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A Comparison between the Cognitive and Emotional Qualities of Music-Evoked Autobiographical Memories and Film-Evoked Autobiographical Memories

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ABSTRACT

Music is a prominent aspect of our lives and is therefore intertwined with many memories and emotions from our past. However, little research has investigated whether these memories are different to those evoked by other cues (e.g. films). This study examines the content and emotional qualities of music-evoked autobiographical memories (MEAMs) and film-evoked autobiographical memories (FEAMs). Participants were exposed to 30 popular songs, and 30 popular films, and were presented with a set of questionnaires investigating both the cognitive and sentimental properties of these memories. On average, 48% of stimuli induced autobiographical memories, and MEAMs were found to be more familiar and pleasing. MEAMs were also found to be more vivid than FEAMs. Both music and films aroused a variety of emotions, the most prominent of which being *happiness/elation* for both music and films. Music was found to evoke more emotions of *pride/confidence, anger/irritation* and *disgust/contempt* than films. However, films induced more emotions of *surprise/astonishment, interested/captivated* and *admiration/awe*. The results not only show the differences in the autobiographical memories evoked by music and films, but the comparison between a range of emotions that these memories induced.

1. INTRODUCTION

Music is an important component of our lives and is intertwined with many social and cultural activities. We hear music daily: on the way to work, on the radio and whilst exercising, as well as background music at cafés and in elevators. As such a salient feature of our lives, it is not surprising that many pieces of music carry distinctive memories of people, places or times. The notion that music can evoke memories is evident and has been shown in various studies (Belfi, Karlan & Tranel, 2016; Janata, Tomic & Rakowski, 2007; Schulkind, Hennis & Rubin, 1999). Watching films is also a prominent feature in our lives, as both a social activity and a means to relax. However, whilst it may seem apparent that films can induce autobiographical memories, there has been limited research that directly investigates these memories, or the importance of films in everyday life. Furthermore, whilst there is a substantial amount of research on music-evoked autobiographical memories, there is little research into the comparison of these memories and those evoked by other cues. Therefore, the current study presents a novel experiment comparing both the strength and emotional aspects of two very similar stimuli; music-evoked autobiographical memories (MEAMs) and film-evoked autobiographical memories (FEAMs).

A substantial amount of research into MEAMs concerns severe memory impairments. El Haj, Fasotti and Allain (2012) carried out a study into the involuntary nature of MEAMs in individuals with Alzheimer's disease. Within the study, individuals with Alzheimer's were asked to recall an autobiographical memory in two conditions, either after silence or after listening to music that they had chosen. Results showed that memories induced in the music condition were more specific, with greater emotional content. This provides evidence for the positive effect music can have on individuals with Alzheimer's. Furthering these results, a study by Baird and Samson (2014) presented preliminary findings from a case series in which five patients with severe acquired brain injury (ABI) and five controls completed a task on MEAMs. In this task, they listened to 50 number-one songs and filled out a written questionnaire, as well as completing an autobiographical memory interview and a standard neuropsychological examination. One participant was excluded from results, as they were not able to evoke any autobiographical memories, as well as having impaired pitch perception. Results showed that the frequency of MEAMs in those with ABI was broadly comparable to the control group, and that music was effective for eliciting autobiographical memories. However, the sample size of this study was small, with results of only four participants with ABI and five controls, possibly providing an inaccurate representation of their respective populations. Nevertheless, the results are in line with those by El Haj et al. (2012), in that music was an effective stimulus for eliciting autobiographical memories, and valuable for rehabilitating those with severe acquired brain injury. Furthermore, Irish et al. (2006) investigated the enhancing effect of MEAMs in mild Alzheimer's disease. Participants took an autobiographical memory interview in two conditions; music or silence. Results showed a significant improvement in the music condition for those with Alzheimer's. This supports results from El Haj et al. (2012) and Baird and Samson (2014), showing the enhancing effect music can have on those with memory impairments or ABI.

A key area of focus within the present study was to look at the emotions elicited by MEAMs, compared to those aroused by films. One vital study into the emotional content of MEAMs was carried out by Janata et al. (2007). Participants completed questionnaires whilst listening to 30 popular music excerpts, describing any memories and noting any emotional content that a song held for them. Results showed that most songs evoked various emotions, the most prominent being positive, happy and youthful; the next most common emotion was nostalgia (27%). These results provide evidence for the ability of MEAMs to elicit emotions, specifically relating to the types of emotions they are likely to produce. Developing from this, Barret et al. (2010) conducted a study looking particularly into

music-evoked nostalgia. They investigated nostalgia as a function of context-level constructs which included rating familiarity, autobiographical salience and other emotions. They also investigated nostalgia as a function of personal-level constructs, including mood state, personality and nostalgia proneness. Results found that of the songs heard, 26% were at least somewhat nostalgic, supporting results of Janata et al. (2007). Results also showed that nostalgia and autobiographical experience were associated with both joy and sadness, and non-nostalgic and non-autobiographical experiences were associated with irritation. The results of Janata et al. (2007) and Barret et al. (2010) provide convincing evidence for the emotional capability of MEAMs, as well as the strong sense of nostalgia that comes with them. Looking specifically into negative emotions, Vuoskoski & Eerola (2012) questioned 'can sad music really make you sad?'. In their study, participants were randomly assigned to four groups; they either listened to unfamiliar sad music, neutral music, self-selected sad music, or recalled an autobiographical event and described it. Results showed that listening to sad music can conjure changes in both emotion-related memory and emotion-related judgment. These results help to show the emotional effects of sad music when related to autobiographical memories. The three studies discussed demonstrate that MEAMs have substantial capability to evoke a range of emotions.

Compared to the vast literature on MEAMs, research into FEAMs is more limited. As far as I am aware, the one study investigating FEAMs is that by Young (2000). Within this experiment, participants took an open-ended interview on their autobiographical memories of films, and the impact that particular films may have had on their lives. Young found, as suspected, that participants could report autobiographical memories of films. He also found that films were an important aspect of an individual's daily life, and aspects of film were often reflected in this; for example, perceptions of cultural issues were found to reflect what had been learnt from or seen in films. This helps to provide evidence for films as an effective memory cue, and suggests that films are an important aspect of our lives.

There has been little research into MEAMs and memories induced by other cues. One essential study into this topic is that of Belfi et al. (2016), which compared MEAMs to memories evoked by famous faces. Participants listened to 30 songs from the Billboard Hot 100 and viewed 30 famous faces from the Iowa Famous Faces test. They rated each song or face for autobiographical association on a three-point scale: no association, somewhat autobiographical, strongly autobiographical. If participants stated that a song was either somewhat or strongly autobiographical, they verbally described the memory. In line with results by Janata et al. (2007), Belfi et al. (2016) found that roughly 30% of stimuli produced memories. Although faces were found to be significantly more evocative of autobiographical memories than songs overall, the number of songs rated as strongly autobiographical showed no difference. Therefore, the overall discrepancy can be attributed to the larger number of 'somewhat autobiographical' memories elicited by faces compared to music. Moreover, analysis into the written details found there to be a significantly greater number of internal/total details in the music than the face condition. This supported their hypothesis that music creates more vivid memories than famous faces. This study is imperative to the current research into MEAMs compared to other cues, in this case FEAMs.

