

Using music to cue autobiographical memories of different lifetime periods

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ABSTRACT Little previous research has examined the link between popular music and autobiographical memory. College-age participants recalled a memory associated with a song from each of five lifetime eras and then described and rated the memories. Participants heard part of the song, read the lyrics, saw a picture of the artist or began describing their memory immediately. Ratings for vividness, specificity, feeling brought back and feeling emotional in connection with the memory were all significantly different across lifetime eras. Differences also existed between sensory conditions in memory description length, feeling brought back and feeling emotional. However, hearing the song did not produce higher ratings than all the other sensory conditions. These findings show that music is a valuable cue to evoke autobiographical memory.

KEYWORDS: *college students, emotion, recall, song*

Autobiographical memory consists of knowledge about events or experiences in one's life, and individuals recall an autobiographical memory when a portion of the knowledge of their lives becomes temporarily activated. The knowledge in this case may or may not include internal pictorial representations of the event, although some details of the memory are generally present in some form (Conway, 2001). These memories refer to events that relate specifically to oneself, and the personally experienced events could be recalled either with or without accompanying sensations such as images, emotions or physiological responses. These sensations lead to actual recollection of a memory, while knowledge without these sensations produces an understanding of the facts of one's autobiography (Tulving, 2002). However, autobiographical memory does not hold all personal experiences of an individual's life. In most cases, events with little accompanying emotion or with trivial meaning to the person's life or self-concept will not be recalled as well as emotional and important events (Skowronski and Walker, 2004).

Autobiographical memories usually include an idea of the timing of the event. In addition, memories incorporate several levels of specificity in the information recalled (Skowronski and Walker, 2004). Conway and Pleydell-Pearce (2000) provide an

overview of the different aspects of autobiographical memory by elaborating on both the microstructure and the macrostructure of autobiographical memory. Within the microstructure, the most general level of memory concerns a lifetime period, such as high school years, college years or working at a specific job. This level encompasses knowledge of both the elements of the period (such as important people, places and endeavors) and the starting point and length of the period. The next level of the microstructure is that of general events, which can involve a repeated event (such as long runs in the park), a single event (such as a specific vacation) or a thematic sequence of events (such as all the games in one sports season). These memories are highly organized and focused on goal-directed and other self-discovery-directed behavior. The most precise level of autobiographical memory is the event-specific knowledge (ESK), which forms the basis of the imagery and details of a memory. This knowledge arises from the sensory-perceptual experiences of the person recalling the memory (Conway and Pleydell-Pearce, 2000).

The three levels of microstructure knowledge may be organized into a hierarchy that allows a cue from a specific lifetime period to aid recall of a number of general events. These events then serve as cues for more general events as well as event-specific knowledge. Thus, autobiographical memories contain general information that precedes specific information during the recall of the memory. This indicates that an individual must remember general information before reliving the specific details of the event (Anderson and Conway, 1997).

While the microstructure of autobiographical memory involves the formation of individual memories, the macrostructure explains the pattern of memory retrieval over an individual's lifespan (Conway and Pleydell-Pearce, 2000). Individuals remember events from different lifetime eras at various rates (Rubin and Schulkind, 1997). Rubin et al. (1986) show that retention is strong in undergraduate students for personal memories for most lifetime eras. However, across all age groups there is an amnesia stemming from early childhood, so no memories from very early childhood (younger than about age three) can be reliably recalled (Rubin et al., 1986). In addition, adults, including college students, remember the recent past more completely than events from more than 10 to 20 years prior, forming a retention function of memory recall (Rubin and Schulkind, 1997).

Several studies have shown that autobiographical memories of events may be organized in the same order in which they occurred. In fact, individuals will recall a series of events faster when the cues for retrieval match the temporal order of events (Anderson and Conway, 1997). When individuals recall a personal event from a particular time, they sometimes use the lifetime period in which the event occurred to assist their recall. Although they may overlap, these lifetime periods allow individuals to think of their lives as a consistent whole rather than a disorganized collection of events. When engaged in retrieval of a particular memory, individuals generally try to place that event in its appropriate lifetime period, rather than attempting to label the event with a more precise time-stamp (Friedman, 2004).

Several techniques have been used to study voluntary autobiographical memory in the laboratory (Crovitz and Quina-Holland, 1976). In cueing, a common technique, a single word is used as a cue for the participant to recall a personal memory. The participant also provides a date for the memory, and this method has been found

to be reliable between tests and valid when compared with diaries (Rubin et al., 1986). The sensory qualities of a cue word for a memory affect the specificity of the memory, with words that produce visual imagery eliciting more specific memories than words relating to auditory, tactile, motor or olfactory representations (Goddard et al., 2005). In addition, although emotions themselves can trigger autobiographical memories, a simple word cue naming an emotion does not necessarily elicit recall of such memories. Although simply reading a word describing an emotion may not induce the participant to feel emotional, if the participant feels the actual emotion instead of merely reading the word, he/she may more easily retrieve a similar memory (Conway and Bekerian, 1987).

The type of cue used also affects the specificity of the memory recalled. Goddard et al. (2005) presented participants with a series of cues that could be a word relating to an odor, a picture relating to an odor or the actual odor. Each participant received cues in all three modalities, although not for the same odors. They found that the odors themselves evoked fewer memories than the words or images, and retrieval times were also slower for the odor cues. Finally, memories recalled to the odors were less specific than those recalled to a word or picture cue. The type of cue also affected vividness of the memory, with words producing the most vivid memories and odors the least vivid. Although the odors were not as efficient as words in cueing memories, the authors suggest that using the odor as a detail retrieval aid after the memory itself has been recalled may provide a more detailed memory (Goddard et al., 2005).

Herz and Schooler (2002) examined memories recalled to words, pictures or odors. They presented participants with the name of a product with a distinctive odor and asked them to think of an answer to questions regarding a personal memory related to that name. Following this, half the participants saw a picture of the product and half smelled the product. After the manipulation, the participants rated their recalled memory with a similar set of questions. Herz and Schooler found that memories recalled by smelling the odors were more emotional and evoked more feelings of being back in the moment than those recalled with the pictures.

