



**The Effect of Familiar Music on the Retrieval of Autobiographical Memories in
Korsakoff Patients**

Master Thesis Neuropsychology

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Abstract

The purpose of this study is to look into the effect of familiar music on autobiographical memory (AM) retrieval in Korsakoff (KS) patients. To get an answer to the question: ‘‘To what extent does Familiar music affect the Retrieval of Autobiographical Memories in Korsakoff patients?’’, 10 individuals (8 male, 2 female), whose ages ranged from 50 – 82 years, participated in a 2x2x3 design. Participants were either classified in the Korsakoff group (n=5) or the control group (n=5). Participants completed two measurements. During measurements, participants were presented either a familiar or an unfamiliar music cue followed by a verbal historical cue. As a result, AMs were obtained and scored via a pre-existing score form. This study reveals that 1) Familiar music does not ameliorate the amount of AMs retrieved to a greater extent compared to unfamiliar music, 2) A time gradient is present, 3) Overall liveliness of AMs is enhanced by familiar music. However, comparing four different qualitative aspects of AMs, 4) emotional arousal is different between periods, dependent of the group. This study contributes to knowledge about the effect of music on the AM retrieval, including various aspects of AM which can be used to develop new compensating and restoring therapy strategies for KS patients. This study also raises new questions, and therefore contributes to the academic field of Neuropsychology. Familiar music enhances overall liveliness, but zooming in, effects are limited to emotional arousal. Further research is necessary to discover which different aspects of autobiographical memory benefit from FM.

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How often do you retrieve memories from your own past? What events are retrieved better: past events or more recent events? In healthy individuals, the amount of autobiographical memories (AMs) that are retrieved decline as the autobiographical memories age. That is, recent autobiographical memories are retrieved better than older autobiographical memories (Rubin, Wetzler & Nebes, 1986; Kopelman, 1989; Schlagman, Kvavilashvili & Schulz, 2007; Kopelman, 2015). Brain damage causes amnesia. According to Ribots' law of retrograde amnesia, brain damage impairs recently formed memories to a greater extent than older memories (Ribot, 1981). This is the opposite of the memory pattern in healthy individuals that was described earlier (Rubin et al., 1986). Ribots' law implies that in autobiographical memory deficits, a pattern (Time gradient) can be recognized that remote memories are recalled better (stronger emotions, more liveliness of detail etc.) than more recent memories (see Figure 1). This time gradient in retrograde amnesia can be found in both Korsakoff (KS) patients as well as in Alzheimer disease (AD) patients (Ribot, 1981; Rensen, Kessels, Migo, Wester, Eling & Kopelman, 2017). In addition, according to a study of Kopelman (1986), the gradient in Korsakoff patients was steeper compared to the time gradient of AD patients.

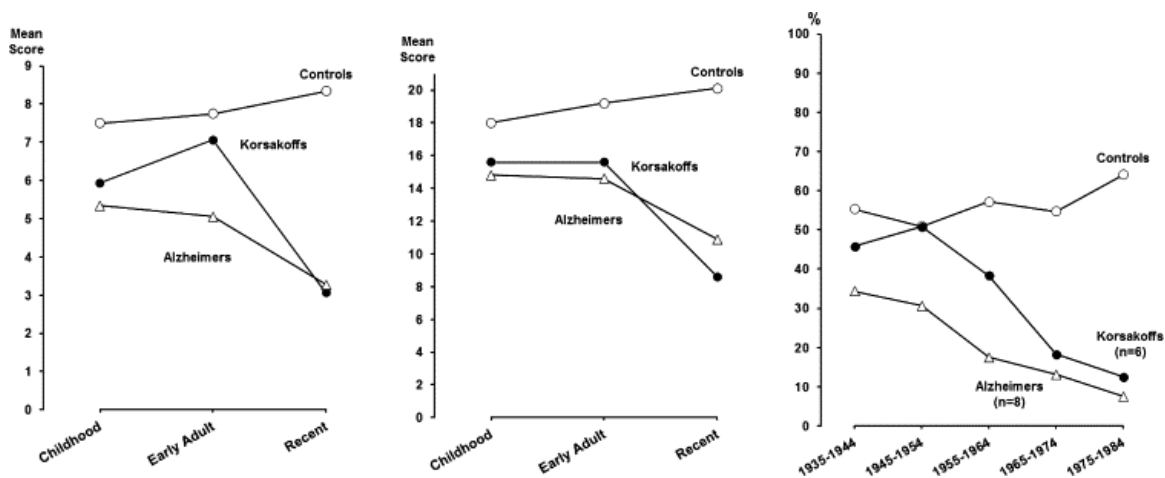


Figure 1. Time gradient in retrograde amnesia (Kopelman, 1986)

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As mentioned above, a group of individuals who experience difficulties in retrieving AMs are Korsakoff (KS) patients. Korsakoff's syndrome is a neuropsychiatric disorder, resulting from a thiamine (vitamin B-1) depletion which is most commonly caused by long-term alcohol abuse. The main problems that KS patients experience are severe learning and memory impairments (Kopelman, Wilson & Baddeley, 1988; Kessels, Eling, Ponds, Spikman & Zandvoort, 2016). Symptoms include anterograde amnesia, retrograde amnesia (both autobiographical and personal semantic memory), confabulation and sometimes hallucinations (Kessels et al., 2016). Adding to that, a recent study focused on deficits in retrieving autobiographical memories in KS patients (El Haj & Nandrino, 2017). In their study, the mean liveliness (reliving, back in time, remembering, realness, visual imagery, auditory imagery, language, emotion, rehearsal, importance, spatial recall and temporal recall) of AMs from KS patients was lower than the mean liveliness of AMs from healthy controls.

This time gradient poses a clinical problem for AD patients and KS patients (Kopelman, 2015). As KS patients progress more into their disease, the black spot in their memory grows larger to an extent that they can no longer take care of themselves and are unable to live independently. Adding to that, Addis and Trippett (2004) concluded that AM deficits affect the sense of identity to an extent which the patient does not remember who he is. There are currently 8000-10000 people with suspected KS in the Netherlands according to the Dutch Korsakov Knowledge Centre (2019). It is of concern to study the qualitative changes in AM over time as well as the stimulation of AM by means of musical cues. Because of the problematic consequences of AM deficits (losing sense of identity, unable to take care of yourself and unable to live independently), there is growing interest in the stimulation of AMs in KS patients. But can the retrieval of AM be stimulated?

El Haj, Gandolphe, Moustafa and Nandrino (2018) concluded that it is possible to ameliorate the AM retrieval by asking questions about Korsakoff patients' conceptual self. KS

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patients and healthy individuals were asked to answer questions such as, ‘‘Who am I?’’ before retrieving autobiographical memories. The autobiographical specificity was higher in both groups compared to a control condition for verbal fluency.

A different tool to ameliorate the retrieval of AM was used by Cady, Harris and Knappenberger (2008). One hundred and twenty-four college students with an age ranging from 18 to 22 years were examined. This group was randomly assigned to four conditions: visual lyrics, visual pictures, auditory conditions, and a control condition. All participants were presented a song (i.e. the lyrics, a visual picture of the artist or listened to the song) from each of five chosen lifetime eras. Immediately after the cue, participants were instructed to recall a memory from each lifetime era and to fill in a questionnaire. Cady et al. (2008) rated the AMs for vividness, specificity, feelings brought back and feeling emotional on a 4-point Likert scale. It appeared that hearing the song did not produce stronger AMs compared to reading the lyrics or seeing a picture of the artist. They argued that reading the lyrics could produce a representation of the song and indirectly stimulate the retrieval of AMs in AD patients.

Cuddy, Sikka, Silveira, Bai and Vanstone (2017) showed that music intensifies the quality of autobiographical memory retrieval. In their study, 20 young adults, 20 older adults and 20 adults with mild-to-moderate AD were investigated. They were instructed to listen to familiar musical fragments and describe any autobiographical memory that came to surface. For older adults and mild-to-moderate AD patients, autobiographical memories were self-rated as less specific, more vivid, more positive and less negative.

Findings of Cady et al. (2008) and Cuddy et al. (2017) were corroborated by Belfi, Karlan and Tranel (2016). Belfi et al. (2016) examined 30 healthy adults who listened to 30 songs and watched 30 faces. After each stimulus, participants rated their autobiographical memory evoked by the stimulus. Music-evoked autobiographical memories appeared to be more vivid

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than face-evoked autobiographical memories. These results affirm that AMs evoked by music are more vivid than AMs evoked by other stimuli (faces).