It is apparent that both music and films can induce autobiographical memories and emotional content linked to these memories. The compatibility of songs and films provide a strong basis for examining their autobiographical memories and the emotions aroused by the stimuli.

2. METHOD

Design This study conducted a laboratory experiment using a repeated measures design. The experiment aimed to compare the differences between autobiographical memories induced by music and films. Films were chosen, rather than another memory cue such as cue-words, as it was thought that they were more comparable to music. Both music and films are external sensory cues and both play an important part in social happenings, and therefore in an individual's life. The primary objective of this study, therefore, was to test the hypothesis that MEAMs are more frequent than FEAMs. This study also compared the vividness of autobiographical memories induced by music and films, not only through self-ratings, but through a detailed analysis of written memory descriptions. A further aim therefore was to test the hypothesis that music will produce more vivid memories than films. As we know that both music and films can arouse emotions, this study aimed to take a novel approach in seeking any emotional differences between MEAMs and FEAMs.

Participants. Participants were recruited by word of mouth and advertisements at Durham University Music Department and St John's College Durham. 34 undergraduate students (Female = 21, Male = 13) participated between 19 and 22 years of age (M = 20.4, SD = 0.8). All participants signed a consent form in accordance with Durham University regulations. This sample size was in alignment with the target sample size of 30; this target was determined by the study from Belfi et al. (2016) that investigated MEAMs using a similar design.

Stimuli. The music excerpts chosen were downloaded from the UK Top 100 end-of-year charts between the years of 2004–2015, sourced from officialcharts.com. The film clips were chosen from the highest UK Box Office sales from the end of each year between the years of 2004–2016, sourced from boxofficemojo.com. The top two songs and films of each year were chosen to increase the probability that participants would be familiar with them. Two different databases were created for older and younger participants to ensure that the stimuli chosen were from when they were between the ages of 9 and 18. Song clips were roughly 30-seconds long and contained the chorus for high recognisability. Film clips were between 30 seconds and 1 minute, containing an important scene to increase the likelihood of recognition. Film clips were often slightly longer than songs to maintain proportionality with the original source. Song and film clips were downloaded using converto.io and cut to length using

QuickTime Player. Film clips were precisely chosen to not include a large passage of film music that might skew a memory evoked about the film music rather than the film. A total of 24 songs and 24 film clips were used in the experiment and were controlled via Google Drive.

Questionnaires. Participants completed both general and excerpt specific questionnaires. Features of the questionnaires were taken from Janata et al. (2007) and Belfi et al. (2016). All aspects of the survey were controlled via Google Forms. For questions included in the questionnaires, see Appendix.

Procedure. Participants who entered the laboratory were seated in front of a laptop with a pair of headphones and could change the volume at any given moment throughout the experiment. Participants were only able to listen to each song/clip once because testing was for involuntary memory; in other words, rapid retrieval. Listening or watching each song/clip once helped to mitigate against strategic retrieval. After completing the general questionnaire, participants listened to 20 songs and watched 20 films, in a counterbalanced design.

Following each excerpt/clip, participants were asked about their familiarity with the song/film and if they found it pleasing or displeasing, both on a 5-point scale. Participants were also asked that, if the film was familiar, how recently they had last seen it, on a 6-point scale. They were then asked about any autobiographical connotation to the song/film on a three-point scale: *no association, somewhat autobiographical*, *strongly autobiographical*. Participants who selected *no association* would go onto the next excerpt/clip. Participants who selected *somewhat* or *strongly autobiographical* were presented with an additional form to explore the memory in detail. Participants were asked about the vividness of the memory, the general content of the memory, any emotions linked to the memory and for a written description of their memory in as much detail as possible.

Response Coding. The recordings of the memory descriptions were analysed and coded using a classification drawn from a combination of those used in Janata et al. (2007) and Levine et al. (2002). Each memory was segmented into single pieces of information, which were subsequently coded as either *internal* or *external details*. *Internal details* referred to the main event of the memory and were considered to reflect episodic re-experiencing (Levine et al., 2002: 679). *External details* refer mainly to instances in which a participant states a general fact or an event unrelated to the memory. *Internal details* were split into the following six categories: *events, places, times, perceptions, emotions/thoughts* and *people.* As *external details* did not relate directly to the memory, they were only split into four categories: *semantic statements, repetitions, external events* and *other details not related to the memory.*

Therefore, a memory might appear as such:

It took me to the end of primary school. It reminded me of the

Times: 'School'

school buildings, and the way we used to talk about the

Perceptions: 'Sights'

X-Factor on Monday mornings after the weekend shows.

Times: 'Time of day'; 'Time of week'

weekend shows. It reminded me of specific friends, one of

People: 'friends'

whom moved to Japan, and school discos.

External: Semantic statement; Events: 'school event'

It was very nostalgic.

Emotions/thoughts: 'nostalgic'

Memories were analysed as such, using a tally for *external details* and noting distinct words for *internal details* (e.g. *Monday*), and tallying these when they appeared numerous times. A higher number of *internal details* indicated a more vivid memory.

Data Analysis. All aspects of numerical data were analysed using Excel, R and RStudio. Some of the data were qualitative so they had to be converted into quantitative figures. For example, see Table 1. For a detailed list of conversions see appendix.

Table 1: Example of conversion from qualitative to quantitative figures.

Familiarity	Quantitative scale
Very familiar	5
Familiar	4
Somewhat Familiar	3
Slightly Familiar	2
Unfamiliar	1

3. RESULTS

Frequency and Familiarity of MEAMs and FEAMs. This section refers to the first set of questions participants answered after each stimulus. Participants answered these questions after every excerpt or clip that they viewed/heard.

Out of all stimuli presented to participants, 48% induced autobiographical memories. Out of the 24 songs presented to participants, 56% evoked autobiographical memories, and out of the 24 films presented to participants, 40% induced autobiographical memories. Consequently, songs elicited a significantly larger number of autobiographical memories than films (t (33) = -4.96, p < .001). Subdividing this, music produced a significantly greater number of both *strongly autobiographical* (t (33) = -2.06, p = .048), and *somewhat autobiographical* (t (33) = -3.39, p = .0018) memories. For a comparison between the number of autobiographical memories evoked, see Figure 1.