Another cue that may evoke emotional autobiographical memories is music, which carries emotional content. Virtually every culture in the world uses music as a form of communication or entertainment, in part because of the affective content and emotional responses it elicits (Roe, 1985). Both instrumental music and lyrics can alter mood, although at times positive music paired with sad lyrics can lead to negative emotions (Stratton and Zalanowski, 1994). Music thus relates to many of the emotional events that individuals can experience. From a young age, children learn information through songs. In particular, songs that contain repeating refrains combined with verses of new information are passed down through generations, and the repeating melody acts as a memory aid to the words themselves (Rubin, 1995). Through such songs, children in all cultures learn important information before they begin formal education, and the memories last long enough to be passed down to the next generation.

The memory for specific elements of songs has been investigated. Bartlett and Snelus (1980) examined the memory for songs in participants who were aged 37–76. Participants were asked to assess the year of popularity for the song and give their estimate of the last time they had heard the song. The results showed that judgments

of time for both questions were accurate and relied partially on the participants' autobiographical memories.

However, little research has been conducted using popular music as a cue for autobiographical memory recall, even though the personal experiences of many people attest to the power of songs in eliciting these memories. Schulkind et al. (1999) examined this link in part of their research on the connection between music, emotions and memories. College students and older adults heard very short clips of songs from the years 1935–94. The clips did not contain the title or chorus of the song. Participants were asked several questions relating to their familiarity with, and knowledge of, the song, including title, performer and year of popularity. They were also asked for more subjective ratings, such as whether they liked the song and whether it made them feel happy. Finally, the participants were asked if the song brought to mind an event or time period from their lives. Results showed that higher emotionality ratings of a song facilitated more autobiographical recall in both groups, although the college students remembered more particular events and the older adults recalled more broad eras of time from their lives.

Music has shown a facilitative effect on autobiographical recall in certain populations. Foster and Valentine (2001) presented adults with moderate dementia with 30 questions relating to their autobiographical memories. Participants recalled memories from earlier in their lives better than more recent memories. Recall for all participants was better when there was some type of background sound (familiar music, novel music or cafeteria noise) than when it was quiet. In addition, retrieval was better in either of the music conditions than the cafeteria noise. This suggests that hearing music can increase arousal, leading to better recall, or that the music uses processing resources different from the resources needed to answer the autobiographical questions (Foster and Valentine, 2001).

Music may increase or produce emotions in the listener (Scherer and Zentner, 2001), which may also improve the cue's ability to elicit memories. When autobiographical memories are recalled, the person may feel similar emotions to those felt at the actual event. Music leads to this emotional recall in part because humans seem to respond reflexively to music rather than after conscious thought about it or associations with other stimuli. In addition, most individuals have extensive and lifelong experience hearing music as part of both everyday life and special events (Scherer and Zentner, 2001). Thus, music can evoke emotions due to either associations with personal events or through the intrinsic emotional nature of the music itself (Krumhansl, 2002).

Present study

Although past research has examined the effects of both cue modality and presence of music on autobiographical memories, little research has combined the two in ways similar to studies of odors and autobiographical memory (e.g. Herz and Schooler, 2002). A question remains as to whether hearing a song, as opposed to reading the lyrics, looking at the artist or only seeing the title, would result in stronger memories. Thus, the present study focused on using popular music to cue autobiographical memories in young-adult college participants, who were placed in one of four conditions. The conditions of auditory, visual picture, visual lyrics and control (no stimulus) were

chosen to better examine the differences between cue modality. All groups saw five lists of songs corresponding to five lifetime eras and were instructed to choose the song that had the strongest positive memory associated with it. Participants in one of the sensory conditions experienced the stimulus for one minute, then described their memory and rated it on dimensions such as vividness, specificity, feeling brought back to the moment and emotionality. Although all participants recalled their memories in response to the written title of the song, it was hypothesized that those who heard a minute of the song would rate their memories as more specific, vivid and emotional than those in the other groups, because the music would increase arousal (Foster and Valentine, 2001) and emotions (Krumhansl, 2002; Scherer and Zentner, 2001) while they were thinking of their memory prior to describing and rating it.

The current study presented participants with lifetime eras from which to recall an autobiographical memory. Although lifetime periods and lifetime eras are similar, periods can overlap because they occur on more than one dimension. For example, 'working at the restaurant' and 'college years' could overlap because working experience could occur during some, but not all, of one's college years. On the other hand, the eras presented in the current study involved only the dimension of school years, so they cannot overlap. The second hypothesis predicted that ratings for the memories from more recent lifetime eras would be higher than ratings for more remote lifetime eras. This hypothesis followed from both the macrostructure of autobiographical memory (Conway and Pleydell-Pearce, 2000), specifically that people recall recent memories more easily than distant memories, and from the findings of Rubin and Schulkind (1997) showing that college students retrieve memories from the recent past better than older memories.

Method

PARTICIPANTS

One hundred and twenty-four young adult undergraduate students at a large Midwestern US university were the participants. They were randomly assigned to one of the four conditions of control, visual lyrics, visual picture or auditory. There were 16 women and 15 men in the control condition, and the other three conditions each contained 15 women and 16 men. Participants were recruited for a study on 'Music as a Cue for Autobiographical Memories' during the spring semester of 2003. The participants were required to have grown up in the USA to maximize the possibility that they had been exposed to the songs. In addition, since certain songs from certain lifetime eras were the stimuli, all but four participants were between the ages of 18 and 22, with a mean age of 19.34 years.

PROCEDURE

Songs were chosen based on a pilot study done in autumn 2001 in which college students named one song from each of five different eras of their lives (early childhood, grade school, middle school, high school and college) and then retrieved memories associated with each song. There were no limitations on the genre of song the participants could name. The songs for the present study were the most frequently picked songs from each era from that pilot study. Each era had a list of between five and 10

songs associated with it. The songs are presented in the Appendix. While most of the songs were popular during the time of the participants' lifetime eras, some songs were popular long before the participants reached those ages. In the latter case, certain songs elicited some common memories. For example, songs of this type from early childhood (e.g. 'American Pie') were generally associated with parents, while songs from high school were associated with dances (e.g. 'Stairway to Heaven') or sports (e.g. 'Eye of the Tiger', 'We Are the Champions'). Although the songs were not released at times that coincided with these participants' lifetime eras, they were chosen with a high enough frequency to warrant inclusion in the present study.