From these studies, it can be concluded that music is a promising technique in ameliorating the retrieval of AMs. El Haj, Fasotti and Allain (2012) used music as a tool to ameliorate the retrieval of AMs in AD patients. Their main goal was to elicit autobiographical memories by presenting music to AD patients. Autobiographical memories elicited by music, appeared to be more specific, accompanied by more emotional content and were retrieved faster compared to autobiographical memories evoked in silence (El Haj et al., 2012). Previous research of AM stimulation by music was limited AD patients (Cady et al., 2008; El Haj et al., 2012; Belfi et al., 2016; Cuddy et al., 2017). Since, according to Ribots' law, the time gradient in retrograde amnesia for patients with AD is similar to the time gradient in retrograde amnesia for Korsakoff patients, it can be assumed that music is also a promising technique in ameliorating the retrieval of AMs and eliciting autobiographical memories by presenting music to KS patients. As stated earlier, the AM deficits in KS patients causes (clinical) problems. It is important to develop further methods to compensate for their memory loss. From literature we know that music enhances the retrieval of AMs in AD patients. However, we do not know if the retrieval of AMs can be enhanced by music with KS patients. To fill this gap of knowledge, the aim of this study is to look into the effect of familiar music on the AM in KS patients. The main question is: 'To what extent does familiar music affect the retrieval of autobiographical memories in Korsakoff patients?'. To answer this question, this study investigates the presence of a time gradient in retrieving autobiographical memories of KS patients. In addition, this study examines if familiar music can reverse the time gradient in KS patients to an extent where the memory curve of KS patients imitates the memory curve in the control group. The current study compares the effect of familiar music with non-familiar music on autobiographical memory retrieval for different time periods (1970-1985;1985-2000;2000-2015). We formulated four hypotheses to test the effect of familiar music on the retrieval of AMs.

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First, we expect to see that KS patients retrieve more AMs when listening to familiar music compared to non-familiar music. This hypothesis is based on the studies of Ribot (1981) and El Haj et al. (2012). El Haj et al. (2012) found that in AD patients, familiar music-evoked AMs were accompanied by more emotional content and were retrieved faster compared to non-familiar music-evoked AMs. Ribot (1981) found a time gradient in patients with brain injury evoked brain damage (KS and AD) in the amount of memories recalled. He concluded in his study that KS patients retrieve less memories for earlier events compared to more remote events. In addition, studies concluded that healthy adults remember less events as memories age (Ribot, 1981; Rubin et al., 1984).

Second, we aim to find out whether a Ribot curve is present amongst KS patients. This aim is supported by studies of Ribot (1981), Kopelman (1986) and Rensen et al. (2017). Adding to that, we aim to investigate whether this time gradient in retrograde amnesia can be compensated for in KS patients when listening to familiar music.

The third expectation is that within the group of KS patients, the mean liveliness of familiar music-evoked AMs is higher compared to the mean liveliness of non-familiar music-evoked AMs. This hypothesis is based on previous findings (Cady et al., 2008; Belfi et al., 2016; Cuddy et al., 2017). Cady et al. (2008) concluded that familiar music cues can enhance AM retrieval. Cuddy et al. (2017) concluded that self-rated autobiographical memories retrieved by means of familiar music cues are less specific, more vivid, more positive and less negative. Belfi et al. (2016) found that familiar music-evoked AMs are rated as more vivid compared to face-evoked autobiographical memories. The expectation of this study is therefore that in familiar music-evoked autobiographical memories the mean liveliness is higher compared to non-familiar music-evoked autobiographical memories.

At last, we examine if the liveliness of retrieved AMs differs with regards to four aspects of an autobiographical memory (experience of time, emotion, sensory and place

configuration). According to studies of Svoboda, McKinnon and Levine (2006), different aspects of an AM depend on different parts of the brain and memory loss in KS patients is limited to certain structures. It could be that within the group of KS patients, in retrograde amnesia, some but not all areas in the brain are affected, therefore, some areas could be relatively intact while others show greater deficits. Also, it is known that the memory loss caused by Korsakoff Syndrome develops like an oil spot. It could be that memory loss does not develop gradually but rather diffuse. This would explain differences between the four aspects (experience of time, emotion, sensory and place configuration) of AM over time.

Methods

Participants

Overall, 12 individuals (10 male and 2 female) participated in this study. The participant group can be divided in two groups: a KS group and a healthy control group. Two participants, one in each group, are excluded. A KS participant refused to proceed and one healthy control is unable to hear the music even though the volume at its highest. As a result, 5 patients with Korsakoff syndrome (KS patients) whose ages ranged from 56 – 71 ($M=64$, $SD=5,9$) and 5 healthy controls whose ages ranged from 50 – 82 ($M=66$, $SD=12,8$) participated in this study. KS patients are obtained from Slingsdael Centre in Rotterdam. Patients with a history of confabulation are restricted from participation. Controls are recruited via a convenience sample. Controls are matched to patients with regards to education level (Verhage, 1964), gender and age (See table 1). Neither KS patients or healthy controls received compensation in response to their participation. To participate in this study, all participants are required to have a minimum age of 50 years. This age minimum was set to make sure that all participants had consciously experienced the chosen lifetime era's (3 areas between a period of 1970 to 2015). The study was approved by the Ethical Committee of the Utrecht University.

Table 1.

Demographic information

	KS Group (N=6)	Control Group (N=6)	Significance
Gender (m:v)	5: 0	3: 2	$\chi^2 = 2.5, p = .114$
Level of Education*	$M = 5,4, SD = 1,5$	$M = 5,2, SD = 1,3$	$\chi^2 = 1.333, p = .721$
Age	$M = 64, SD = 5,9$	$M = 66, SD = 12,8$	$t = -.412, p = .270$

Note: Level of education according to the ‘Codering van Verhage’ (Verhage, 1964), $p < 0.05$

Design & Procedure

A total of 10 participants were divided into two groups: healthy controls and KS patients. Two different combinations of two cues were used to retrieve autobiographical memories: a non-familiar music cue + verbal historical cue (non-familiar music condition) or a familiar music cue + verbal historical cue (familiar music condition). A familiar music cue involves pop-music that was very popular during a specific lifetime era but not likely to be played nowadays (Cady et al., 2008). A non-familiar music cue involved music that is not associated to any autobiographical memory and most likely unknown to the participant. For this study, selected familiar music (FM) is matched to non-familiar music (NFM) (See Appendix 1). A website for professional DJ’s was used to match FM with NFM (Tunebat, 2019). NFM is required to resemble the selected FM on several aspects: beats per minute, key, camelot, danceability and energizability. Because NFM- should be unknown to the participants, an additional requirement is that NFM should not have higher popularity than 30 according to Tunebat (2019). All songs were piloted and checked for recognisability.

Verbal historical cues are obtained from the Amsterdamse Media Vragenlijst (AMV) (Meeter, Weerdenburg & Heederik, 2010). Because the AMV did not cover a proper time span, several additional questions are added using a Dutch media base (Wikipedia, 2018a; Wikipedia, 2018b, Wikipedia, 2018c; Wikipedia, 2018d) where most influential events were highlighted (See Appendix 2). All verbal historical cues were checked for recognizability via an online form (See Appendix 3). Piloting the recognizability of the verbal historical cues

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amongst 18 healthy individuals resulted in a balanced distribution of strong and weak events over conditions.

We investigated three lifetime eras: 1970-1985, 1985-2000 and 2000-2015. Logically, each lifetime era represents a block. Each block contains three trials (3x3). Blocks were presented in chronological order (past to present). Furthermore, we measured participants for two days. On one day, participants listened to familiar music (FM). On the other day, participants listened to unfamiliar music (NFM). From the KS group, three participants started with the FM condition and two started with the NFM-condition. For the control group, three participants started with the NFM-condition and two participants started with the familiar music condition.

For the familiar music-condition (FM-condition), the purpose for each trial was to retrieve an AM. Because each trial produced an AM, we collected 18 autobiographical memories per measure per participant. We presented participants in the FM-condition with a song from a specific lifetime era (familiar music cue) followed by a historical question (verbal historical cue). After presenting the music-cue and the verbal historical cue, the participants retrieved one autobiographical memory.

For the non-familiar music-condition (NFM-condition) it is also attempted to retrieve an AM, but by means of NFM instead of FM. Participants were presented with a NFM-cue followed by a verbal historical question. After presentation of the familiar or unfamiliar music-cue and the verbal historical cue, the participants retrieved one autobiographical memory.

To measure the retrieved AMs, we used a pre-existing score form (See Table 2). Participants evaluated all questions presented in Table 2 by means of a 7-point Likert scale (1= strongly disagree, 7= strongly agree) (See Appendix 4). We used the score form to compare the mean liveliness of each derived memory and to compare the quality of the

autobiographical memories per group, per condition. We divided 12 questions over seven subcategories: ‘experience of time’ (question 12 and 13), ‘emotion-valence’, ‘emotion-arousal’, ‘ego perspective’, ‘place configuration’ and ‘sensory details’. These six subcategories appear to be the most important aspects of AMs (Baddeley & Wilson, 1986; Cady et al., 2008). The six subcategories were used to compare AMs between and within participant groups. Question 9 and question 14 were left out during measurements because of irrelevance in the present study.