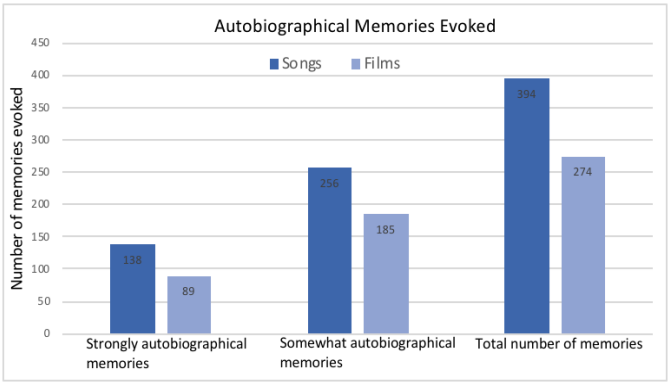

Figure 1: Comparison of the number of autobiographical memories evoked.

Participants were asked about their familiarity for each song/film on a 5-point scale from *Unfamiliar* to *Very Familiar*. 74% of stimuli showed were familiar. 86% of songs presented to participants were familiar compared to 62% of films presented. See Figure 2 for a comparison of the individual familiarity ratings. Results showed that songs were significantly more familiar than films (t (33) = -8.89, p < .001), see Figure 3.

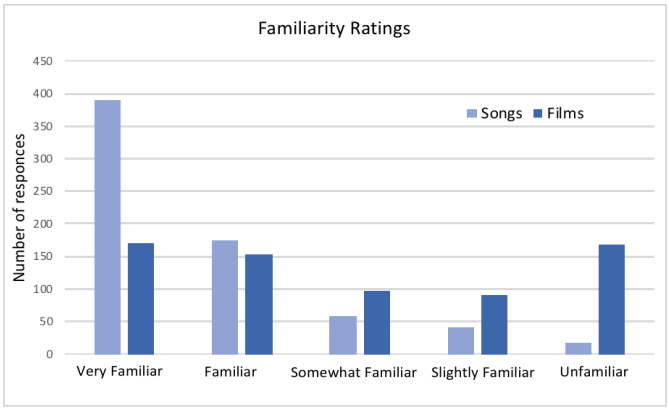

Figure 2: Comparison of individual familiarity ratings

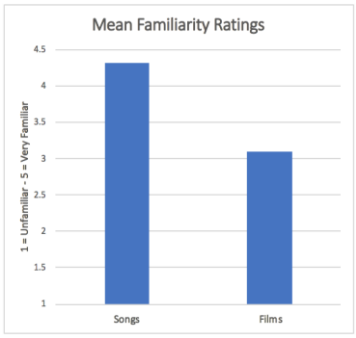

Figure 3: Comparison of familiarity ratings

After each stimulus, participants were asked that, if the song/film was familiar, when they had last heard or seen it. They could choose from a list of six, from *Last Week* to *More than 10 Years ago*. See Figure 4 for a comparison of the number of responses for each category. Results showed that songs were heard significantly more recently than films (t (33) = -5.15, p < .001), see Figure 5.

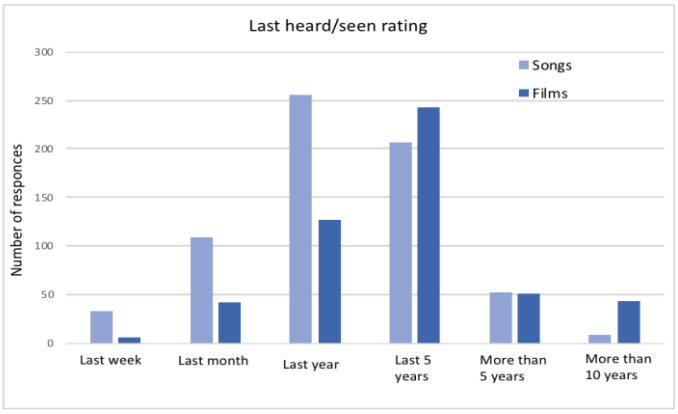

Figure 4: Comparison of individual last seen/heard ratings

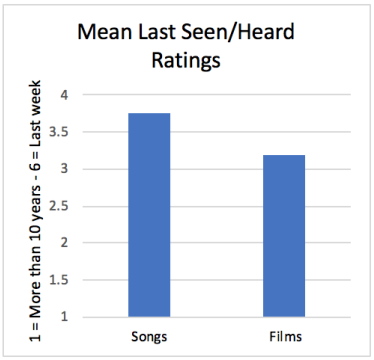

Figure 5: Comparison of when a film/song was last seen/heard

Participants were then asked how pleasing the song/film they just experienced was, using a 5-point scale from *Very Displeasing* to *Very Pleasing*. Results showed that 60% of films were rated as *pleasing* or *very pleasing*, 36% as *neutral/mixed* and 4% as *displeasing* or *very displeasing*. 69% of songs, in comparison, were rated as *pleasing* or *very pleasing*, 23% as *neutral/mixed* and 8% as *displeasing* or *very displeasing*. See Figure 6 for a comparison between these

responses. Results showed that songs were significantly more pleasing than films (t (33) = -16.66, p < .001), see Figure 7.

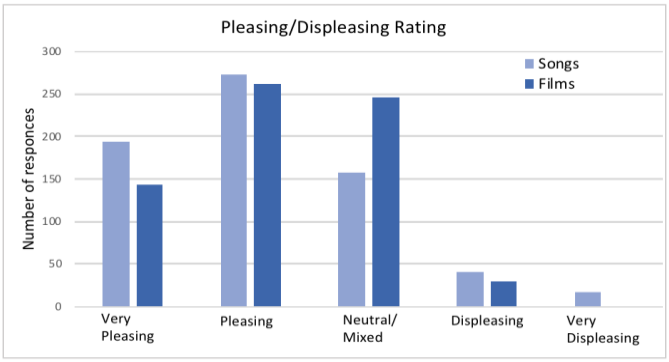

Figure 6: Comparison of individual pleasing/displeasing ratings

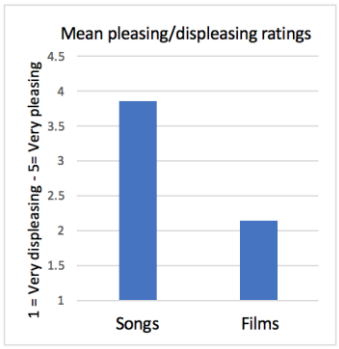

Figure 7: Comparison of pleasing/displeasing ratings

Cognitive content of the memories. This section refers to the set of questions asked if a participant stated that a memory was either *somewhat* or *strongly autobiographical.* Participants were given a series of follow-up questions to explore these memories in more detail. Participants rated the vividness of their present memory on a 5-point scale, however the comparison of this between music and films was not significant (t (33) = -.39, p = .70). To explore any potential differences in the cognitive content of MEAMs and FEAMs, participants were presented with a list of categories of what a memory might be associated with. Participants chose one or more categories for each time they indicated a distinct memory. The number of responses for these categories is shown in Figure 8. Results showed that songs evoked significantly more memories from *a specific period in an individual's life* than films (t (33) = 5.53, p < .001). Results also showed that films induced a significantly larger number of memories that reminded an individual of a particular *person/people* (t (33) = -3.30, p = .0023). See Table 2 for all t-test results for these categories.