The participants were all tested individually, except for 22 control participants who were tested in groups of between two and six. First, the participant filled out a preliminary mood assessment survey (PANAS; Watson et al., 1988). The PANAS measures both positive and negative affect using 10 adjectives associated with each affect valence. Participants indicated on a scale of 1 (very slightly or not at all) to 5 (extremely) how much of each emotion they felt. The participant was then shown the list of the songs from the early childhood era, instructed to choose the song with the strongest positive memory associated with it, and given as much time as they needed to think of a memory. Participants in a sensory condition were then exposed to a minute of the stimulus, and then all participants filled out a questionnaire in relation to the song and memory. If participants could not remember any of the songs in the list, they were asked to think of a different song and a memory and to fill out the questionnaire using that information.

Participants were randomly assigned to one of the four conditions, although the questionnaire for each condition was the same. In the control condition, only the title of the song was shown prior to participants filling out a questionnaire. The auditory condition consisted of one minute of the chosen song played on a CD. One minute from each song was chosen so the samples contained as many lyrics as possible. Most selections contained the chorus or the title of the song. The visual lyrics condition consisted of the lyrics typed on one page in Times New Roman 10- or 12-point font, and participants were instructed to look at the lyrics for one minute. The picture condition consisted of a picture of the album cover and a separate picture of the artist or group if not shown on the cover. Participants were instructed to study the picture for one minute. The pictures were shown on a computer monitor in order to maintain size consistency of the stimuli. The song, lyric or picture was removed prior to the participants filling out a questionnaire regarding their memory.

First, participants were asked to write about that memory in as much detail as possible until they had no more to add to the description. There was no time limit for the description, and participants had approximately 2 inches of space in which to describe their memories. They then indicated on a scale of 1 (not very vivid) to 5 (very vivid) how vivid the memory was. They then stated how specifically they remembered the memory, on a scale from 1 (recall specific incident) to 5 (recall vague association) and whether the memory was pleasant or unpleasant (1 = very unpleasant to 5 = very pleasant). The next question asked the participants to indicate the predominant emotion (happiness, anger, sadness, love, hate, fear, surprise or disgust) connected with the memory, and the following question asked for a description of how strong the emotions connected with the memory were (1 = very weak to 5 = very strong).

The participants then answered, 'To what degree do you feel "brought back" to the time the memory occurred' on a scale from 1 (not very brought back) to 5 (very brought back). They also stated how emotional they felt at the moment in connection with the memory (1 = not very emotional to 5 = very emotional). The next question asked the participants 'How quickly did this memory "pop into" your mind when you saw the name of the song' (1 = took a while to 5 = very quickly). The participants indicated the predominant social context of the memory by circling one of the following choices: family, friends, school, boy/girlfriend, sports or solo. The participants also indicated on a scale of 1 (very little/not at all) to 5 (a lot), 'To what degree did you "hear" the song in your head as you filled out the questionnaire?' The final question asked the participants how much they liked the song, on a scale from 1 (not at all) to 5 (a lot).

Following this, the participants saw the list of the songs from the grade school era. Once they could recall a personal memory relating to one of the songs, they completed another questionnaire identical to the first. This process was then repeated for the songs from middle school, high school and college. The songs are presented in the Appendix. Each participant received the same sensory condition for all five songs and recalled all five lifetime eras in the same order. Lifetime eras were not counterbalanced because recalling temporally ordered events is easier when the cues are presented in the same order as the events (Anderson and Conway, 1997). Following the completion of the final questionnaire for the college era, the participants filled out the PANAS mood assessment survey again, followed by a suspiciousness questionnaire to ensure that they answered all the questions honestly.

Results

The data were first examined for missing data points. Overall, four participants did not fill out one of the five music questionnaires. Of these, two did not complete the middle school era page and two did not complete the college era page. All four were female, and in each lifetime era one lyrics and one picture condition had a missing response. However, since the missing data were only 3.2 percent of the total participants, they were not replaced, and instead the ratings from those pages not completed were excluded from the analyses. The remaining data from those participants were included in analyses.

Prior to further analysis, the control group was examined to determine if differences existed between the 22 tested as a group and the nine tested individually. A one-way (testing environment – group or alone) MANOVA was conducted with the questions on the music questionnaires as dependent variables. The results were not significant, Wilks' $\Lambda = .01$, $F(1, 29) = 2.47$, NS, indicating that the testing environment did not affect the responses of the participants in the control group. Thus all 31 control participants were considered as a group in further analyses.

The PANAS scores were analyzed to determine whether the participants experienced a change in affect during the experiment. Overall, the positive affect of the participants was unchanged, and this pattern held for each of the conditions. The mean positive affect score for all participants was 2.74 out of a possible 5 (SD = 0.73) before the experiment and 2.78 (SD = 0.74) after the experiment.

The negative affect means for all participants were 1.34 (SD = 0.38) before the experiment and 1.25 (SD = 0.35) after the experiment. The negative affect of participants decreased, and the paired *t*-test results were significant, $t(123) = 2.78, p < .05$, although this difference occurred in only two of the four groups and was small in magnitude. Those in the auditory condition also had a significant decrease in negative affect ($t(30) = 3.17, p < .05$) as did those in the picture condition ($t(30) = 2.25, p < .05$), while the lyrics and control groups showed no change.

For each of the questions regarding the ratings of the memories, the means and standard deviations for the sensory condition and gender variables are presented in Table 1 and means and standard deviations for the lifetime era are presented in Table 2. All ratings questions were analyzed with a 2 (Gender) × 4 (Condition: Auditory, Visual Lyrics, Visual Picture, Control) × 5 (Lifetime Era) mixed-design ANOVA. With significant Lifetime Era main effects, follow-up paired *t*-tests with Bonferroni corrections were conducted, while with significant Condition main effects Tukey tests were completed. Gender was included as a variable because women perform better than men on some tests of autobiographical memory (Davis, 1999; Pohl et al., 2005).

For the question 'To what degree did you "hear" the song in your head as you filled out the questionnaire?', the Lifetime Era × Condition × Gender interaction was significant ($F(12, 289) = 1.97, p < .05$, partial $\eta^2 = 0.07$). The post-hoc tests revealed that none of the comparisons met the Bonferroni adjusted criteria of .005. However, no other effects or interactions were significant for this question, indicating that participants in all four conditions were able to form similar representations of the songs. The means and standard deviations for 'hearing' the song are presented in Table 1.