Materials

During measurements, we used a questionnaire that contains national events of a period of 1970-2015 (autobiographical event questionnaire), a questionnaire that contains questions with regards to the recalled autobiographical memory, a laptop for playing music

Table 2:

Score form autobiographical memories

Vraag	Inhoud van de vraag	Antwoord
1	Deze herinnering roept positieve gevoelens bij mij op	
2	Deze herinnering roept negatieve gevoelens bij mij op	
3	Ik ervaar deze herinneringen door mijn eigen ogen, ik observeer	
4	Ik ervaar deze herinneringen door andermans ogen, ik ervaar het moment van bovenaf	
5	Ik herinner mij de plaats van het moment	
6	Ik herinner mij de plek van mensen en objecten tijdens het moment	
7	Ik herinner mij visuele details	
8	Ik herinner mij geluiden	
9	Ik herinner mij tastbare details	
10	De herinnering heeft een duidelijke verhaallijn	
11	Het koste mij moeite deze herinnering op te halen.	
12	Wanneer ik de herinnering oproep, heb ik het gevoel dat ik terugga in de tijd en het moment herbeleef	
13	Ik heb een goed gevoel van wanneer dit moment plaatsvond	
14	In welk jaar vond dit moment plaats?	Exact in jaren:

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(autobiographical memory questionnaire) and an informed consent (see appendix 6).

Measurement took place in a quiet area in Slingsdael Centre for Korsakoff (KS group) or in a quiet room outside of Slingsdael Centre (Control group).

Analysis

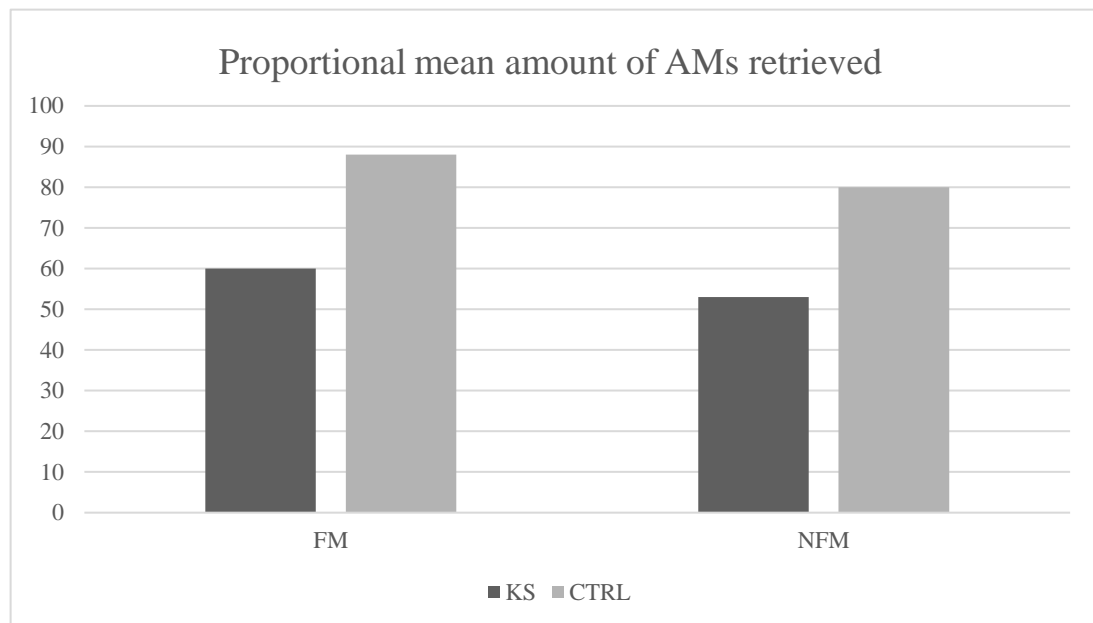
We computed both the amount of recalled memories per condition as well as the overall liveliness of AMs. The dependent variables were submitted to non-parametric tests and Repeated Measures ANOVA (RM-ANOVA) for comparisons. This study consists of a 2 x 2 x 3 design with group (KS or control) as a between subjects factor and both music (familiar or unfamiliar music) as well as period (1970-1984;1985-1999;2000-2014) as a within subjects factors.

Results

We first examined data for missing data points. In total, two participants withdrew their participation. Due to practical reasons, the missing participants were not replaced. We collected multiple autobiographical memories. An example of a response to verbal historical question 5 (see Appendix 6), translated to English is: ‘‘Yes, I remember car-free Sundays. We went to the highways and lay there without any cars surrounding us!’’ One of the questions that the participant received was: ‘‘When you think of that event, do you have positive feelings?’’ which was responded by: ‘‘Yes, it was a nice time’’, followed by a more specific rating (see Appendix 4).

At times, a participant was unable to retrieve AMs over one period. For completing a thorough analysis of the results, missing points had to be substituted with a manually computed value (See Appendix 7). Missing values were computed by calculations of average mean for one condition. For example, if participant ID04 had no memories for period one in the NFM condition, this value was computed by a sum of the values that corresponded period two and period three within the same condition. In this way, every missing value of all participants in each condition was substituted with a manually computed value. Further

analysis with regards to the mean liveliness is based upon the data including substituted values. Adding to that, Appendix 8 shows visual displays using the corrected values.



Overall, there is a significant difference between the KS group ($M=5.4$, $SD=1.52$) and the control group ($M=8$, $SD=1$) in the total amount of memories recalled within the FM-condition ($t(8)=-2.6$, $p = .013$). There is no significant difference between the KS group ($M=4.8$, $SD=1.48$) and the control group ($M=7.2$, $SD=1.9$) in the total amount of memories recalled within the NFM condition ($t(8)=-2.4$, $p = .058$). Figure 1 shows a visual display of the amount of AMs recalled by both groups for both conditions. **Figure 1.** Mean amount of AMs recalled within the FM and the NFM condition for KS patients and healthy controls in percentages.

Notice the foregoing analysis does not allow us to look at the recall rates per period. Since the number of cues per time period was relatively low, we use a nonparametric test to examine the recall rate per group and period. Data are analysed by means of a non-parametric Friedman's test with the group (KS or control) as a between subjects factor and both period (1970-1985;1985-2000;2000-2015) as well as music (autobiographical and unfamiliar music) as a within subjects factor. Friedman's test combined with post-hoc analysis (Wilcoxon signed-rank test) including a Bonferroni correction, results in a significance level set at $p < 0,017$.

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The first prediction that KS patients retrieve more AMs when listening to familiar music compared to non-familiar music is not confirmed. For the KS group, there is no significant difference in the total amount of memories recalled between the FM condition and the NFM condition for period 1 ($Z = -.577, p = .564$), period 2 ($Z = -.2, p = .056$) and period 3 ($Z = -.743, p = .458$). For the control group, there is also no significant difference in the amount of memories recalled between the FM condition and the NFM condition for period 1 ($Z = -1.633, p = .102$), period 2 ($Z = -.577, p = .564$) and period 3 ($Z = -1.414, p = .157$). A visual display is presented in Figure 2. The results are shown in table 3.

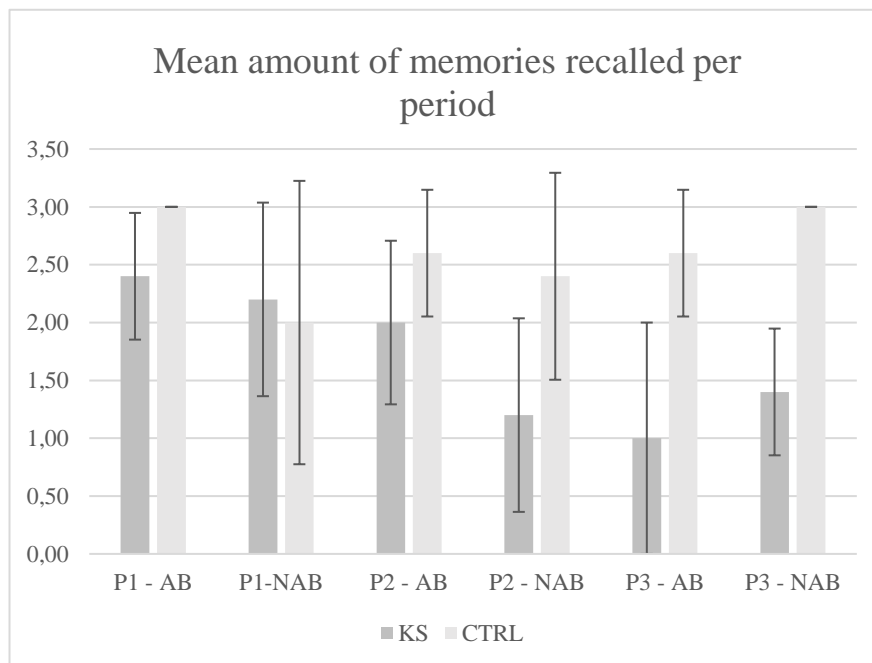


Figure 2: mean amount of memories recalled per period: a visual display per condition, per group.