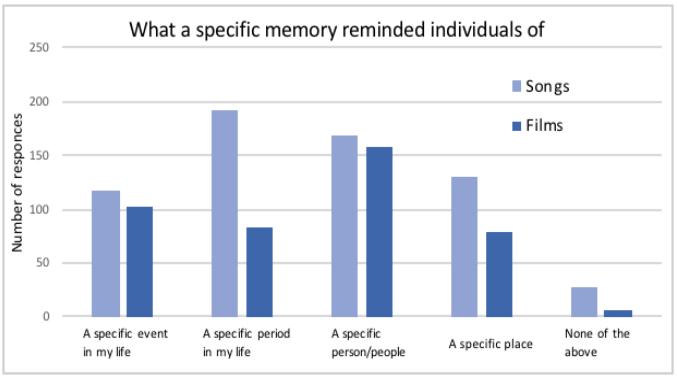

Figure 8: Comparison of cognitive content categories

Table 2: Significance of the contrast of cognitive content categories of music and films.

Cognitive content categories	t-value	df	p-value	Mean of the differences
A specific event in my life	t = 1.86	df = 33	p = .07	0.10
A specific period in my life	t = -5.53	df = 33	p = < .001 ***	-0.23
A specific person/people	t = 3.30	df = 33	p = .0023 **	0.12
A specific place	t = -.55	df = 33	p = .60	-0.02
None of the above	t = -1.34	df = 33	p = .19	-0.03

When a participant indicated that a stimulus evoked an autobiographical memory, they had the opportunity to provide a description of the memory in as much detail as possible. To explore which memory cue produced more vivid memories, if any, there would need to be a greater number of *internal details*. Results showed that music produced a significantly larger number of *internal details* (t (33) = -3.17, p = .0032), showing music produced more vivid memories than films. Within the sub-categories of *internal details*, music provoked significantly more details of *events* (t (33) = -3.42, p = .0017), *times* (t (33) = -5.44, p < .001), *places* (t (33) = -2.97, p = .0055) and *perceptions* (t (33) = -2.14, p = .04). There was no notable difference for *emotions/thoughts* or *people*. Music also induced a significantly larger number of *external details* (t (33) = -3.47, p = .0015), suggesting that, whilst the memories evoked by music were more vivid due to a higher number of *internal details*, they also contained more details not specifically related to the memory. Out of the sub-categories for *external details*, music elicited a significantly higher number of *semantic statements* (t (33) = -3.81, p < .001). There was no notable difference for *external events*, *repetition* or *other*. See Table 3 for all t-test results for the *internal* and *external* details.

Table 3: Significance of the contrast between films and music for the analysis of written responses

Individual analysis of written responses	t-value	df	p-value	Mean of the differences
Internal: Events	t = -3.42	df = 33	p = .0017 **	-1.53
Internal: Times	t = -5.44	df = 33	p = < .001 ***	-5.35
Internal: Places	t = -2.97	df = 33	p = .0055 **	-4.09
Internal: Perceptions	t = -2.14	df = 33	p = .04 *	-2.38
Internal: Emotions/thoughts	t = -.32	df = 33	p = .75	-0.26
Internal: People	t = .13	df = 33	p = .90	0.09
All Internal Details	t = -3.17	df = 33	p = .0032 **	-13.53
External: Semantic Statement	t = -3.81	df = 33	p = < .001 ***	-2.88
External: External Event	t = -.44	df = 33	p = .66	-0.06
External: Repetition	t = 0	df = 33	p = 1	0
External: Other	t = 0	df = 33	p = 1	0
All External Details	t = -3.47	df = 33	p = .0015 **	-2.82

Internal details were split into six categories (*Events, Times, Places, Perceptions, Emotions/Thoughts, People),* and were then segmented into various categories which comprised of common themes within written responses. See appendix for a full breakdown. As external details were comprised mainly of instances in which a participant stated a general fact or an event not related to the memory, it was not possible to segment additional categories in this way.

Emotional content of the memories. One focus in this study was to conduct a novel approach of investigating the comparison of the emotional content between MEAMs and FEAMs. Participants rated each emotion on a 5-point scale from 1, *not at all* to 5, *a lot*, and rated the *emotionality strength* for each memory. *Happiness/elation* was the most highly rated emotion for both songs and films. For songs, *nostalgia/longing* was the second most highly rated emotion, then *interested/captivated.* However, for films, the second most highly rated emotion was *interested/captivated,* then *nostalgia/longing.* See Figure 9 for a comparison of the ratings for all emotions.

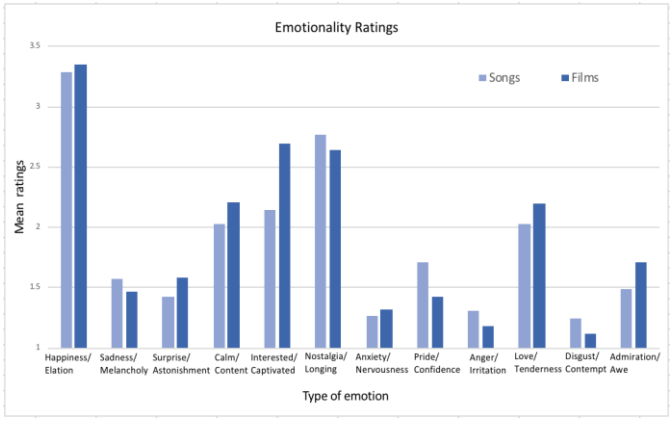

Figure 9: Mean emotionality ratings

There was no significant effect on *emotionality strength* between MEAMs and FEAMs (t (33) = .80, p = .43). However, there were various emotions which showed a significant difference. Results showed that films evoked a significantly stronger rating of *surprise/astonishment* (t (33) = 2.86, p = .0072), *interested/captivated* (t (33) = 4.64, p < .001) and *admiration/awe* (t (33) = 2.47, p = .019). Furthermore, music elicited a significantly higher rating of *pride/confidence* (t (33) = -3.71, p < .001), *anger/irritation* (t (33) = -2.71, p = .011) and *disgust/contempt* (t (33) = -3.00, p = .0051). See Table 4 for results of the t-tests for all emotions.