RATINGS FOR ORIGINAL MEMORIES

Lifetime era was significant for the 'How pleasant was this memory?' question, $F(4, 109) = 9.82, p < .05$, partial $\eta^2 = 0.27$. Post-hoc tests with Bonferroni corrections showed differences between early childhood and middle school ($t(121) = 4.60, p < .005$), between early childhood and high school ($t(123) = 4.18, p < .005$), and between early childhood and college ($t(121) = 5.23, p < .005$). There was also a difference between grade school and college, $t(121) = 3.53, p < .005$. This indicates that memories recalled from early childhood and grade school were remembered as more pleasant than memories recalled from late adolescence. However, the condition and gender main effects for the pleasantness rating were not significant ($F(3, 112) = .17, p > .05$ and $F(1, 112) = .82, p > .05$, respectively), indicating that the memories chosen across the conditions did not differ in their pleasantness and that women and men chose comparably pleasant memories.

There was a decrease in positive emotions in the memories chosen from early childhood to college, as seen in the predominant emotion chosen for the memories, although the type of emotion connected to the original memories did not vary much. Overall, 'happiness' was the most common emotion chosen¹ in all five lifetime eras, and positive emotions were dominant in 78 percent of the memories, with the two earliest lifetime eras somewhat higher in happiness than the last two eras. This does indicate that participants were choosing happy and pleasant memories, but the instructions were to think of a positive memory so this may indicate that the participants were following directions. The frequencies for the emotion types are presented in Table 3.

TABLE 1 Means and standard deviations for sensory condition and gender for memory ratings*

	Auditory		Lyrics		Picture		Control		Male		Female	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Pleasant	3.98	0.61	3.99	0.65	3.93	0.65	3.89	0.61	4.00	0.63	3.89	0.60
Emotion then	3.50	0.56	3.58	0.59	3.37	0.59	3.63	0.56	3.39	0.56	3.65	0.60
Quickly to mind	3.91	0.61	4.18	0.59	3.86	0.59	4.12	0.61	3.96	0.56	4.08	0.60
Vivid	4.15	0.56	4.12	0.59	3.84	0.59	3.94	0.56	3.95	0.56	4.07	0.60
Specific	3.93	0.56	4.10	0.59	3.78	0.59	3.88	0.56	3.87	0.56	3.98	0.60
Brought back	3.95	0.56	4.05	0.59	3.38	0.59	3.85	0.56	3.73	0.56	3.88	0.60
Emotion now	2.97	0.72	3.12	0.70	2.67	0.70	3.13	0.72	2.67	0.71	3.28	0.75
'Hear' Song in head	3.94	0.78	4.33	0.75	3.96	0.75	4.05	0.78	3.94	0.79	4.20	0.75
Word count	30.89	12.92	33.49	12.71	27.44	12.98	24.28	12.92	26.48	12.94	31.57	12.83

* On a scale of 1 = not very to 5 = very, except for word count

TABLE 2 Means and standard deviations for lifetime era for memory ratings*

	Early		Grade		Middle		High		College	
	M	SD	M	SD	M	SD	M	SD	M	SD
Pleasant	4.39	0.88	4.12	0.92	3.77	1.07	3.84	1.26	3.66	1.40
Emotions then	3.41	0.85	3.12	1.07	3.39	1.03	3.91	1.20	3.73	1.14
Quickly to mind	4.02	1.08	4.14	1.07	3.75	1.27	4.25	1.08	3.91	1.23
Vividness	3.70	1.01	3.94	0.93	3.88	1.02	4.21	1.04	4.31	0.99
Specificity	3.49	0.98	3.77	1.09	3.75	1.05	4.27	0.99	4.29	0.99
Brought back	3.59	1.01	3.88	1.06	3.57	1.12	4.12	1.07	3.84	1.14
Emotions now	2.84	1.02	2.77	1.14	2.82	1.21	3.32	1.19	3.11	1.25
Word count	27.19	14.39	29.53	13.96	28.39	15.21	28.76	15.39	29.79	17.99

* On a scale of 1 = not very to 5 = very, except for word count

TABLE 3 *Frequencies of type of emotions selected to describe memories*

	Early		Grade		Middle		High		College		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Positive	117	94.4	111	89.5	86	62.9	83	66.9	89	71.8	486	78.4
Happiness	100	80.6	100	80.6	68	54.8	68	54.8	71	57.3	407	65.7
Love	14	11.3	5	4.0	10	8.1	12	9.7	14	11.3	55	8.9
Surprise	3	2.4	6	4.0	8	6.5	3	2.4	4	3.2	24	3.9
Negative	7	5.6	13	10.5	36	29.0	41	33.1	33	26.6	130	21.0
Anger	1	0.8	3	2.4	3	2.4	6	4.8	7	5.6	20	3.2
Sadness	3	2.4	3	2.4	19	15.3	27	21.8	15	12.1	67	10.8
Hate	0	0.0	0	0.0	1	0.8	1	0.8	5	4.0	7	1.1
Fear	1	0.8	2	1.6	8	6.5	1	0.8	0	0.0	12	1.9
Disgust	2	1.6	5	4.0	5	4.0	6	4.8	6	4.8	24	3.9

The memories were also equivalent in their remembered emotionality at the time of occurrence for participants in all conditions, $F(3, 112) = 1.11, p > .05$. However, for the same question, the lifetime era main effect was significant, $F(4, 109) = 12.73, p < .05$, partial $\eta^2 = 0.32$. Post-hoc tests showed that college memories were more emotional at the time of the event than grade school memories ($t(121) = -4.67, p < .005$) and that high school memories were more emotional at the time than early childhood memories ($t(123) = -4.12, p < .005$), than grade school memories ($t(123) = -5.67, p < .005$), and than middle school memories ($t(121) = -4.46, p < .005$). The means for this question are presented in Table 1.

For the question 'How quickly did the memory "pop into" your mind when you saw the name of the song?', the lifetime era main effect was significant, $F(4, 109) = 2.77, p < .05$, partial $\eta^2 = 0.09$. Follow-up analyses indicated that memories from high school came to the minds of participants more quickly than memories from middle school, $t(121) = -3.20, p < .005$. There were no differences between sensory condition groups or genders on this question.

