance of 0.024.

Table 5

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	MusicMemMean & ImageMemMean	42	0.199	0.206
Pair 2	MusicEmotionMean & ImageEmotionMean	42	0.349	0.024

Table 6 shows the paired samples test and the paired difference at a 95% confidence interval of difference.

The p-value for memories retrieved denoted by “Sig. (2-tailed)” is 0. (If double-clicked, it shows precisely 0.000222, meaning a .00022 % chance.) therefore if the population means are equal, there's a 0% chance of finding this result.

The p-value for emotions evoked denoted by “Sig. (2-tailed)” is 0.001. (meaning a .0001 % chance.) therefore if the population means are equal, there's a 0% chance of finding this result.

The null hypothesis can be rejected. Memories retrieved and emotions evoked using music from a point in time for a participant do occur.

Table 6

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	MusicMemMean – ImageMemMean	0.8571	1.37169	0.21166	0.42969	1.28459	4.050	41	.000
Pair 2	MusicEmotionMean – ImageEmotionMean	0.3297	0.57796	0.08918	0.14956	0.50978	3.697	41	.001

Discussion

The primary purpose of this study was to examine if music from a person's past, specifically from points in time in their past could act as a cue for them to retrieve memories and evoke emotions associated with these memories. Research has suggested that music does indeed act as a cue to trigger memory retrieval and that emotions are indeed associated with music, Janata, P., Tomic, S. T., & Rakowski, S. K. (2007).

This research indicates that this hypothesis can be accepted in that music from a point in time in a person's past can act as such a cue and trigger. For the participants in the research the significance value for both memory retrieval (0.00022 %) and emotional (0.0001 %) triggers are well within the level of significance 5% level tested.

Retrieval

The findings from the research indicated that participants did indeed retrieve memories from the stimuli presented to them, and that the music stimuli effectiveness was higher that of the image stimuli. This is in line with several areas of research, including that of King, J. B., et al (2019), who confirmed the support for an effect in Alzheimer patients for personalised music interventions. This research supported the use of personalised musical selections of individuals to promote improved attention and function.

The research showed a higher level of correlation between the emotions evoked than the memories retrieved as seen in table 5, indicating that the memories retrieved were not similar for both stimuli in intensity, similar to the findings of Belfi, A. M., Karlan, B., & Tranel, D. (2016). However once a memory was retrieved the emotional cue was triggered. More research would be required to understand the difference in correlation versus the evidence of retrieval for memory and emotion.

Gender

In reviewing the paired sample t test broken down my gender the level of significance for male for memory retrieval was 0.002 and for female it was 0.071. The female level is outside the level of confidence of 0.05. A similar comparison for emotion retrieval was 0.013 for males and 0.007 for females. While the memory retrieval for females is noted, no conclusions are drawn similar to the research by Piefke, M., Weiss, P. H., Markowitsch, H. J., & Fink, G. R. (2005). This may be an avenue for the future which will be discussed later.

One consideration that was considered was the impact of the genre of the music played to a participant during the research. If the music offered was not that of a genre that the participant preferred would it impact the triggering of the cue? When considering the methodology used versus the results achieved reference can be made to the IFPI, the International Federation of the Phonographic Industry, an organisation that represents the interests of the recording industry worldwide. The IFPI insight report of 2018 indicates that consumers listen to the Pop genre then the Rock genre as their preferred 1st and 2nd choice genres, Music Consumer Insight Report, (2018). This is in line with the participants in the research for this study as indicated in table 1 above.

Limitations

The research carried out used music associated with a participant based on their date of birth, in an attempt to recreate a similar point in time from a participant's past. The music was tailored to the individual on this basis. More significant results may have been achieved if a more precise and targeted musical stimuli was used. For example, if the participants could have selected music based on preferred genre and then by preferred artists in that genre. This may have created a more tailored cue, however the act of selection of both may create some unconscious bias when completing the PANAS scale post selection.

The research was conducted on a sample of 42 participants with an age range between 19 and 55, the mean age was 42.5 with the majority of participants clustered around this mean. There is an argument that this demographic is too narrow, with a wider sample coupled with a more targeted genre profile results may reveal a different impact on the null hypothesis.