Table 4: Significance of the comparisons of emotional content of memories between music and films

Emotion	t-value	df	p-value	Mean of the differences
Happiness/elation	t = .58	df = 33	p = .57	0.06
Sadness/melancholy	t = -1.31	df = 33	p = .20	-0.10
Surprise/astonishment	t = 2.86	df = 33	p = .0073 **	0.16
Calm/contentment	t = 1.68	df = 33	p = .10	0.18
Interested/captivated	t = 4.64	df = 33	p = < .001 ***	0.56
Nostalgia/longing	t = -1.16	df = 33	p = .25	-0.13

Anxiety/nervousness	t = .88	df = 33	p = .39	0.05
Pride/confidence	t = -3.71	df = 33	p = < .001 ***	-0.30
Anger/irritation	t = -2.71	df = 33	p = .01 **	-0.13
Love/tenderness	t = 1.49	df = 33	p = .15	0.18
Disgust/contempt	t = -3.00	df = 33	p = .0051 **	-0.13
Admiration/awe	t = 2.47	df = 33	p = .023 *	0.23
Emotionality strength	t = .80	df = 33	p = .43	0.09

4. DISCUSSION

In this study, I sought to investigate whether music produces more autobiographical memories than films. The primary objective of this study, therefore, was to test the hypothesis that MEAMs are more frequent than FEAMs. This study compared the vividness of autobiographical memories induced by music and films, through both self-ratings and a detailed analysis of written memory descriptions. It was hypothesised that music would produce more vivid memories than films. As both music and films can arouse emotions, this study has taken a novel approach in seeking any emotional differences between MEAMs and FEAMs.

Results showed that both popular music and films serve as potent retrieval cues for autobiographical memories. Out of all stimuli, 48% induced autobiographical memories (56% MEAMs; 40% FEAMs). This is slightly higher than the rate of MEAMs found in previous studies, with Janata et al. (2007) and Belfi et al. (2016) both finding that approximately 30% of stimuli elicited autobiographical memories. However, this was a little lower than Schulkind et al. (1999) who found that approximately 40% of stimuli produced autobiographical memories. In the present study, results also showed that out of all stimuli presented, 74% were familiar (86% MEAMs, 62% FEAMs); this is higher than Janata et al. (2007), who found that 54% of music presented in their study was familiar. These differences most likely point to the distinction in stimuli selection between the studies. Janata et al. (2007) downloaded stimuli from the Billboard Top 100 Pop and R&B lists, using a total of 1515 different songs within the study. Belfi et al. (2016) used 20 stimuli from each year (1950-2013) from the Billboard Hot 100 year-end charts and Iowa Famous Faces test. Both these studies used random selection with a much larger corpus of stimuli. However, in the present study only the top two songs and films from each year-end chart were used; 24 songs and 24 films. Therefore, it was probable that participants would be more familiar with the stimuli presented in the present study than in Janata et al. (2007) and Belfi et al. (2016), and thus, eliciting a larger percentage of autobiographical memories. Nevertheless, all three studies found that out of the stimuli rated as familiar, roughly half of the stimuli were linked to an autobiographical memory. This indicates that familiarity with a song or film does not necessarily mean that an autobiographical memory will be provoked. Janata et al. (2007) even found that, in rare cases, unfamiliar songs can at times induce autobiographical memories.

The findings of the current study are not consistent with the limited previous research on music and other memory cues. Belfi et al. (2016) found that famous faces evoked a larger number of autobiographical memories than popular music. One possible explanation for these conflicting results could be that famous faces are more correlated with familiarity and autobiographical salience than music and films. Another possible explanation for these different results could be that faces are more likely to be associated with a range of different contexts than music and films. One might recognise a face from a song and film, as well as advertisements or the news. Therefore, it could be that we have a larger amount of lifetime exposure to these faces, making them more familiar to us, and consequently have stronger autobiographical associations than songs and films. Looking at a numeric comparison between both studies, Belfi et al. (2016) found that 41% of faces shown elicited an autobiographical memory compared to 29% of songs. However, in the present study 56% of songs shown evoked an autobiographical memory, compared to 40% of films. The number of memories induced by faces and films are similar within both studies; however, the number of autobiographical memories from songs in the present study is larger than any other stimulus within both studies. As discussed earlier, this difference is most likely due to the comparison in stimuli selection between the studies. Nonetheless, it could be interesting to compare all three memory cues using the same selection of stimuli.

A key area of focus within the current study was to present a novel analysis and comparison of the emotional content of autobiographical memories between music and films. There is compelling research showing that MEAMs can evoke emotional content. Results of the present study showed that both popular music and films aroused a wide range of emotions. The highest rated emotion for both songs and films was *happiness/elation*, with *nostalgia/longing* being the second for songs and third for films. This is consistent with the results from Janata et al. (2007), who found that the most prominent emotions were positive (happy and youthful), followed by nostalgia. Whilst the results in the present study for music align with those by Janata et al. (2007), there has been no research, to my knowledge, into the comparison of emotions elicited by autobiographical memories between music and another cue.

Results showed that music produced a significantly higher rating of *pride/confidence*, *anger/irritation* and

disgust/contempt. One possible explanation for the higher rating of *pride/confidence* could be that people often use music as a source of motivation (e.g. before sporting activities). This is supported by Brooks and Brooks (2010), who found that music can successfully be used as a motivational tool for sports, having the greatest effect on cardiovascular exercise. Subsequently, if music as motivation is correlated with success, people may associate a song with the *pride/confidence* felt whilst participating. Films, however, are watched to a lesser extent in such a context, and therefore it is less likely that one would feel such a strong sense of *pride/confidence* whilst watching a film. Music also produced a higher rating of *anger/irritation* and *disgust/contempt.* A reason for this could be due to the regularity in which popular songs are repeatedly played. These types of songs can often lead to 'earworms', which for some individuals can make them feel frustrated when hearing the song. Films are not comparable in this way, as they are not so repeatedly played and, as far as we know, do not commonly get stuck in our memory as songs do. An interesting question for future research could be to compare the enlightening impact of the emotional content of MEAMs and of another potent memory cue, such as FEAMs, on individuals with Alzheimer's or other memory impairments.

An additional variable that may have affected the autobiographical memories induced in this study may be music in films. Film clips were specifically chosen to not include a large passage of film music that could lead to a memory about the music rather than the film. However, music in films has direct relevance to whatever you are watching as it is scored to direct your mood. Therefore, most film clips presented did have background music, to elicit a fair representation of the film. Film music did not seem to affect any of the autobiographical memories evoked, apart from one memory:

> *The music in the clip reminded me of my Youth Orchestra at home with which I played the music of The Hobbit in my final concert with them before university.*

Consequently, it didn't appear that the music in films affected many autobiographical memories.

This research shows that both music and films can elicit not only autobiographical memories, but the emotional content of these memories. Therefore, marrying both visual and audio cues could be interesting for future research. A question for further research could be to investigate the autobiographical memories and the emotional content associated with films in which music is a large feature, for example a musical like *Mamma Mia!*. A limitation of the current study is the relatively small age range. Whilst 34 participants were involved, the age range only spanned from age 19 – 22. However, this was necessary, so that the films and music would be familiar to the participants. Age has been seen to affect autobiographical memories and Levine et al. (2002) found that older adults reported less detailed autobiographical memories than younger adults. An area of future research could be to explore the effects of age on autobiographical memories evoked by various cues.