The contexts of the memories were also compared across gender and lifetime era. In early childhood, over half of the participants (60.5%) chose a memory related to family. However, for the other four lifetime eras, the most frequently chosen context was friends, with 48.4 percent of participants choosing friend-related memories for grade school, 44.4 percent choosing them for middle school, 41.9 percent choosing them for high school, and 49.2 percent choosing them for college. As the lifetime era became more recent, the number of participants choosing family-related memories decreased and those choosing boy/girlfriend memories increased. The only gender difference was in middle school, with more females choosing family-related memories (31.1% as compared to 9.5%) and males choosing more friend-related memories than expected (55.6% as compared to 32.8%). The χ^2 was significant for this era ($\chi^2(5) = 17.30, p < .05$).

In addition, participants liked the songs from more recent lifetime eras more than those from earlier eras. The lifetime era main effect was significant ($F(4, 109) = 10.60, p < .05$), and post-hoc tests revealed that the songs from high school were liked more than those from early childhood ($t(123) = -4.84, p < .005$), from grade school ($t(123) = -5.70, p < .005$), and from middle school ($t(121) = -3.54, p < .005$). In

addition, the songs from college were liked more than those from early childhood ($t(121) = -4.03, p < .005$) and from grade school ($t(121) = -4.99, p < .005$). To examine the relationship between the participants' attitudes towards the songs and their ratings of the memories, ratings of liking the songs were correlated with ratings of memory vividness, specificity and feeling brought back to the moment. Liking the song from grade school was not correlated with any of the memory measures, although some correlations from other lifetime eras were modest but significant. This indicates that liking the song is not a proxy for the other measures, so lifetime era differences cannot be attributed solely to the differences in liking the songs. These results are presented in Table 4.

RATINGS FOR STRENGTH OF MEMORIES

For the number of words written in the open-ended descriptions of the memory, there was a main effect of condition ($F(3, 116) = 2.95, p < .05$, partial $\eta^2 = .07$) and of gender ($F(1, 116) = 4.68, p < .05$, partial $\eta^2 = 0.04$). Females wrote an average of 31.57 words, while males wrote an average of only 26.48 words. A Tukey post-hoc test conducted on the condition variable showed that those in the lyrics condition wrote significantly more words than those in the control condition, although there were no other significant differences. Figure 1 shows the means of the word counts for participants in different conditions and of different genders.

For the question 'How vivid is this memory?', the lifetime era variable was significant, $F(4, 109) = 7.18, p < .05$, partial $\eta^2 = 0.21$. Several of the post-hoc comparisons were significant at the .005 level. Specifically, the college era produced more vivid memories than the early childhood era ($t(121) = -4.75, p < .005$), than the grade school era ($t(121) = -3.41, p < .005$), and than the middle school era ($t(119) = -3.46, p < .005$). In addition, the high school era produced higher vividness ratings than the early childhood era ($t(123) = -4.56, p < .005$) and the middle school era ($t(121) = -2.84, p < .005$). However, there was no main effect for either gender or sensory condition for this question. The means for the vividness of the memories are presented in Table 2.

Similarly, the lifetime era main effect was significant for the question 'How specifically do you remember this memory?' ($F(4, 109) = 15.46, p < .05$, partial $\eta^2 = 0.36$). In this case, post-hoc tests using a Bonferroni correction revealed that the high school and college memories were more specific than those of other eras. Specifically, the high school era memories were more specific than those from early childhood

TABLE 4 *Correlations between liking the song and memory strength ratings*

		Memory		
		Vividness	Specificity	Feeling brought back
Like song	Early childhood	0.18*	0.23*	0.28*
	Grade school	0.17	0.13	0.14
	Middle school	0.28*	0.35*	0.19*
	High school	0.31*	0.17	0.18*
	College	0.29*	0.21*	0.17

* $p < .05$

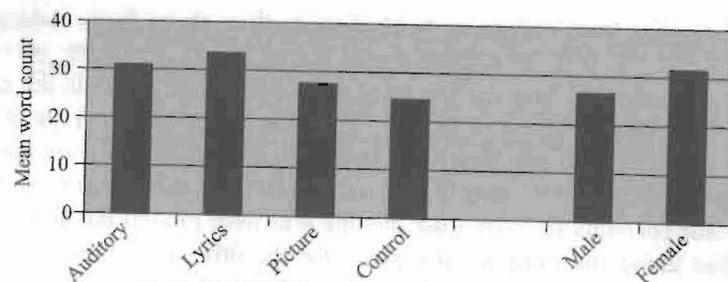


FIGURE 1 Means for word count for auditory, lyrics, picture, and control conditions and males and females.

($t(123) = -6.81, p < .005$), from grade school ($t(123) = -4.25, p < .005$), and from middle school ($t(121) = -4.14, p < .005$). In addition, the college memories were more specific than the early childhood memories ($t(121) = -6.26, p < .005$), the grade school memories ($t(121) = -4.41, p < .005$), and the middle school memories ($t(119) = -4.27, p < .005$). However, this question also did not have significant main effects for condition or gender. The means for this question are presented in Table 2.

For the question 'To what degree do you feel "brought back" to the time the memory occurred?', the lifetime era effect was significant, $F(4, 109) = 6.03, p < .05$, partial $\eta^2 = 0.18$. Post-hoc tests revealed differences between high school and early childhood ($t(123) = -4.29, p < .005$) and between high school and middle school ($t(121) = -4.28, p < .005$). This indicates that participants felt more brought back to high school memories than to either early childhood or middle school memories. In addition, the condition main effect was significant, $F(3, 112) = 7.97, p < .05$, with a partial η^2 of 0.18. A Tukey post-hoc test showed that those participants in the picture condition felt significantly less brought back than those in any other condition. Figure 2 shows the mean scores for vividness, specificity, and the feeling of being brought back for the memories from each lifetime era.

For the question 'How emotional do you feel right now in connection with this memory?', the lifetime era was also significant, $F(4, 109) = 6.98, p < .05$. The partial η^2 for this effect was 0.20. Post-hoc tests revealed significant differences between high school and early childhood ($t(123) = -4.15, p < .005$), grade school ($t(123) = -4.26, p < .005$), and middle school ($t(121) = -4.16, p < .005$). This indicates that recalling high school memories leads to more emotions than recalling memories from earlier in life. In addition, for this question the condition and gender main effects were significant. For condition, $F(3, 112) = 2.63, p < .05$ and for gender, $F(1, 112) = 21.34, p < .05$. The partial η^2 for these effects were 0.07 and 0.16, respectively. This indicates that women had stronger emotions while thinking of their memories than men did. A Tukey post-hoc test on the condition main effect showed that the control condition produced more emotionality than the picture condition, but there were no significant differences between any of the other conditions.