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Table 3:

Comparison of amount of memories between conditions (FM and NFM condition) over time periods for both the KS group as well as the control group.

		Period 1 FM – Period 1 NFM	Period 2 FM – Period 2 NFM	Period 3 FM – Period 3 NFM
KS group	Z-value	-.577	-2.000	-.743
	P-value* (2- tailed)	.564	.046	.458
Control group	Z-value	-1.633	-.577	-1.414
	p-value* (2-tailed)	.102	.564	.157

Note. α : $p < 0.017$

Second, we aimed to see whether a time gradient in retrograde amnesia is present.

During measurements, a maximum of six AMs can be recalled per period. It is investigated if music has a significant effect on AM retrieval between groups. Music has no significant effect on AM retrieval ($F(1,8) = 1.508, p = .254, \eta^2 = .159$). Then, we investigated if time period has a significant effect on AM retrieval. ($F(1,8) = 1.600, p = .092, \eta^2 = .314$). Figure 3 shows a significant interaction between the effect of group and period on the amount of retrieved AMs ($F(1,8) = 11.2, p = .010, \eta^2 = .583$)

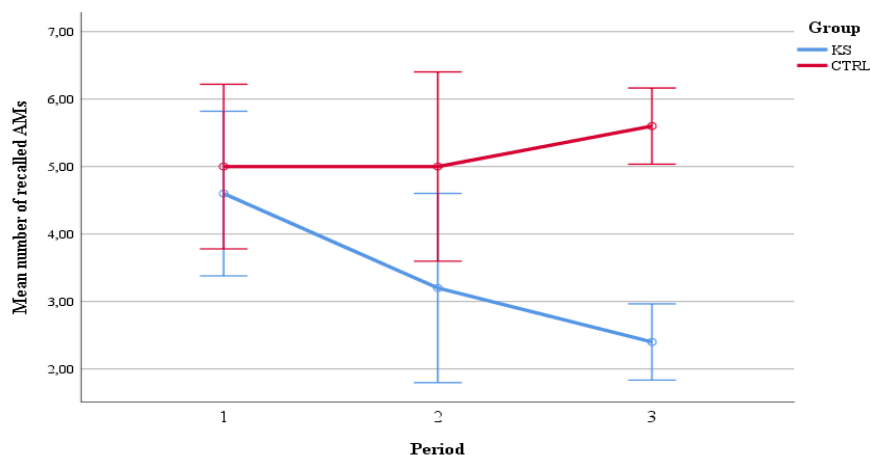


Figure 3. time gradient in Ribot curve.

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Thirdly, we expected to see that in KS patients, familiar music increases the liveliness of AMs compared to unfamiliar music. This hypothesis is confirmed. First of all, A visual inspection (See Figure 4, Figure 5 and Figure 6) indicates that the mean liveliness of the AMs retrieved within the familiar music condition is higher compared to the AMs retrieved within the non-familiar music condition for both groups. Moreover, music has a significant effect on the retrieval of AMs ($F(1,8) = 5,918, p = .041, \eta^2 = .425$). Both main effects for period are non-significant ($F(2,16) = 1.908, p = .181, \eta^2 = .193$), as well as the interaction effects (Music x Group: $F(1,8) = .725, p = .419, \eta^2 = .083$; Period x Music: $F(2,16) = 2.407, p = .122, \eta^2 = .231$; Period x Group: $F(2,16) = .148, p = .864, \eta^2 = .018$; Music x Period x Group: $F(2,16) = 1.988, p = .380, \eta^2 = .114$).

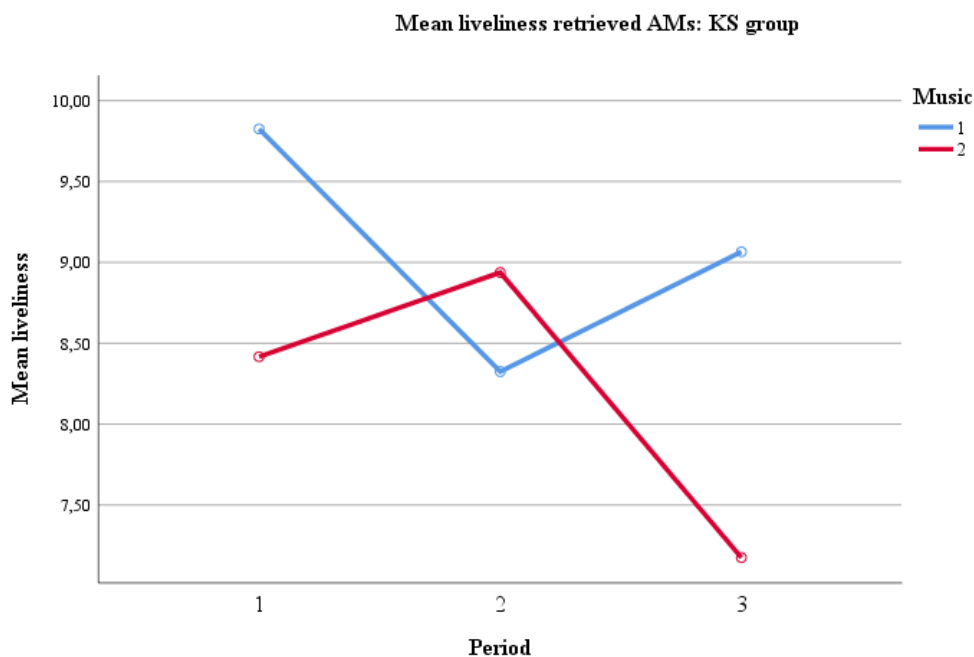


Figure 4. Visual inspection of the mean liveliness of retrieved AM within the KS group (N=5)

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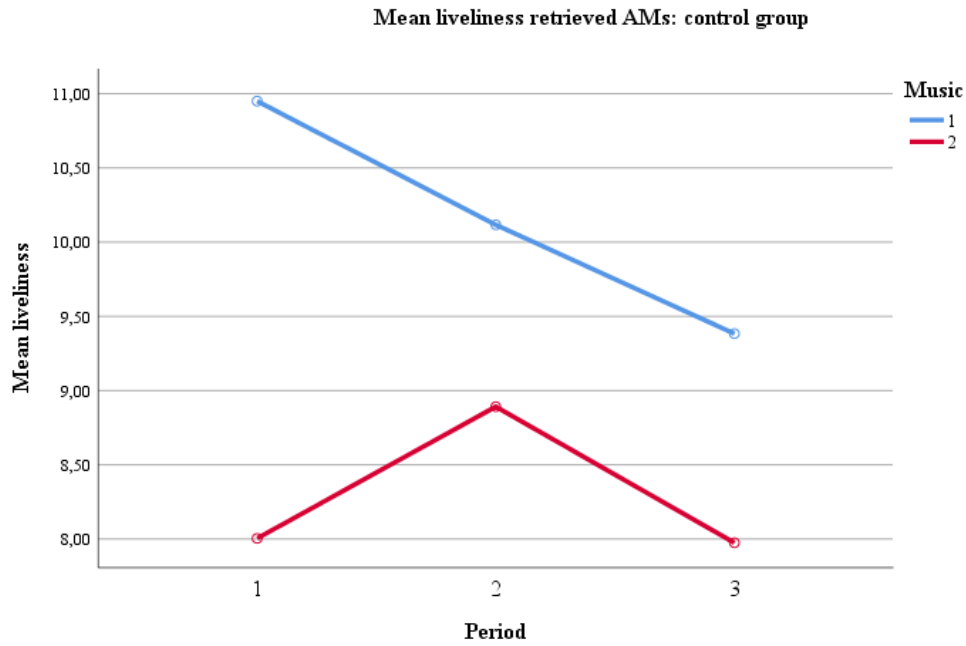


Figure 5. Visual inspection of the mean liveliness of retrieved AM within the control group (N =5).