The method used during the research meant that a participant when asked to listen to the musical stimuli had already a) been introduced to the process for the method and, b) had commenced retrieving memories for the period in question. Knowing the process and commencing retrieval limit the validity of the finding due to, a) a participant being primed to retrieve and, b) the tendency to trust one's own autobiographical memories can discourage people from systematically testing or accepting strong evidence to the opposite, Nash, R. A., Wade, K. A., Garry, M., & Adelman, J. S. (2017).

Finally, it could be argued that the images used were too remote from the participants in that they were for a magazine cover mainly supplied to the north American market when most participants were northern European.

Further research

The method used in this research allowed for some retrieval of a participant's memories and once retrieved they did evoke emotions. Which based on the results indicate a stronger retrieval for musical stimuli. Suggestions for further research are as follows:

- Change in the method used, if possible, request that participants provide access to their musical usage over a period of time, between 6-12 months. This would provide the researcher with a broad landscape of usage in that period. This could be mapped to events such as national holidays, birthdays, anniversaries for the individual. With this data a more in-depth analysis of the emotional cues and their triggers could be carried out along with an analysis of the memories retrieved.
- While carrying out the research in this study there was consideration given to the ethical considerations if such a trigger could cause the participant a negative reaction, and it was felt that such a manipulation was something that could occur in everyday life from say a piece being played on a local radio station randomly. However, if the randomness was taken out of the targeting of the piece, there are possibly many applications to use this data in further research. For example, one such use could open the possibilities of cross referencing to a person's other online activities for example shopping for example and was there a correlation between the music listened to and the purchases made. Ethical approval can be found in appendix b.

Conclusion

Music is indeed a powerful cue for memory retrieval and emotional triggers. The research carried out indicated that when a piece of music was found to be relevant from a point in a participants past it did trigger a vividness in recall of an associated autobiographical memory, and this in turn did act as a cue for the associated emotion. Online music services such as Spotify, Google play, iTunes etc. choose to use the data they have captured about the usage of the service and present it back to the user at set times they possibly may be able to elicit a targeted emotional response and use this to trigger a possible behavioural response. This could become an interesting commercial proposition when coupled with other online services. But for now, the cue when it occurs is both vivid and emotional.

References

Barrett, F. S., Grimm, K. J., Robins, R. W., Wildschut, T., Sedikides, C., & Janata, P. (2010). Music-evoked nostalgia: Affect, memory, and personality. *Emotion*, *10*(3), 390.

Belfi, A. M., Karlan, B., & Tranel, D. (2016). Music evokes vivid autobiographical memories. *Memory*, *24*(7), 979-989.

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological review*, *107*(2), 261.

Conway, M. A. (2008). Exploring episodic memory, volume 18, chapter 1.2.

Ekman, P. (1992). An argument for basic emotions. *Cognition & emotion*, *6*(3-4), 169-200.

Halpern, A. R., Talarico, J. M., Gouda, N., & Williamson, V. J. (2018). Are musical autobiographical memories special? It ain't necessarily so. *Music Perception: An Interdisciplinary Journal*, *35*(5), 561-572.

Hartley, J. (2014). Some thoughts on Likert-type scales. *International journal of clinical and health psychology*, *14*(1), 83-86.

Hockenbury, D. H., & Hockenbury, S. E. (2007). Discovering psychology (4th ed.). New York, NY, US: Worth Publishers.

Koelsch, S. (2014). Brain correlates of music-evoked emotions. *Nature Reviews Neuroscience*, *15*(3), 170.

Izard C. E. (2009). Emotion theory and research: highlights, unanswered questions, and emerging issues. Annual review of psychology, 60, 1–25. doi:10.1146/annurev.psych.60.110707.163539

Janata, P., Tomic, S. T., & Rakowski, S. K. (2007). Characterisation of music-evoked autobiographical memories. *Memory*, *15*(8), 845-860.

Jiang, J., Zhou, L., Rickson, D., & Jiang, C. (2013). The effects of sedative and stimulative music on stress reduction depend on music preference. *The Arts in Psychotherapy*, *40*(2), 201-205.

King, J. B., Jones, K. G., Goldberg, E., Rollins, M., MacNamee, K., Moffit, C., ... & Breitenbach, K. R. (2019). Increased functional connectivity after listening to favored music in adults with Alzheimer dementia. *The journal of prevention of Alzheimer's disease*, *6*(1), 56-62.

Krumhansl, Carol L. "Music: A link between cognition and emotion." Current directions in psychological science 11, no. 2 (2002): 45-50.