For each lifetime era, the remembered strength of the emotion at the time of the event and the strength of the emotion at the time of the experiment were positively correlated, indicating that memory of emotions and current emotions are related. These correlations also held when covarying out the positive and negative affect scores on the first PANAS questionnaire. The correlations are presented in Table 5. In

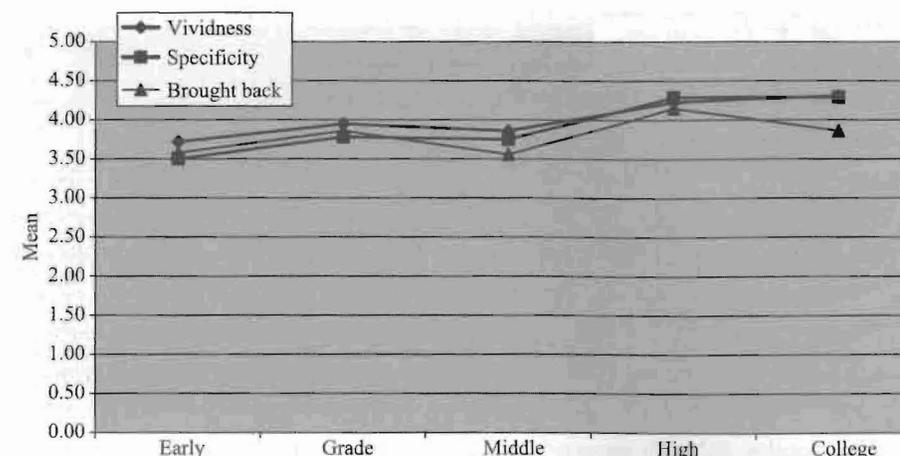


FIGURE 2 Means for the vividness, specificity, and feeling brought back for memories in five lifetime

TABLE 5 Correlations between emotions at time of event and emotions now

	Full	Partial ⁺
Early	0.46*	0.46*
Grade	0.72*	0.70*
Middle	0.60*	0.61*
High	0.78*	0.77*
College	0.80*	0.80*

* $p < .05$; ⁺controlling for positive and negative affect before the experiment

addition, Figure 3 shows the constant difference across all lifetime eras in the relationship between emotions at the time and emotions now.

Discussion

The present study examined the effects of differences in cue and memory aid modality on autobiographical memories elicited by popular song titles. Although the auditory condition in this study had been predicted to produce more emotionality in the memories than all other conditions due to the emotional nature of music (Krumhansl, 2002; Scherer and Zentner, 2001), there were no differences in the emotion strength during the experiment across the conditions, except that the control condition produced significantly stronger emotions than the picture condition. However, the auditory condition did produce more feelings of being brought back than the picture condition did, although the lyrics and control conditions also produced significant differences from the picture condition on that rating.

There are several possible reasons for these results, and any combination of them may have contributed to the effects. All participants 'heard' the song in their heads equally and were tested in an environment without any other music, indicating that the title was enough to produce an internal representation of the song. Participants in the lyrics condition had more interaction with the lyrics, because they were allowed

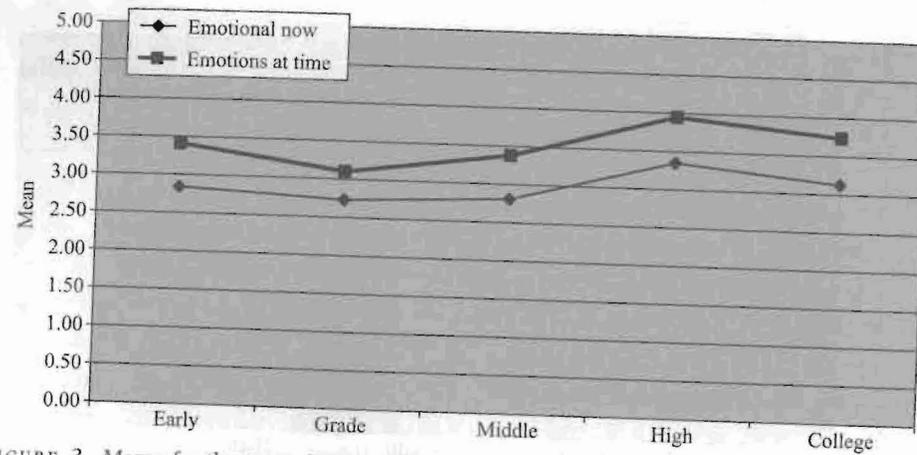


FIGURE 3 Means for the strength of emotions for memories in five lifetime eras.

to finish reading them in one minute if they could. However, those in the auditory condition heard only one minute of the lyrics, which generally did not include all of the lyrics. The participants in the control condition were also allowed to complete the questionnaire immediately after seeing the title of the song, so the internal representation of both the song and the memory may have been strong throughout the task. This may account for the lack of differences between these three conditions.

Related to this, the picture condition may have actually interfered with the participants' memory. While the lyrics and auditory conditions experienced a minute of the actual song, and the control condition was allowed to begin completing the questionnaire immediately, the picture condition required the participant to look at a computer screen showing a picture of the cover of the album on which the song was originally released. This could have interfered with the participant's emotions and memory by serving as an irritating distractor task, because the participant may have been unfamiliar with the artist or album. The participants were asked to look at the picture for a minute but were not forced to do so, and may have let their mind wander away from their memory during that minute, although they kept the representation of the song in their heads.

The ratings of the memories also may have been similar across conditions because of the nature of the task. As Berntsen and Hall (2004) explain, consciously recalled memories like those in the present study are more general and schematic than memories recalled to an environmental cue without conscious effort. This would suggest that participants hearing a song would retrieve an involuntary memory, so had the participants in the auditory condition retrieved their memories without being instructed to do so, they may have rated them as more vivid than those in the other conditions.

Overall, the participants in this study remembered specific events in some detail, which is consistent with existing models of autobiographical memory that include links between lifetime periods, general events and event-specific knowledge (e.g. Conway and Pleydell-Pearce, 2000). According to their model, memory recall most often progresses from general to specific, which occurred in the present study as participants recalled details of memories cued with a lifetime era. The mean results for the vividness, specificity

and feeling brought back were all above 3 on a five-point scale, although more recent memories had higher scores on all three ratings than older memories did.