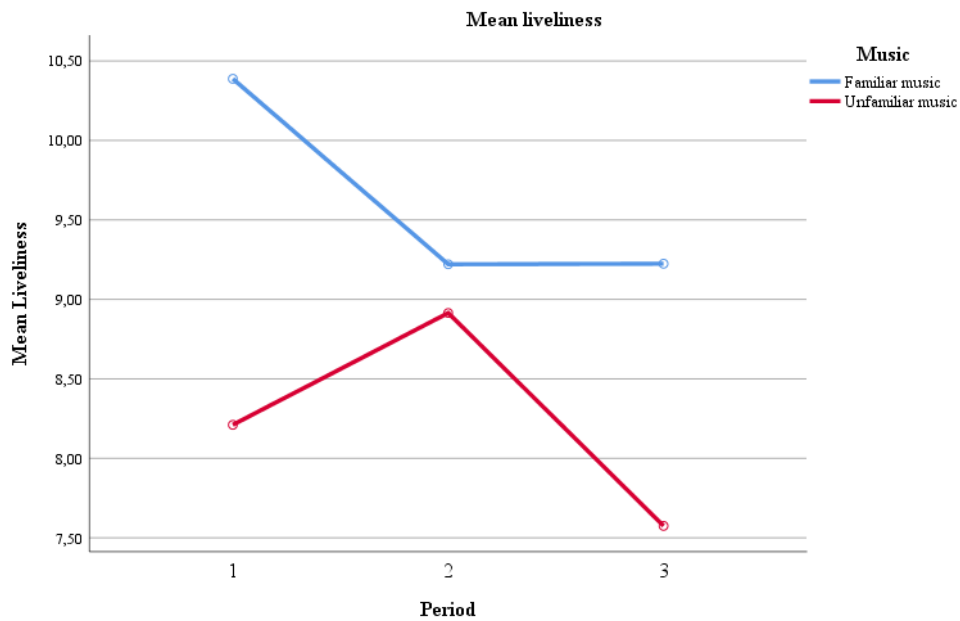


Figure 6. Overall mean liveliness of retrieved AMs, both groups combined (N=10)

Cady et al. (2008) found differences in AM retrieval on some, but not all aspects of autobiographical memories. Therefore, statistical analysis of the performance data per subcategory rather than the overall liveliness per period might provide more detailed information about the effect of familiar music on the retrieval of AM.

In total, we composed six aspects and analyzed them using SPSS based on previous research ‘ego perspective’, ‘emotion-valence’. However, we only analyze four aspects that are the most prominent aspects of autobiographical memories according to previous studies:

‘experience of time’, ‘emotion-arousal’, ‘place configuration’ and ‘sensory details’ (El Haj et al., 2012; Barry, Chiu, Raes, Ricarte & Lau, 2018; Rubin, Deffler & Umanath, 2019).

For ‘experience of time’, the main effects of period ($F(2,16) = 2.896, p = 0.084, \eta^2 = .266$) and music ($F(1,8) = 4.568, p = 0.065, \eta^2 = .363$) as well as the interaction effects (Period x Group: $F(2,16) = 5.391, p = .43, \eta^2 = .100$; Music x Period: $F(2,16) = 4.213, p = .439, \eta^2 = .098$; Music x Group: $F(1,8) = 8.624, p = .398, \eta^2 = .091$) are non-significant. The mean liveliness for ‘experience of time’ is displayed below in figure 7.

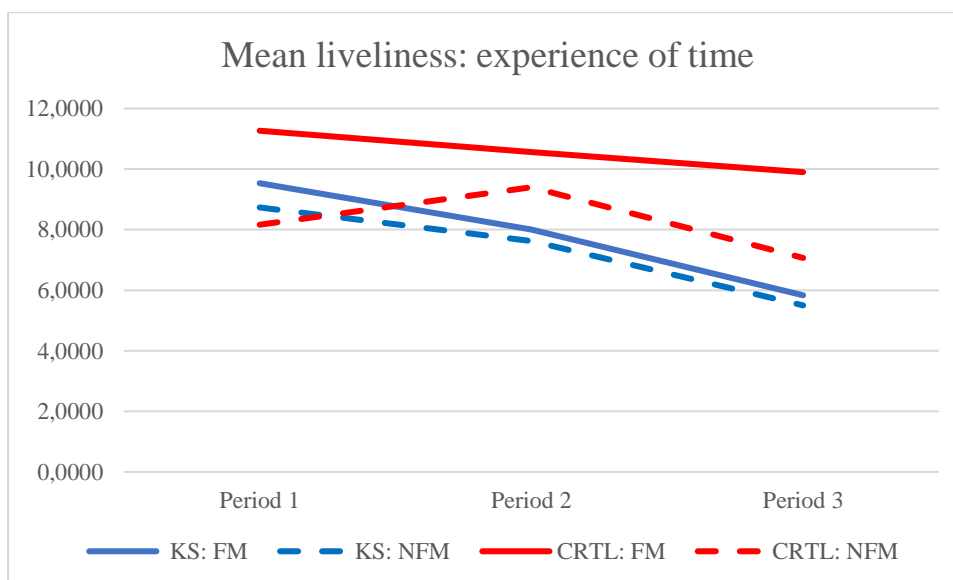


Figure 7. Mean liveliness for ‘experience of time’. A maximum score of 12 could be reached.

For ‘emotion-arousal’, both the main effect for period ($F(2,16) = .835, p = .452, \eta^2 = .094$) and music ($F(2,8) = 2.239, p = .173, \eta^2 = .219$) as well as the interaction effect (Music x Group: $F(1,8) = .002, p = .964, \eta^2 = .000$; Music x Period: $F(2,16) = .1216, p = .322, \eta^2 = .132$) are non-significant. A significant interaction effect (Period x Group: $F(2,16) = 4.500, p = .028, \eta^2 = .360$) is found, having a large effect size. The mean liveliness for ‘emotion-arousal’ is displayed below in figure 8.

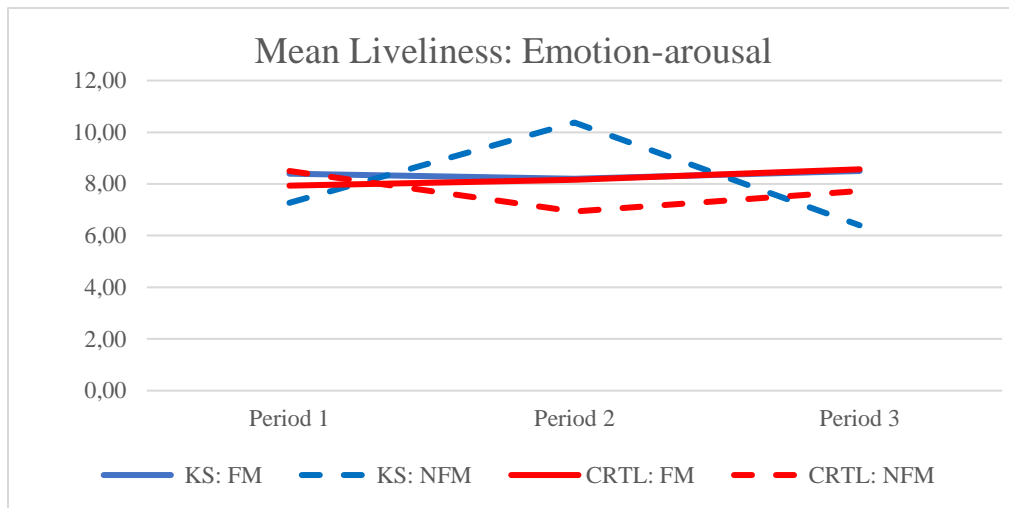


Figure 8. Mean liveliness for ‘emotion-arousal’. A maximum score of 12 could be reached.

For ‘place configuration’, the main effects for music ($F(1,8) = 4.537, p = .066, \eta^2 = .362$) and period ($F(2,16) = .496, p = .618, \eta^2 = .058$) as well as the interaction effects (Music x Group: $F(1,8) = .1295, p = .288, \eta^2 = .139$; Period x Group: $F(2, 16) = .212, p = .811, \eta^2 = .026$; Music x Period: $F(2,16) = 3.291, p = .091, \eta^2 = .291$) is non-significant. The mean liveliness for ‘place configuration’ is displayed below in figure 9.

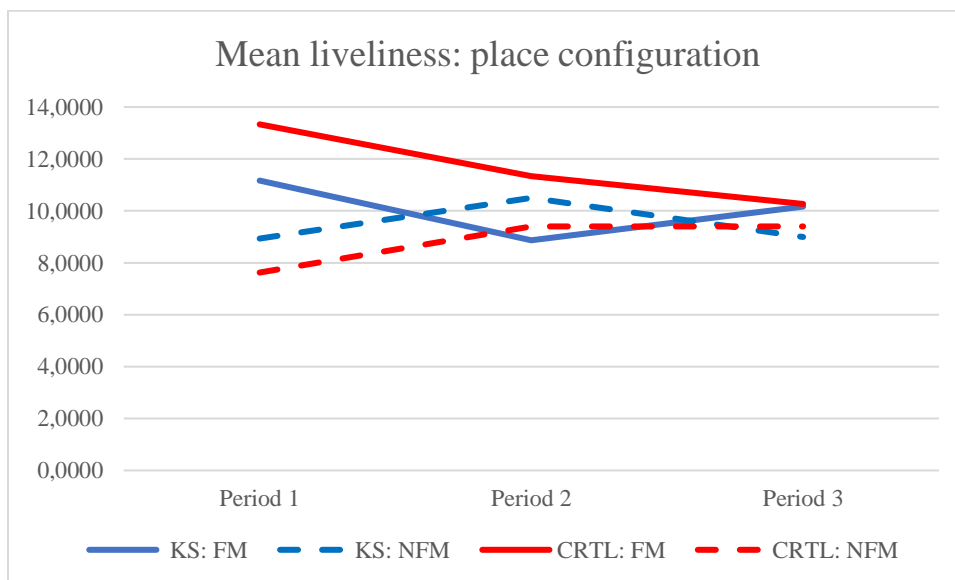


Figure 9. Mean liveliness for ‘place configuration’. A maximum score of 12 could be reached.