This study is the first to compare the emotional content of autobiographical memories evoked by music to those by other cues. Results indicate that popular music induces a larger number and more vivid autobiographical memories than films. Findings of this study suggest that whilst both the autobiographical memories of music and films can arouse emotions, they can elicit different emotions. Results imply that films can produce stronger emotions of *surprise/astonishment, interested/captivated* and *awe/admiration* within autobiographical memories. However, music can evoke more emotions of *pride/confidence, anger/irritation* and *disgust/contempt* within autobiographical memories. This corresponds to the theory that music is especially supported to elicit strong emotions from autobiographical memories, but no such alignment can be made with the prevailing view on FEAMs, due to the dearth of literature. Given the abundance of research on music in everyday life (North et al., 2004; Sloboda, 1999, 2010; Sloboda et al., 2001) and MEAMs (Barlett & Snelius., 1980; Belfi et al., 2016; Janata et al., 2007; Schulkind et al., 1999), this study can now provide a new area of research into the emotional content of MEAMs compared to those from another potent memory cue.

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APPENDIX

General Questionnaire

* Required

What is your participant number? *_____

How old are you? *_____

What is your gender? *

Female ☐

Male ☐

Prefer not to say ☐

What degree are you studying? *_____

What title best describes you? *

- Non-musician ☐
- Music-loving non-musician ☐
- Amateur musician ☐
- Serious amateur musician ☐
- Semi-professional musician ☐
- Professional musician ☐

How familiar are you with the film/song you just saw/heard? *

- Unfamiliar ☐
- Slightly familiar ☐
- Somewhat familiar ☐
- Familiar ☐
- Very familiar ☐

If this film/song if familiar, how recently have you seen/heard it?

- Last week ☐
- Last month ☐
- Last year ☐
- Last 5 years ☐
- More than 5 years ☐
- More than 10 years ☐

In the present moment, do you find this film/song pleasing, displeasing or neutral/mixed? *

- Very displeasing ☐
- Displeasing ☐
- Neutral/Mixed ☐
- Pleasing ☐
- Very pleasing ☐

What is your autobiographical association with this film/song? In other words, how strongly does this film/song cause you to have memories of people, places, events, or time periods in your life? *

- No association ☐
- Somewhat autobiographical ☐
- Strongly autobiographical ☐

Excerpt Specific Questionnaire

* Required

How vivid was the memory you experienced whilst watching/listening to this film/song? *

Not vivid at all 1 2 3 4 5 Very Vivid

What does watching/listening to this film/song remind you of? (State all that apply) *

- A specific event in my life ☐
- A specific period in my life ☐
- A specific person/people ☐
- A specific place ☐
- None of the above ☐

Please describe the autobiographical memory that this film/song evoked, in as much detail as possible. Use your own words and describe the memory as you now remembered it. *

Please rate how much you feel the following emotions when thinking about this memory: *

Happiness/elation: Not at all 1 2 3 4 5 A lot

Sadness/melancholy: Not at all 1 2 3 4 5 A lot

Surprise/astonishment: Not at all 1 2 3 4 5 A lot

Calm/contentment: Not at all 1 2 3 4 5 A lot

Interested/captivated: Not at all 1 2 3 4 5 A lot

Nostalgia/longing: Not at all 1 2 3 4 5 A lot

Anxiety/nervousness: Not at all 1 2 3 4 5 A lot

Pride/confidence: Not at all 1 2 3 4 5 A lot

Anger/irritation: Not at all 1 2 3 4 5 A lot

Love/tenderness: Not at all 1 2 3 4 5 A lot

Disgust/contempt: Not at all 1 2 3 4 5 A lot

Admiration/awe: Not at all 1 2 3 4 5 A lot

How strongly did you experience these emotions when thinking about this memory? *

Not at all 1 2 3 4 5 Very Strongly

Qualitative to quantitative conversions

Some of the data was qualitative, and so it was necessary to convert this into quantitative figures. All conversions of this are listed below:

Familiarity conversion from qualitative to quantitative figures.

Familiarity	*Quantitative Scale*
Very familiar	5
Familiar	4
Somewhat Familiar	3
Slightly Familiar	2
Unfamiliar	1

Last seen/heard conversion from qualitative to quantitative figures.

Last seen/heard	*Quantitative Scale*
Last Week	6
Last Month	5
Last Year	4
Last 5 Years	3
More than 5 Years Ago	2
More than 10 Years Ago	1

Pleasing/Displeasing conversion from qualitative to quantitative figures.

Pleasing/Displeasing	*Quantitative Scale*
Very Pleasing	5
Pleasing	4
Neutral/Mixed	3
Displeasing	2
Very Displeasing	1

Music: *Internal Details*					
Events *104*	**Occasional events = 35:** Party: 13; Festival: 9; Concert: 8; Moved house: 1; Brownie disco: 1; Dinner party: 1; Sleepover: 1; Gymnastics competition: 1	**School events = 28:** School disco: 13; Prom: 5; School trip: 4; School competition: 2; Exchange trip: 2; Exam: 1; Leaving ceremony: 1	**Yearly events = 19:** Christmas: 9; Birthday: 8; New year: 2	**Holidays/away = 16:** Holiday: 8; Travelling 3; Road trip: 2; Orchestra course: 1; Christian camp: 1; Flight: 1	**University events = 6:** Ball: 4; Silent disco: 1; Ski trip: 1
Times *323*	**Period in life = 150:** School: 109; Uni: 20; Early teenager: 4; After school: 4; Finished exams: 3; Teenager: 3; Gap year: 2; End of school: 2; After A levels: 1; More than 5 years ago: 1; After results: 1	**School/Uni year = 64:** Sixth form: 18; 1st Year Uni: 11; Year 7: 6; Year 6: 6; Year 10-11: 5; Year 9: 4; Year 11: 3; Year 13: 4; Year 12: 2; Year 8: 2; Year 5: 1; 2nd Year of Uni: 1; Year 7-9: 1	**Time of year = 39:** Summer: 15; Christmas: 10; Holiday: 7; New year: 2; December: 1; Summer term: 1; School holidays: 1; End of summer term: 1; End of the year: 1	**Time of day = 26:** Evening: 8; Breaktime: 6; Morning: 3; Late at night: 2; End of the day: 1; 5.30am: 1; 8am: 1; 7.20: 1; Early morning: 1; 3am: 1; End of the night: 1	**Specific age/year = 21:** Age 16: 3; Age 15: 3; Age 10-11: 3; Age 12: 2; 2017: 2; Age 13: 2; 2009: 1; 2013-14: 1; 2012: 1
	Time of week = 17: Weekend: 13; Friday: 2; Wednesday: 1; Monday: 1	**Other = 6:** Assembly: 1; Walking to school: 1; Last week: 1; Very recently: 1; Lesson: 1; First kiss: 1			
Places *432*	**School = 96:** School: 79; Classroom: 6; School TV room: 2; School dorm: 2; Sixth form common room: 2; Boarding house: 2; One part of campus: 1; Music department: 1; Library: 1	**Houses = 72:** Home: 26; Living room: 8; Bed: 6; Bedroom: 5; Kitchen: 5; Friends house: 4; Old house: 3; House: 3; Desk: 2; Friends room: 2; Country house: 2; Toilet: 1; Garden: 1; Stairs: 1; Dining room: 1; Grandparents house: 1; Room: 1	**Modes of transport = 47:** Car: 38; School bus: 4; Bus: 2; Train: 1; Coach: 1; Tuk Tuk: 1	**Holiday/Out of UK = 31:** Beach: 5; France: 4; Russia: 2; Barbados: 1; India: 1; New York: 1; Spain: 1; Peru: 1; Sri Lanka: 1; Turkey: 1; South East Asia: 1; Dubai: 1; Jersey: 1; China: 1; Santa Monica: 1; Ecuador: 1; Guernsey: 1; Australia: 1; Italy: 1; Loure Valley: 1; Hotel: 1; Hostel: 1; Airport: 1	
	University = 28: University: 16; Jimmys: 3; Klute: 3; Lloyds: 1; College: 1; Halls: 1; Castle college: 1; Lecture: 1; Corridor: 1	**Places for social activity = 25:** Club: 17; Resteraunt: 2; Underground bar: 1; Play park: 1; Ice Rink: 1; Bowling alley: 1; Dance floor: 1; Village hall: 1	**Places in the UK = 22:** London: 4; Durham: 3; Glastonbury: 3; Countryside: 3; Litchfield: 1; Leiston: 1; Reading: 1; High Street Kensington: 1; Kendal: 1;	**Weekly activities = 9:** Gym, Zumba: 5; Outside: 2; Church: 1; Park: 1	**Other = 12:** Wooden shed: 1; Car park: 1; Yard: 1; Specific road: 1; Harvey Nickols store: 1; Elevator: 1; Lobby: 1; Woolworths: 1 Indoor ski slope: 1; O2: 1; Recording studio: 1;