Consistent with the second hypothesis, the memories and patterns of recall followed the model of Rubin and Schulkind (1997). According to their proposed retention function, college students remembered the previous 10 years more completely than events from prior years. Participants in the present study rated their memories from college as more vivid and more specific than those from early childhood, grade school and middle school. The high school memories were also more vivid and specific than those from early childhood and middle school and more specific than those from grade school, although there was no significant difference between the high school and grade school memories in vividness. In addition, recalling high school memories caused participants to feel more brought back and more emotional than recalling events from early lifetime eras. Although there were significant differences for the emotion strength during the experiment between the high school and all the earlier eras, again there was no significant difference for feeling brought back between high school and grade school. Overall, participants rated more recent memories as stronger, consistent with the retention function (Rubin and Schulkind, 1997).

Although the middle school era had the fewest songs on the list (with five), the lifetime era differences are likely not related to increased choices provided on the high school era (seven songs) or college era (10 songs), because overall very few participants could not recall a memory associated with one of the songs on any one list. In fact, two participants did not complete the middle school questionnaire and another two did not complete the college questionnaire, although all other lifetime eras were completed. In addition, although participants liked more recent songs better, liking the song was not consistently related to the strength of the memory except in early childhood and middle school (Table 4). Liking the more recent songs better may also be a function of aging, because adolescents begin to control their choice in music during middle school (Christenson and Roberts, 1998), and popular music continues to influence social activities throughout high school and college. However, the inclusion of songs that were not released during the participants' appropriate lifetime eras (e.g. 'Eye of the Tiger' in the high school era) suggests further research. Perhaps limiting the songs to those released in the given lifetime eras would affect the strength of the associations between songs, lifetime eras and memory, as the participants would presumably hear the song much more frequently at the time of release than later. Future studies in this area should address the incongruity between participant lifetime era and song release date.

The strength of the memories in the different conditions was also analyzed using the written descriptions. The memory descriptions were analyzed for word count to determine whether certain sensory conditions lead to more prolific writing, with number of words in the descriptions used as a measure of detail of the memories. Participants in all conditions wrote moderately long descriptions given the small space provided, as indicated by the mean word count results ranging from an average of 24 to 33 words across conditions. The only significant difference between sensory conditions was that between lyrics and control, with those in the lyrics condition using significantly more words in their descriptions than those in the control group did. This was not due to the participants actually writing the lyrics, as all memory descriptions were of the memories themselves and not merely rewriting the song.

However, there were no significant differences between the lyrics and either the auditory or the picture conditions, although the lyrics condition had the highest mean word count. There are several possible reasons for these results. One could be that reading may have a priming effect on verbal production, so seeing many words on a page (as in the lyrics condition) before writing may influence the participant to write more words. Another explanation for the results could stem from the fact that participants may have looked directly at the lyrics longer than they looked at the picture, even though both were available for one minute. Modality specificity is a third reason. Although the participants experienced the lyrics in both the auditory and lyrics condition, they were asked to respond in the same modality (writing) in which they had received the lyrics.

According to Levine and Safer (2002), most people accurately recall emotions that are associated with events. Although the present study has no way to verify that the strength of emotion at the time of the event was correctly indicated in the experiment, overall participants did experience a strength of emotion while thinking of the memory that was similar to their emotional strength at the time. Figure 3 shows the relationship between emotions at the time of the event and emotions while completing the questionnaires. Although the curves are almost parallel, the ratings for the strength of emotions now are consistently lower for each era than those for remembered strength of emotions at the time. However, because the questions were only two items apart on the questionnaire, it is possible that these results assessing the current emotion merely reflect a response bias from the participants. If this were the case, the estimated strength of emotions at the time of the event (the first of these two questions to be completed) would be accurate even with a response bias on the strength of emotions during the experiment. In addition, because the emotional state of a person at the time of recall may affect memory for emotions (Levine and Safer, 2002), there is no way of knowing whether this correlation indicates that the current emotions are a result of the memory or contributed to the choice of the memory. However, the partial correlations that show similar correlations with and without pre-experiment PANAS scores (Table 5) indicate that the mood of the participants did not affect their memories of their emotions.

The valence of the memories is shown in the frequencies of each emotion type for each of the questions, although this result could also be the product of the instructions to the participants. Participants were instructed in each lifetime era to 'choose the song with the strongest positive memory associated with it'. Happiness was the most common emotion chosen in each lifetime era, although as the participants progressed to later memories, the proportion of happy memories decreased and that of sad memories increased. Table 3 shows the change in the valence of the emotions across the lifetime eras.

These results are consistent with the pleasantness ratings for the different lifetime eras, as the early childhood pleasantness rating was significantly higher than the ratings for middle school, high school and college, although there was no significant difference between early childhood and grade school using Bonferroni alpha corrections. In addition, there was a significant difference between grade school and college using the correction. Taken together, the memory emotion content and pleasantness ratings show that college students tended to remember pleasant memories from their childhoods, and memories from later periods in their lives were recalled as significantly less

pleasant. Since the participants did not have a change in positive affect during the experiment, and overall their negative affect scores decreased, this seems contrary to Bower (1981). In other words, the participants overall were in a positive mood throughout the experiment, but chose less positive memories from the more recent eras. This may indicate that their mood did not match their recall of emotions and was not a strong determinant of the choice of memory selected. However, overall the memories were rated as above the midpoint on the pleasantness scale, consistent with the instructions to recall the strongest positive memory associated with one of the songs.

Because the accuracy of the memories cannot be verified, there is no way to examine whether the participants had happier childhoods than later periods in their lives or if they were exhibiting a memory bias towards remembering happy memories from childhood. However, negative emotions associated with autobiographical memories diminish more quickly than autobiographical memory-related positive emotions (Skowronski and Walker, 2004; Walker et al., 2003), possibly because telling others about an emotional memory prolongs positive affect but reduces negative affect. Although individuals believe they discuss positive and negative events at approximately the same rate, other studies show that people believe that they experience twice as many positive events as negative events (Skowronski and Walker, 2004). Research suggests that individuals remember approximately twice as many positive as negative events, and the corresponding emotions related to those memories decrease at different rates, leading to a bias towards positive memories (Walker, et al., 2003). Thus, individuals may recall fewer negative emotions associated with events from the lifetime eras in the distant past, whereas negative emotions associated with more recent events have not lessened and are thus recalled more easily. Thus, these results are consistent with past studies of emotion and autobiographical memory.