Laukka, P. (2007). Uses of music and psychological well-being among the elderly. *Journal of happiness studies*, *8*(2), 215.

McDonald, D. G., Sarge, M. A., Lin, S. F., Collier, J. G., & Potocki, B. (2015). A role for the self: Media content as triggers for involuntary autobiographical memories. *Communication Research*, *42*(1), 3-29.

McLeod, S. A. (2008). Likert scale. Retrieved from https://www.simplypsychology.org/likert-scale.html

Mohn, C., Argstatter, H., & Wilker, F. W. (2011). Perception of six basic emotions in music. *Psychology of Music*, *39*(4), 503-517.

Music Consumer Insight Report, (2018). *IFPI, 8.* Retrieved from https://ifpi.org/downloads/

Nash, R. A., Wade, K. A., Garry, M., & Adelman, J. S. (2017). A robust preference for cheap-and-easy strategies over reliable strategies when verifying personal memories. *Memory*, *25*(7), 890-899.

Piefke, M., Weiss, P. H., Markowitsch, H. J., & Fink, G. R. (2005). Gender differences in the functional neuroanatomy of emotional episodic autobiographical memory. *Human brain mapping*, *24*(4), 313-324.

Plutchik, R. E., & Conte, H. R. (1997). *Circumplex models of personality and emotions*. American Psychological Association.

Salimpoor, V. N., Benovoy, M., Longo, G., Cooperstock, J. R., & Zatorre, R. J. (2009). The rewarding aspects of music listening are related to degree of emotional arousal. PloS one, 4(10).

Saarikallio, S. (2011). Music as emotional self-regulation throughout adulthood. *Psychology of music*, *39*(3), 307-327.

Scherer, K., Zentne M. (2001) Music and emotion: theory and research. Oxford; New York: Oxford University Press.

Scoville, W. B., & Milner, B. (1957). Loss of recent memory after bilateral hippocampal lesions. Journal of neurology, neurosurgery, and psychiatry, 20(1), 11.

Sutin, A. R., & Robins, R. W. (2007). Phenomenology of autobiographical memories: The memory experiences questionnaire. *Memory*, *15*(4), 390-411.

This Day in Music - https://www.thisdayinmusic.com/

Tulving, E., & Murray, D. (1985). Elements of episodic memory. Canadian Psychology, 26(3), 235-238.

Van Campen, C. (2014). *The Proust effect: The senses as doorways to lost memories*. Oxford University Press.

Van den Tol, A., & Ritchie, T. D. (2014). Emotion memory and music: A critical review and recommendations for future research.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of personality and social psychology*, *54*(6), 1063.

Appendices

Appendix A

Music and Autobiographical Memory

Information sheet

Invitation

You are being invited to participate in this research study. This project is being undertaken by Adrian Noone as part of the Masters in Cyberpsychology program at the Institute of Art, Design, and Technology, Dun Laoghaire, Dublin, Ireland. Before you decide whether or not you want to participate, it is important for you to understand why this research is being undertaken and what it will involve. Please take the time to read this information carefully and discuss it with others if you wish. If anything is unclear, if you have any questions, or if you would like more information, please contact Adrian Noone at N00182609@student.iadt.ie.

This study has been approved by the Department of Technology and Psychology Ethics Committee at the Institute of Art, Design, and Technology.

Study Title

A study of the effect of music from the past on memory when presented to a person and the emotions they may create.

Purpose of the study

Online music services such as Spotify, iTunes and Google Play provide listeners with music whenever and wherever they want it. These services capture large amounts of data on the users of these services - from playlists to genres these service providers 'know' a user's musical tastes intimately. The purpose of this study is to determine if a targeted personalised piece of music can envoke autobiographical memory for the listener and would this manifest in an emotional change for the listener?

Do I qualify as a participant?

You qualify as a participant if you are 18 years of age or older and you are willing to participate.

Do I have to participate?

You are free to decide whether or not you wish to participate. If you decide to participate, you will be asked to indicate your consent by completing a short form. You are free to withdraw from this study at any time without explanation.

If I participate, what do I have to do?

To participate in this study, you must read a consent form and indicate your agreement to participate. You are first asked to answer a number of pre-test demographic questions.

Images

1

You will be asked to view a series of images, following which you will be asked two questions. The first question asking if the images created any memories for you and to what extent these were strong. The second question asking did you feel anything after viewing the images, responding using 13 statements on a scale from Very slightly to Extremely.