For ‘sensory details’, both the main effect for period ($F(2,16) = 1.144, p = .343, \eta^2 = .125$) and music ($F(1,8) = 3.384, p = .103, \eta^2 = .297$) as well as the interaction effects (Music x Group: $F(1,8) = .109, p = .750, \eta^2 = .013$; Period x Group: $F(2,16) = 2.190, p = .144, \eta^2 =$

.251; Music x Period: $F(2,16) = 1.686, p = .216, \eta^2 = .174$) is non-significant. The mean liveliness for ‘sensory’ is displayed below in figure 10.

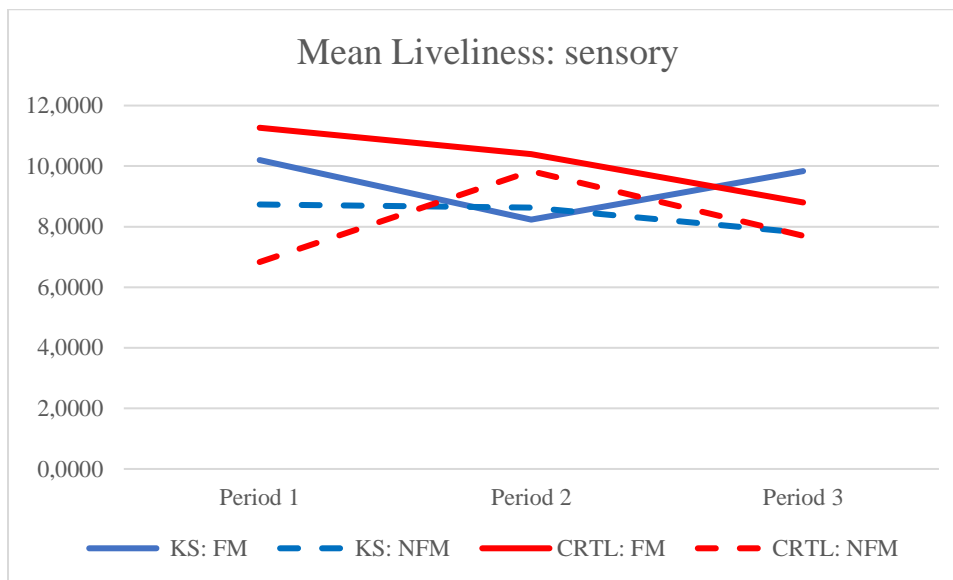


Figure 10. Mean liveliness for ‘sensory details’. A maximum score of 12 could be reached.

Discussion

The purpose of this study was to gain more insight into the effect of music on AM retrieval in KS patients. El Haj et al. (2012) and Cady et al. (2008) demonstrated that music can ameliorate AM retrieval in a way that autobiographical memories are retrieved faster, in larger numbers and accompanied by more liveliness (detail, emotions etc.). An increasing amount of studies investigate the effect of music on AM retrieval. However, it remains unclear if familiar music can enhance AM retrieval in KS patients. To answer the research question “To what extent does familiar music affect AM retrieval in Korsakoff patients?”, four hypotheses were formulated. The first expectation is that KS patients retrieve more AMs when listening to familiar music compared to non-familiar music. Second, we aimed to see whether a Ribot curve is present amongst KS patients. The third expectation is that in KS patients, the mean liveliness of familiar music-evoked AMs is higher compared to the mean liveliness of non-familiar music-evoked AMs. The fourth expectation is that the liveliness of

retrieved autobiographical memories differ with regards to the four aspects of an autobiographical memory (experience of time, emotion, sensory and place configuration).

The four hypotheses are tested by means of a questionnaire based on the AMV (Meeter et al., 2010), music and a questionnaire for scoring the autobiographical memories. Participants are first cued via a familiar or non-familiar music cue and a verbal historical cue before they retrieve an autobiographical memory. The autobiographical memories are scored via a specially composed questionnaire.

We first expected that in KS patients, familiar music ameliorates AM retrieval to a greater extent compared to non-familiar music. No significant difference in the amount of autobiographical memories recalled between music conditions is found for both groups. The first expectation is therefore not confirmed. Familiar music does not enhance AM retrieval compared to non-familiar music. These results are not in line with the results of El Haj et al. (2012) who have shown that autobiographical memories elicited by music appeared to be more specific, accompanied by more emotional content and were retrieved faster compared to autobiographical memories evoked in silence.

Although music has no effect on the amount of retrieved AMs, it is of importance to notice that the mean amount of retrieved AMs was higher within the FM condition compared to the NFM-condition (See Figure 2). We can conclude that music ameliorates the AMs retrieval, however, limited to healthy controls. Originally, the time gradient shows that the AM retrieval declines significantly amongst KS patients for more remote memories. Because healthy participants seem to benefit from listening to familiar music further research is necessary to discover why healthy controls retrieve more AMs when listening to familiar music whilst Korsakoff patients do not.

One explanation why the control group would benefit more from listening to familiar compared to KS patients is that within the NFM-condition, KS patients do not perform better

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or worse than control participants in the amount of retrieved AMs. Given the fact that in general KS patients have significantly more problems with retrieving AMs compared to healthy people, the similarity in performance between the two groups indicates that the NFM cue stimulated the retrieval of AMs in KS patients. The fact that a significant difference between groups within the FM condition has been found may not be due to a deficit in AM retrieval, but rather the AM retrieval is compromised due to poor memory encoding. The third lifetime era concerns a time span of 2000-2015. Within this time frame, a number of KS patients stated that they were often very drunk at the time or they were already institutionalized. Alcohol administration prior to memory encoding negatively affects memory (Weafer, Gallo & de Wit, 2016). Adding to that, within the institution, often music is played from an earlier lifetime era and not from the current lifetime era. Consequently, less autobiographical memories are formed or linked to pop songs from that lifetime era. Due to the fact that healthy controls are generally less often drunk and live in other environments than KS patients, healthy controls benefit from an increased performance of memory retrieval within the FM-condition of the third lifetime era.

Second, we aim to see whether a time gradient is present amongst KS patients. This was supported by studies of Ribot (1981), Kopelman (1986) and Rensen et al. (2017) where they showed a time gradient in retrograde amnesia. Rensen et al. (2017) studied if methodological differences affected the presence of a temporal gradient in retrograde amnesia. They concluded that using both the AMI as well as the AI produced a time gradient in KS patients. Furthermore, they found that the Ribot curve was not affected by examining only one event per lifetime era. Supported by literature, we have found a time gradient as well. The presence of a time gradient verifies that we investigated autobiographical memories and it confirms the outcome of the study of Rensen et al. (2017). Furthermore, the presence of a time gradient shows us that this study uses sufficient lifetime events to measure the effect of

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music on AM retrieval. Also, the presence of a time gradient shows us a pattern in forgetting autobiographical memories of KS patients. KS patients remember less of recent memories compared to more remote memories. The forgetting curve of KS patients can have two possible explanations. The first explanation is that KS patients remember older memories to a greater extent because older memories exist for a longer period of time within KS patients. Therefore, older memories have been retrieved and consolidated for more times than recent memories. That is, older memories are stronger and, therefore, forgotten less easily than recent memories. The second explanation is that recent memories were not stored properly. Errors in storing memories could arise due to alcohol consumption which clouds patients awareness. However, this is mere speculation and additional research is necessary to explain the reason behind a time gradient in retrograde amnesia.

Third, we expected to see that in KS patients, the mean liveliness of AMs retrieved with familiar music is higher compared to the mean liveliness of non-familiar music-evoked AMs. Our results confirm this hypothesis. Familiar music enhances the mean liveliness of autobiographical music in both groups.

With regards to ‘experience of time’, we found no significant differences indicating that the extent to which a person relives the time period of a memory is independent from the group or how far back in time the event has occurred. Familiar music also does not affect the experience of time in AMs retrieved by KS patients or healthy controls.

With regards to ‘emotion-arousal’, emotional arousal that accompanies AM retrieval per period depends on whether a participant was from the KS group or the control group. Familiar music did not enhance the emotion-arousal of autobiographical memories.

Lastly, with regards to ‘place configuration’ and to ‘sensory details’, no significant effects were found. This first of all indicates that familiar music does not affect the place configuration or the amount nor the strength of sensory details of AMs within KS patients or

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healthy controls. Adding to that, it shows us that the memories retrieved by KS patients were similar on the aspects of place configuration and sensory details compared to the AMs retrieved by healthy controls.