The results indicated that almost all of the participants were familiar with a small list of songs and were able to relate them to autobiographical memories. Out of 620 music questionnaires, only four (0.65%) were not completed and analyzed, and one of those participants had chosen another song for one lifetime era. This seems to indicate that the participants found this to be an easy task, even when given the songs rather than choosing them. Most studies that cue autobiographical memories find that the participants recall valid and reliable memories with relative ease (Rubin et al., 1986), so this indicates that music is an effective cue for autobiographical memory. The participants 'heard' the song in their heads regardless of whether they actually heard it or not, so cueing autobiographical memory may be possible using only the title of a popular song.

In conclusion, the first hypothesis, that hearing the song would provoke more vivid and specific memories, more feelings of being back in the moment of the memory and more emotions, was not supported. This contrasts with some results (e.g. Herz and Schooler, 2002) of analogous studies using olfaction and autobiographical memory. On the other hand, the present findings are consistent with Goddard et al. (2005), who found no increase in specificity or vividness of memories with an actual odor compared to a word or picture.

However, the second hypothesis, that the same ratings would be higher for more recent lifetime eras, was supported. In general, memories from college and high school were rated higher on the scales than memories from middle school or earlier.

The memories followed a retention function, since they were strongest for the most recent 10 years in the participants' lives. In this way, the results are consistent with those of Rubin and Schulkind (1997) and Conway and Pleydell-Pearce (2000).

Although this study supports models of autobiographical memory (i.e. Conway and Pleydell-Pearce, 2000; Rubin and Schulkind, 1997), several limitations must be noted. First, there is no way of verifying that the event occurred and that the memory of it is veridical. Recall of details often has been shown to be incorrect when compared to the actual event even though the overall theme of the memory is correct (Neisser, 1981). However, the focus of this study is on the memories of the participants, and it is their recollection of the event and its association with the song that affects them, so whether or not they remember the events exactly as they happened is a lesser concern. The participants knew that the event occurred, remembered the overall theme of the event and know how it affected them personally, and these qualities may be the most important for autobiographical recall (Skowronski and Walker, 2004). Since the present study was concerned with the differences in memory ratings from different lifetime eras and across different conditions, it assumes similar rates of decay across all participants, and thus the memory ratings can be reliably compared.

Another limitation concerns the order of the lifetime era cues. Participants were provided with the song title cues in order from most distant to most recent lifetime era because it was assumed that the order would allow participants to easily judge the time frames of their memories and thus be able to complete the task. In addition, individuals recall ordered events better when cued in the same order (Anderson and Conway, 1997). However, counterbalancing lifetime era presentation might have allowed for better conclusions to be drawn, especially concerning the recency effect of the memory retrieval (Rubin and Schulkind, 1997). The memories were stronger for the more recent lifetime eras, but without counterbalancing, it is impossible to know whether the participants were recalling stronger memories or whether they were improving their performance through practice on the task. However, given the robustness of the findings of the patterns of autobiographical memory retrieval for college students (e.g. Conway and Pleydell-Pearce, 2000; Rubin and Schulkind, 1997), there is no reason to suspect that the pattern of results found in the present study differs from prior research.

Overall, the present study showed differences between the ratings for the memories chosen for different lifetime eras. There were also some differences between the ratings for the memories across the sensory conditions, and several other important points emerge. First, the results from the lifetime era analyses show that music can evoke autobiographical memories in much the same way as other cues. Second, it may be sufficient to cue these memories using only the title or at most the written lyrics of the song, as shown by the similarities in ratings between all the conditions. Finally, almost universally, the participants were able to choose a memory related to one of the songs. These results indicate that this procedure, or one involving only the title or lyrics of the song, could be used to examine autobiographical memory in participants in other age groups or special populations as well as college students.

NOTE

1. Participants were asked to choose from the following list of emotions: happiness, anger, sadness, love, hate, fear, surprise and disgust.

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Appendix: Percentage of songs chosen in each lifetime era*

	%	Start
Early Childhood		
'ABC Song' - Big Bird	8.9	
'Sesame Street' - Cast	25.0	
'Itsy Bitsy Spider' - Male singer	15.3	
'Happy Birthday' - Male singer	18.5	
'Wheels on the Bus' - Group	9.7	
'American Pie' - Don McLean	10.5	
'Beat It' - Michael Jackson	12.1	
Grade School		
'Ice Ice Baby' - Vanilla Ice	25.8	
'Hanging Tough' - New Kids	7.0	
'Thunder Rolls' - Garth Brooks	13.7	
'The Sign' - Ace of Base	17.7	
'Baby Got Back' - Sir Mix-A-Lot	12.1	
'To Be With You' - Mr Big	3.2	
'Achy Breaky Heart' - Billy Ray Cyrus	16.9	
'Rump Shaker' - Wreckz N Effect	3.2	
Middle School		
'Tha Crossroads' - Bone Thugs	14.5	
'It's So Hard' - Boys II Men	13.7	
'Enter Sandman' - Metallica	19.4	1:00
'U Can't Touch This' - MC Hammer	14.5	
'Gangsta's Paradise' - Coolio	36.3	
Other	0.8	

(Continued)

Appendix (Continued)

	%	Start
High School		
'Time of Your Life' - Green Day	27.4	0:05
'Eye of the Tiger' - Survivor	24.2	0:40
'Stairway to Heaven' - Led Zeppelin	5.6	0:45
'Crash' - Dave Matthews Band	8.9	
'The Freshmen' - The Verve Pipe	12.1	0:18
'Cowboy' - Kid Rock	11.3	0:15
'We Are The Champions' - Queen	9.7	
Other	0.8	
College		
'Superman' - Five For Fighting	8.1	
'How You Remind Me' - Nickelback	6.5	
'I'm Real' - J Lo & JA Rule	7.3	0:25
'Crazy Game of Poker' - Oar	13.7	0:30
'Fallin' - Alicia Keyes	10.5	
'Chop Suey' - System of a Down	5.6	0:30
'It Wasn't Me' - Shaggy	8.1	0:15
'Drive' - Incubus	7.3	0:10
'#1' - Nelly	13.7	
'In the End' - Linkin Park	17.7	0:05

* One minute of song played beginning at time 0:00 unless otherwise indicated

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