			Yorkshire Dales: 1; Wycombe: 1; Scotland: 1; Campsite: 1		Royal albert hall: 1
Perceptions 137	**Sights = 80:** Sun: 6; Watching them dance and sing: 3; Ocean: 2; Pool: 2; School buildings: 1; Physical description: 1; Concerte playground: 1; Candles: 1; Men covered in paint: 1; Dramatically acting it out: 1; Chairs in the corner: 1; Wearming my mums blue top as a dress: 1; Re-enacting Bruno Mars: 1; Balcony: 1; Muddy: 1; Covered my white dress in mud: 1; Running up the beach towards me: 1; Dancing in underwear around his room: 1; Bright pink bikini: 1; Short white beach shirt: 1; Costumes: 1; Lights: 1; Image: 1; Pitch black: 1; Cathederal: 1; Bright red: 1; Outside in lines: 1; Trampoline: 1; Crushed up on a couch: 1; Friend on shoulders: 1; Performed a dance: 1; Lights went out: 1; Darkened corridor: 1; Palm trees: 1; Inflatables: 1; Tanned body: 1**;** Eye contact: 1; Bobbing our heads to the radio: 1; Kitchen was lit up: 1; Dancing on someones sofas: 1; Video of her dancing to this song: 1; Tearful smiles: 1; Dark sky and stars: 1; Dodgy looking: 1; Dark: 1; The rooms and corridors: 1; Sat towards the back of the hall: 1; Colours used: 1; Punches through a wall: 1; Kilts: 1; Winding roads: 1; 4x4: 1; Tacky handmade paperchains strung form the ceiling: 1; Vineyards: 1; Funny faces: 1; Windows wide open: 1; Grungey: 1; Confetti: 1; Burning hosue: 1; 50 guys dancing: 1; Football: 1; Grass: 1; Wooden shed: 1; Nokia brick: 1; Huge mass: 1; Drenched in sweat: 1; Wernt friendly looking: 1; 80s outfits: 1; Expensive brand clothes: 1; Sandy: 1			
	Sounds = 28: Very loud music: 5; Playing from a phone: 4; Sing along loudly: 2; People trying to sing the ooh ooh: 1; Harp: 1; Silence: 1; QUote from radio: 1; Having drinks and chatting: 1; Singing the harmony in the lobby: 1; Putting phone in a plastic cup to try and make it a bit louder: 1; People shouting lyrics at the top of their voice: 1; Sung the song: 1; Funny words: 1; Screaming: 1; Clicking our fingers: 1; Screaming it though the window: 1; Shouts 'Mazel tov': 1; Hear the song on the builders radio outside': 1; Music booming out of massive speakers: 1; Not very loud: 1			**Feelings = 10:** Cold: 1; Warm: 1; Stuffy: 1; Hot: 1; Jumping: 1; Uncomfy seats: 1; Room was cold: 1; Floor was sticky: 1; Sitting on a bench: 1; Warm evening: 1	**More than 1 sense = 15:** Live performance 4; Raining: 3; Atmosphere: 2; Pouring down with rain: 1; Fireworks: 1; Raining: 1; BBQ: 1; Jumping on the trampoline in the rain: 1
	Tastes = 3: Eating biscuits: 1; Ice cream: 1; Picnic: 1		**Smells = 1:** Smelly: 1		
Emotions/thoughts 185	**Happiness/elation = 73:** Favourite: 14; Laugher: 9; Good: 8; Like: 8; Happy: 7; Funny: 7; Excitement: 5; Hilarious: 4; Amusement: 2; Smiling: 2; Enjoyment: 1; Great: 1; Giggling: 1; Fun: 1; Thrill: 1; Positive: 1; Joy: 1	**Anger/irritation = 32:** Annoyed: 12; Hate: 6; Dislike: 4; Anger; 3; Fustrating: 1; Crazy: 1; Awful: 1; Not good: 1; Unimpressed: 1; Horrible: 1; Bad: 1	**Love/tenderness = 22:** Love: 19; Pretty: 1; Fond: 1; Bessotted: 1	**Sadness/melancholy = 21:** Emotional: 4; Crying: 3; Struggle: 2; Disappointed: 2; Upset: 1; Traumatic: 1; Heartbreak: 1; Hurt: 1; Tragic: 1; Soppy: 1; Woe: 1; Sulking: 1; Grief: 1; Fragile: 1	**Anxiety/nervousness = 9:** Embarrassed: 2; Nervous: 2; Scared: 1; Nervous: 1; Stressful: 1; Awkward: 1; Dizzy: 1
	Other = 6: Bored: 4; Tired: 1; Awe: 1	**Surprise/astonishment = 6:** Surprised: 3; Amazed: 2; Shocked: 1	**Interested/captivated = 5:** Obsessed: 3; Blown away: 1; Interested: 1	**Pride/confidence = 4:** Confidence: 2; Courage: 2	**Calm/contentment = 4:** Relaxed: 3; Calm: 1