Since the mean liveliness of four different aspects is similar between healthy controls and KS patients, we believe that KS patients, although they seem to forget a significant amount of AMs, the liveliness of the ones they remember remains the same. Especially emotional-arousal of the AMs stays intact.

These results are not in line with previous findings (Cady et al., 2008; Belfi et al., 2016; Cuddy et al., 2017). The design of this study could give an explanation for the unexpected results. Previous designs enabled participants to respond freely to the stimuli. In this study, however, the design was structured in a way that participants responded to the music cue followed by a verbal historical cue by answering several questions. Rensen et al. (2017) studied the influence of two different methods (Autobiographical Memory Index and Autobiographical Index) to retrieve AMs on the presence of a temporal gradient in KS patients. This study examined 20 patients with Korsakoff's syndrome and compared them to 27 healthy control participants. Participants recalled knowledge from different time periods (childhood, young adulthood and recent years). Participants responded by speaking freely about their memory and rated their memories on a 5-point Likert scale on the aspects pleasantness, emotional intensity, vividness, rehearsal, personal significance and confidence. All events were scored by means of the AMI procedure and by means of the AI procedure. The study concluded that using the Autobiographical Memory Index (AMI) instead of the Autobiographical index (AI), the effect sizes for the main effect of group and the interaction effect (Group x Period) were higher. Because this study uses a method similar to the AI, the study of Rensen et al. (2017) can help explain why no significant effects were found in the overall liveliness. To verify whether using the AMI as a method to retrieve AMs does give

significant results, a repetition of this study using an AMI method instead of an AI method is advised.

Limitations and Conclusion

Limitations

This study knows several limitations: participants, knowledge of music and ambiguous questions.

First of all, the number of participants should be addressed. This study pre-selected a number of six participants in each group. After excluding two participants there were five participants left in each group. A relatively small group size of five participants can influence the results (group size effect). It is possible that when this study is conducted with a larger group of participants, non-significant results may become significant. Repeating this study with more participants is recommended to determine whether or not the results in this study are reliable.

A second limitation of this study concerns knowledge of music. Sometimes participants did not recognize a song from the FM-music condition. Despite the meticulous selecting process of music for the FM-condition and the NFM-condition, some songs within the FM-condition were not recognized by some participants. When participants have no earlier recollection of an assumed familiar song, the dispute song resembles an unfamiliar music song. Due to the fact that music within the autographical condition were not recognized a few times, the results of the measurements were alloyed. As a result of the alloyed measurements, it is no longer possible to observe effect of both conditions (autobiographical and unfamiliar music) on the test performance. A replication of this study with more songs included could eliminate this limitation.

A third limitation with regards to this study concerns the ambiguous questions on the autobiographical memory questionnaire. Question 3, question 4 and question 12 were

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experienced as abstract and were therefore not always understood properly, although the meaning of above questions were explained by the researcher multiple times, in multiple ways. However, when analysis the concerned aspect ('experience of time'), a significant main effect of period as well as a significant interaction effect (Period x group) has been found. This indicates that this limitation is negligible.

Conclusion

Results of the present study shows that within the KS group, familiar music does not enhance the amount of recalled autobiographical memories. However, familiar music enhances the mean liveliness of retrieved autobiographical music in both groups. Looking more into the overall liveliness in AMs, we did not find differences between groups. An explanation for this result can be that in KS patients, only the most lively memories survive their memory loss. This way, the autobiographical memories that KS patients retrieve, are of equal liveliness to the AMs that healthy controls retrieve.

Looking more into a total of four different aspects (experience of time, ego perspective, emotion-arousal and place configuration) of an autobiographical memory, we did not find any effects of music.

Implications

Present study shows that familiar music does not enhance AM retrieval to a greater extent compared to unfamiliar music memories. However, this study points out that KS patients suffer most from contextual binding problems whilst emotional arousal stays relatively intact KS patients.

For therapies, clinicians often make use of two different types of rehabilitation: compensation and restoration (Ponds & Hendriks, 2006). Knowledge about deficits in KS patients helps us developing new therapies to restore the cognitive declines in KS patients,

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such as contextual binding. For KS patients who suffer most from contextual binding problems, this study teaches us that therapies using familiar music could be an outcome.

Not only is it of importance to be aware of memory declines in KS patients, the knowledge that emotional arousal of autobiographical memories is relatively spared in KS patients is also helpful in KS patients' daily life. Making use of preserved cognitive abilities such as emotional arousal can compensate for the declines and can help patients live more independently. According to Svoboda et al. (2006) there are two distinct pathways involved in AM. First, Svoboda et al. (2006) describe a core network that involves the medial and ventrolateral prefrontal cortices, medial and lateral temporal cortices, temporoparietal junction, retrosplenial/posterior cingulate cortex, and the cerebellum. Furthermore Svoboda et al. (2006) describe a secondary network that involves the dorsolateral prefrontal cortex, superior medial and superior lateral cortex, anterior cingulate cortex, medial orbitofrontal, temporopolar and occipital cortices, thalamus and the amygdala. Noticing The amygdala is a structure that is believed to have a moderating role in memory function (Kril & Harper, 2012), more specifically the amygdala plays a role within the secondary pathway whilst in KS disease the memory loss is due to damage to the core pathway (hippocampus, frontal regions, thalamus and hypothalamus) (Kril & Harper, 2012; Savage, Hall & Resende, 2012). By using the secondary pathway (adding emotional content to an autobiographical event) to store new memories, patients are better able to retrieve newly created memories which helps them to remember for example what they did during the day. What a patient experiences as emotional, is different between patients. Therefore, a clinician should look into each patient specifically to discover what makes a patient feel emotional. A more controversial method to trigger a patients' amygdala is to use brain stimulation. By stimulating the amygdala continuously, events will always be coupled to emotions and, therefore, retrieved better. However, research is necessary to explore Deep Brain Stimulation (DBS) as an option to stimulate KS patients

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their memory. All in all, this study helps us gain more knowledge about the effect of music on autobiographical memory retrieval in KS patients and develop new therapy strategies for KS patients. However, this study also raises new questions and therefore contributes to the academic field of Neuropsychology. While healthy participants seem to benefit from listening to familiar music more than KS patients, further research is necessary to discover why healthy controls retrieve more AMs when listening to familiar music whilst Korsakoff patients do not.

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Appendix 1: List of music that has been used

Table 4

Selected music

	Song	Artist	Camelot	BMP*	Energy	Danceability	Popularity	Key
1a.	Don't stop me now	Queen	7B	156	78	57	51	F Major
1b.	Bad to be good	Poison	4B	99	93	59	28	A \flat Major
2a.	Big in Japan	Alphaville	7A	98	41	75	65	D Minor
2b.	Now that I have you	Information Society	6A	124	54	67	17	G minor
3a.	Ma Baker	Boney M	7A	129	76	75	48	D Minor
3b.	Moscow Moscow	Dschinghis Khan, Jay Khan	6A	130	72	67	13	G Minor
4a.	Vogue	Madonna	2B	116	88	74	62	F# Major
4b.	Itchycoo Park	M People	2B	124	77	77	24	F# Major
5a.	... Baby one more time	Britney Spears	5A	93	70	76	76	C Minor
5b.	Right Guy	S Club 7	4A	100	69	67	0	F Minor
6a.	Earth Song	Michael Jackson	2A	138	44	50	63	E \flat Minor/Major
6b.	Your Letter	112	10B	139	39	53	35	D Major
7a.	Someone like you	Adele	11B	135	33	56	76	A Major
7b.	The skies will break	Corinne bailey Rae	10B	125	47	58	36	D Major
8a.	Stan	Eminem ft. Dido	11A	80	77	78	71	F# Minor
8b.	These Drugs	D12	11A	89	73	81	29	F# Minor
9a.	Wake me up	Avicii	10B	124	78	52	82	D Major
9b.	Children of the World	John De Sohn, Niclas Lundin	7B	128	76	49	23	F Major

Note. * Beats Per Minute, a indicates familiar music, b indicates non-familiar music

Appendix 2: Questionnaire based on the AMV.

1. *Participantnummer:*
2. *Leeftijd van de patiënt:.*
3. *Opleidingsniveau*

LET OP: ROOD = non-autobiografische conditie; ZWART = autobiografische conditie
Vragen

1970-1984

Vraag 1: De tweede feministische golf manifesteert zich in de jaren '70 in Nederland met de stichting van moedermavo's, met VOS-cursussen en met de actie "Baas in eigen buik" van Dolle Mina. Kunt u zich een moment herinneren die u doet denken aan de Dolla Mina's?

Vraag 2: In 1980 won Joop Zoetemelk als tweede Nederlander de Tour de France. Kunt u zich een moment herinneren die u doet denken aan de winst van Joop Zoetemelk? Wilt u deze voor mij beschrijven?