Music
You will be asked to listen to a number of musical pieces, following which you will be asked three questions. The first question asking if the music created any memories for you and to what extent these were strong. The second question asking did you feel anything after listening to the music, responding using 13 statements on a scale from Very slightly to Extremely.

In total, the study should not take more than 15 minutes.

What are the benefits and risks (if any) of taking part?
It is not anticipated that your participation in this study will cause any distress or discomfort. As part of the debrief information will be provided should any distress or discomfort occur for you as participant.

Music and Autobiographical Memory

Information sheet continued...

How will information about me be used and who will have access to it?
All the information that you provide during the course of the research will be kept strictly confidential. Only the researcher, the research supervisor, and a statistics lecturer will have access to the data. All data is anonymised and as such, your responses cannot be identified. Any hard copy data will be stored in a locked cabinet in the research supervisor's office.

The data will be used to complete a thesis, in partial fulfillment of the Masters in Cyberpsychology program, at the Institute of Art, Design, and Technology. If you wish to be provided with the results of the study when it is completed, please contact the researcher. The data will be retained by the researcher for two years after which time, it will be securely destroyed.

What if there is a problem?
If you have concerns about any aspect of this study or wish to speak to the researcher, you can contact N00182609@student.iadt.ie or the Research Supervisor, Robert Griffin, at robert.griffin@iadt.ie.

Thank You.

iadt DUN LAOGHAIRE

Music and Autobiographical Memory

Consent Form

* 1. Understanding of study and rights

- [ ] I confirm that I have read and understood the information sheet for this study.
- [ ] I have had the opportunity to ask questions.
- [ ] I understand that my participation is voluntary, and I can withdraw without explanation at anytime.
- [ ] I am 18 years old or older.

Music and Autobiographical Memory

Demographic questions

* 2. What gender do you identify as?

- Female
- Male
- Other
- Prefer not to answer

* 3. Please describe your race/ethnicity.

- White
- Asian
- Black or African American
- Other

* 4. Please describe your highest level of Education

- Some High school
- High school
- Bachelor's degree
- Master's degree
- Ph.D.
- Trade school
- Other
- Prefer not to say

* 5. Please indicate your favourite genre of music

- ◯ Alternative / Indie
- ◯ Classical
- ◯ Blues / Jazz
- ◯ Country
- ◯ Dance
- ◯ HipHop/Rap
- ◯ Pop
- ◯ Rock
- ◯ Reggae
- ◯ R&B / Soul
- ◯ Other

6

Music and Autobiographical Memory

Images for you to look at

Please use the dropbox link (you do not have to install dropbox) below to open a series of images provided, to view each image please scroll or page next. Please look at each image in the series. Once you have viewed the images please then answer the questions following.

Images for you to look at.

* 6. Indicate to what extent did viewing the images create past memories (if at all)?

	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
Memories remembered	○	○	○	○	○
Memories strength / vividness	○	○	○	○	○

* 7. Indicate to what extent you feel this way after viewing the images?

	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
Interested	○	○	○	○	○
Upset	○	○	○	○	○
Strong	○	○	○	○	○
Nervous	○	○	○	○	○
Guilty	○	○	○	○	○
Determined	○	○	○	○	○
Scared	○	○	○	○	○
Attentive	○	○	○	○	○
Hostile	○	○	○	○	○
Jittery	○	○	○	○	○
Active	○	○	○	○	○
Proud	○	○	○	○	○
Afraid	○	○	○	○	○

7

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Music and Autobiographical Memory

Music for you to listen to

Please listen to the following music using the dropbox link (you do not have to install dropbox) below. There are maximum 3 songs numbered 01 followed by title & artist, 02 followed by title & artist and 03 followed by title & artist. Each song lasts for circa 3 minutes. Please play each one from 01 to 03 (if applicable) and then please answer the questions following.

Music for you to listen to

* 8. Indicate to what extent listening to the music evoked past memories? if at all.

	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
Memories remembered	○	○	○	○	○
Memories strength / vividness	○	○	○	○	○

* 9. Indicate to what extent you feel this way after listening to the music played?