					Nostalgia/longing: 3: Nostalgia: 3; Hoping: 1
People *272*	**Friends = 128:** Friends: 95; Best friend: 10; Classmate: 7; Choir: 6; Family friend: 3; Housemates: 2; Peers: 1; People in school house: 1; Friends mum: 1; Exchange student: 1; Godparents: 1	**Family = 104:** Mum, Dad, Parents: 49; Brother, Sister, Sibling: 26; Family: 22; Cousins: 4; Grandpa, Grandma, Grandparents: 2; Aunt: 1	**Other = 17:** Boy: 8; Guy: 3; Chefs: 1; Kids: 1; Homeless bloke: 1; Miley Cyrus: 1; Tom Hanks: 1; Danny O'Donohue: 1	**Significant other = 13;** Boyfriend: 8; Girlfriend: 5	**Person of authority = 10;** Teacher: 7; Headmaster: 1; Dance instructor: 1; Surfing instructor: 1

Full breakdown of the segmented categories for Internal Details: Films

Films: Internal Details					
Events 50	**Yearly events = 22:** Christmas: 14; Birthday: 8	**Holiday = 12:** Holiday: 12	**Occasional events = 9:** Theatre: 5; Concert: 2; Party: 2; Father's day: 1; Driving test: 1	**Other = 5;** School trip: 3; Scout sleepover: 1; Ball: 1	
Times 152	**Time of year = 44:** Christmas: 19; Holiday: 12; Summer holidays: 7; Winter: 3; Half term: 1; Summer day: 1; Holiday season; 1	**School = 27:** School: 19; Sixth form: 2; Revising; 2; Year 13: 1; Year 11: 1; Post GCSEs: 1; Last week of school: 1	**Time of day = 23:** Evening: 15; Midnight: 3; Late at night: 2; Morning: 1; Afternoon; 1; 4am: 1	**University = 20:** University = 15; 1st Year Uni = 5	**Specific age/year = 17;** Age 14-15 = 5; 2017: 3; Age: 3; Age 4-5: 2; Age 9-10: 1; Age 18: 1; 2013: 1; Gap year: 1
	Time of week = 13: Weekend: 11; Friday: 2	**Past Year = 5:** Very recently: 2; This year: 1; Couple of months ago: 1; Last week: 1	**Stage of life = 3:** Teenage: 2; Adolescent: 1		
Places 192.	**Houses = 63:** Home: 31; Living room: 11; Grandparents house = 5; Friends house: 4; Bedroom: 2; Brothers room: 1; Garden: 1; Room: 1; Dads office: 1; Aunties house: 1; Second cousins house: 1; Country house: 1; House: 1	**Cinemas = 61:** Cinema = 56; Gala, Durham: 2; IMAX: 1; Odeon Marble Arch: 1; Everyman Belsize Park: 1	**Holiday/Out of UK = 21:** France: 4; Greece: 3; Spain: 2; Russia: 3; New York: 1; Florida: 1; Denmark: 1; Scotland: 1; Ireland: 1; St Petersburg: 1; Corfu: 1; Guernsey: 1; Portugal: 1; Hern Island: 1	**School = 14:** School: 14	**Places in the UK = 10:** London: 3; Durham: 2; Newcastle: 1; High Wycombe: 1; Waterloo: 1; Leicester Square: 1; Countryside: 1
	Other = 12; Car = 4; Library: 1; Tesco: 1; Science Lab: 1; Nandos: 1; Rooftop: 1; Village Hall: 1; Canteen: 1	**University = 6:** University: 6	**Tourist attractions = 5:** Harry Potter Studios: 3; Novello Theatre: 1; National Gallery: 1		
Perceptions 52	**Sights = 26:** Fire: 6; Fancy dress: 2; 3D: 1; Big marquee: 1; Posters and billboards: 1; Yellow chair by the window: 1; Huge platform TV: 1; Unhygenic food: 1; Mums reaction: 1; People all over sofa and floor: 1; Christmas lights: 1; Hogwarts: 1; Yellow duffle coats: 1; Harry potter/Durham: 1; Dark living room: 1; Journey there and back: 1; Lights off: 1; Toystory table cover/plates: 1; Pop up drinks and sweets bar:1; Re-enactment of sword fights: 1			**Feelings = 9:** On the sofa: 3; Cold: 1; Sitting on the wooden floor: 1; 4 squashed on a 2-seater couch: 1; Sitting on the arm chair: 1; Lying on the sofa: 1; Sofa sat on: 1	**Tastes = 8:** Popcorn: 3; Yummy pie: 1; Marmalade sandwiches: 1; Chocolate: 1; Fish fingers and peas: 1; Sweets: 1
	Sounds = 6: Accent = 4; Conversations: 2	**More than 1 sense = 2:** Sick: 1; Rainstorm: 1	**Smells = 1**		

Emotions/thoughts *166*	**Happiness/elation = 58:** Favourite: 12; Excitement: 11; Enjoyment: 8; Happy: 7; Great: 4; Like: 4; Hilarious: 3; Positive: 2; Cheer: 1; Smile: 1; Entertaining: 1; Funny: 1; Fun: 1; Amusing: 1; Encourage: 1	**Love/tenderness = 36:** Love: 30; Nice: 5; Fond: 1	**Sadness/melancholy = 22:** Crying: 8; Sad: 4; Unpleasant: 2; Upset: 1; Lonely: 1; Hurt: 1; Feeling bad: 1; Grief: 1; Feeling terrible: 1; Emotional: 1; Uninterested: 1	**Anxiety/nervousness = 15:** Scared = 4; Stressed: 2; Nervous: 1; Terrified: 1; Worried: 1; Tense: 1; Suffocated: 1; Conscious: 1; Awkward: 1; Uncomfortable: 1; Embarrassed: 1	**Anger/irritation = 12:** Hate: 4; Annoying: 3; Anger: 1; Jealousy: 1; Criticize: 1; Unimpressed: 1; Bitter: 1
	Interested/captivated = 8: Obsessed: 4; Interested: 2; Facinated: 1; Edge of my seat: 1	**Nostalga/longing = 6:** Nostalgic: 4; Hopeful: 2	**Other = 5:** Tired: 2; Goosebumps: 1; Relatable: 1; Pride: 1	**Surprise/astonishment = 2:** Surprised: 1; Aghast: 1	**Disgust/contempt = 2:** Disgust: 1; Cringe: 1
People	**Family = 186:** Family: 55; Mum, Dad, Parents: 58; Brother, Sister, Sibling, Twin: 59; Grandma, Grandpa, Grandparents: 8; Aunt, Uncle: 3; Cousins: 2; Second cousins: 1	**Friends = 64:** Friend, Mate: 48; Flatmates: 7; Best friend: 6; Choir: 1; Desk partner: 1; Friends family: 1	**Significant other = 9;** Boyfriend: 7; Girlfriend: 1; Partner: 1	**Person of authority = 4:** School teacher: 2; Lecturer: 1; Driving instructor: 1	**Other = 4:** Priest: 1; Two Russian men: 1; Alan Rickman: 1; Person: 1