	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
Interested	○	○	○	○	○
Upset	○	○	○	○	○
Strong	○	○	○	○	○
Nervous	○	○	○	○	○
Guilty	○	○	○	○	○
Determined	○	○	○	○	○
Scared	○	○	○	○	○
Attentive	○	○	○	○	○
Hostile	○	○	○	○	○
Jittery	○	○	○	○	○
Active	○	○	○	○	○
Proud	○	○	○	○	○
Afraid	○	○	○	○	○

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Music and Autobiographical Memory

Debrief and Submission

Thank you for participating in this research study which is designed to determine if a targeted personalised piece of music invoke autobiographical memory for the listening and how would this manifest in an emotional change for the listener?

The collective responses from the scales used will be used to categorize participants reactions into emotive segments. This collated information will be used to determine whether there is a relationship point in time music listened to and the evoking of emotions through the recall of autobigraphical memory.

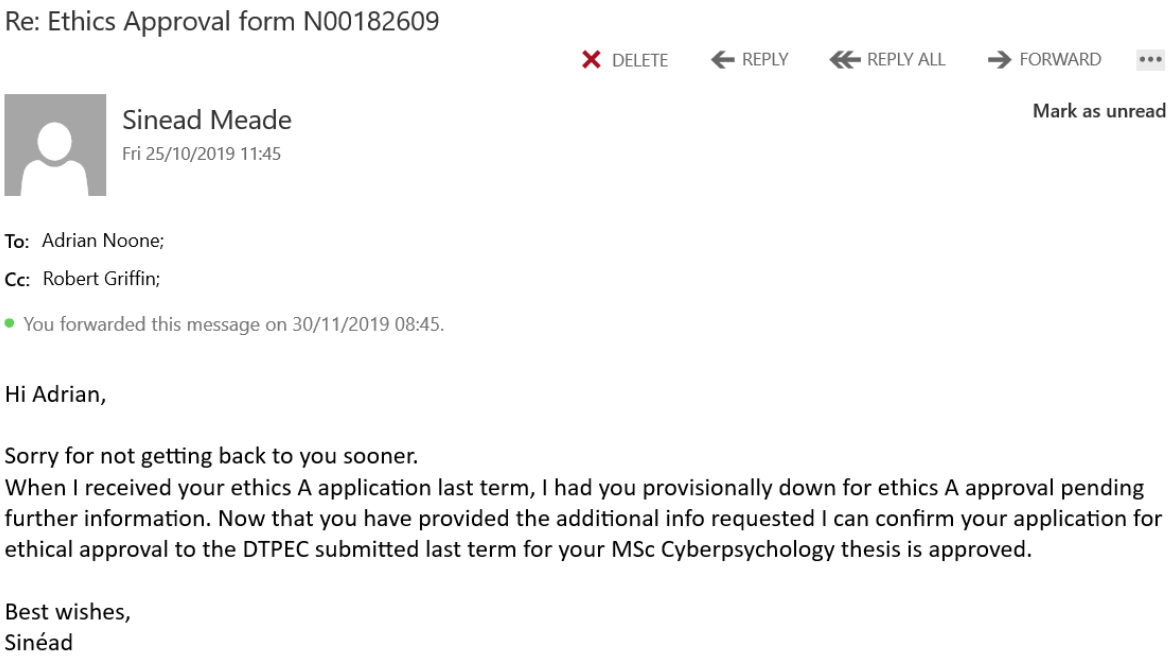
As mentioned previously, the data that you provide is anonymous and you will not be identified in the thesis for which this study was designed.

If you have concerns about any aspect of this study or wish to speak to the researcher, you can contact N00182609@student.iadt.ie or the Research Supervisor, Robert Griffin, at robert.griffin@iadt.ie.

If partaking in this survey has caused you as participant any emotional concerns there are a range of services provided on the site https://www.mentalhealthireland.ie/.

Thank you

Appendix B



Re: Ethics Approval form N00182609

DELETE REPLY REPLY ALL FORWARD

Mark as unread

Sinead Meade
Fri 25/10/2019 11:45

To: Adrian Noone;
Cc: Robert Griffin;

You forwarded this message on 30/11/2019 08:45.

Hi Adrian,

Sorry for not getting back to you sooner.
When I received your ethics A application last term, I had you provisionally down for ethics A approval pending further information. Now that you have provided the additional info requested I can confirm your application for ethical approval to the DTPEC submitted last term for your MSc Cyberpsychology thesis is approved.

Best wishes,
Sinéad