Vraag 3: Zowel De Sterrenshow als Vijf tegen Vijf werden gepresenteerd door Willem Ruis. Waar denkt u aan bij deze programma's? Wilt u dat voor mij beschrijven?

Vraag 4: In de jaren '80 was er vaak een reclame op de televisie voor Calvé Pindakaas. De jongen in de reclame die heette Petje Pitamientje. Kunt u zich hier een moment bij herinneren die u doet denken aan de reclame van Calvé Pindakaas? Wilt u deze voor mij beschrijven?

Vraag 5: Een tweede oliecrisis in 1979 veroorzaakt een wereldwijde economische crisis waarvan ook de olieproducerende landen te lijden hebben. Weet u nog hoe dat toen was? Kunt u zich een moment herinneren die u doet denken aan de oliecrisis?

Vraag 6: Het Verenigd Koninkrijk vocht in de jaren '80 in de Falklandoorlog. Kunt u zich hier een moment bij herinneren die u doet denken aan de Falklandoorlog? Wilt u deze voor mij beschrijven?

1985-2000

Vraag 7: In 1989 viel de Berlijnse muur. Dit wordt door velen gezien als einde van de koude oorlog. Kunt u zich hier een moment bij herinneren die u doet denken aan de val van de Berlijnse Muur? Wilt u deze voor mij beschrijven?

Vraag 8: In 1992 stortte er een Jumbo jet neer in de Bijlmer. Deze gebeurtenis wordt ook wel de Bijlmerramp genoemd. Kunt u zich hier een moment bij herinneren die u doet denken aan de Bijlmerramp? Wilt u deze voor mij beschrijven?

Vraag 9: Posh, Scary, Baby, Sporty en Ginger vormden samen een meidenband genaamd Spice Girls. Kunt u zich hier een moment bij herinneren die u doet denken aan de Spice Girls? Wilt u deze voor mij beschrijven?

Vraag 10: De walkman gaat na 1990 het straatbeeld beheersen. Kunt u zich een moment herinneren die u doet denken aan de Walkman?

Vraag 11: Voetballer Kluivert kwam in de jaren '90 in opspraak omdat hij werd verdacht van verkrachting en/of betrokkenheid bij een auto-ongeluk. Kunt u zich hier een moment bij herinneren die u doet denken aan Kluivert? Wilt u deze voor mij beschrijven?

Vraag 12: In 1989 werd de schrijver Salman Rushdie vogelvrij verklaard door ayatollah Khomeini vanwege het schrijven van het boek: "De Duivelsversen". Kunt u zich hier een moment bij herinneren die u doet denken aan ayatollah Khomeini? Wilt u deze voor mij beschrijven?

2000-2015

Vraag 13: In 2006 werd Saddam Hussein gevonden. Kunt u zich hier een moment bij herinneren die u doet denken aan de vondst van Saddam Hussein? Wilt u deze voor mij beschrijven?

Vraag 14: in 2008 bracht Geert Wilders de controversiële film Fitna uit. Kunt u zich hier een moment bij herinneren die u doet denken aan Fitna, de film van Geert Wilders? Wilt u deze voor mij beschrijven?

Vraag 15: De Franse politie beëindigt in 2015 een gijzeling in een drukkerij in Dammartin-en-Goële door de twee verdachten van de aanslag op *Charlie Hebdo*, en een gijzeling in een joodse supermarkt in Parijs. Bij het begin van de gijzeling in de supermarkt komen vier slachtoffers en drie daders van de gijzeling om het leven. Kunt u zich een moment herinneren die u doet denken aan de aanslag op *Charlie Hebdo*?

Vraag 16: In 2010 was het luchtverkeer in Europa enkele dagen verstoord. Dit kwam door een aswolk van een vulkaan. Kunt u zich hier een moment bij herinneren die u doet denken aan Europa? Wilt u deze voor mij beschrijven?

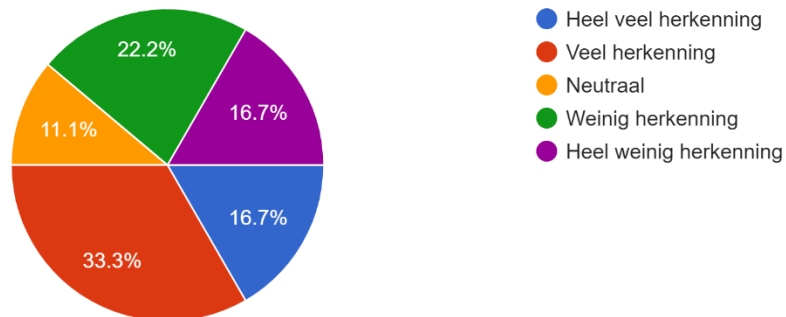
Vraag 17: vanaf 2014 werd de zwartepietendiscussie veelvuldig gevoerd in Nederland. Kunt u zich een moment herinneren die u doet denken aan de zwartepietendiscussie?

Vraag 18: Pim Fortuin, die in 2003 om het leven werd gebracht door Volkert van der G. Kunt u zich hier een moment bij herinneren die u doet denken aan de moord op Pim Fortuin? Wilt u deze voor mij beschrijven?

Appendix 3: Recognizability investigation of the questionnaire

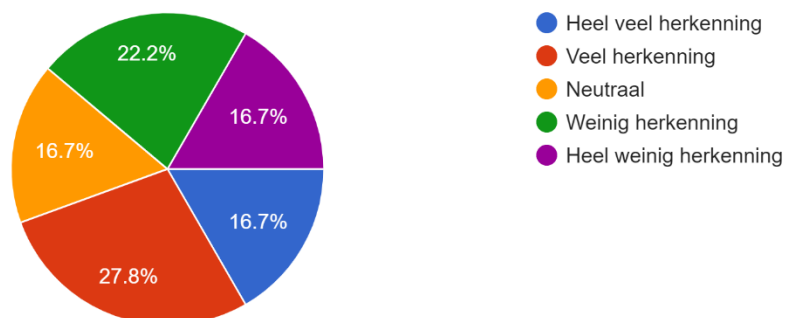
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18 responses



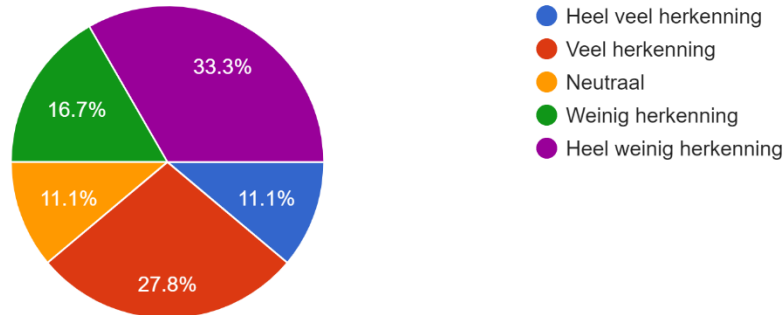
In 1980 won Joop Zoetemelk als tweede Nederlander de Tour de France

18 responses



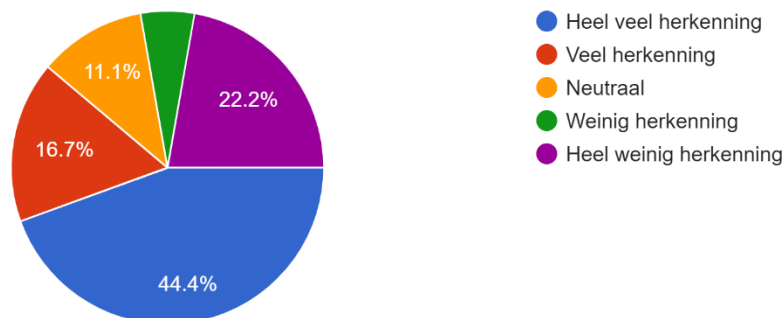
Zowel De Sterrenshow als Vijf tegen Vijf werden gepresenteerd door Willem Ruis.

18 responses



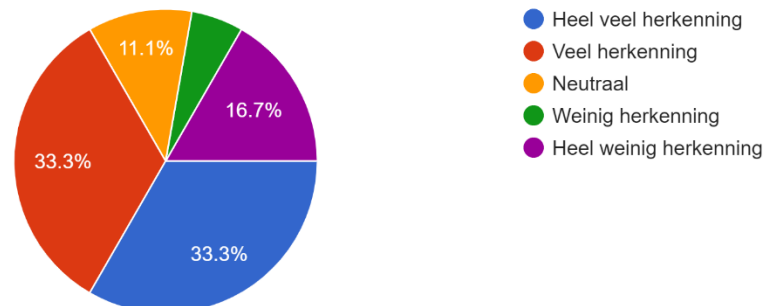
In de jaren '80 was er vaak een reclame op de televisie voor Calvé Pindakaas. De jongen in de reclame die heette Petje Pitamientje

18 responses



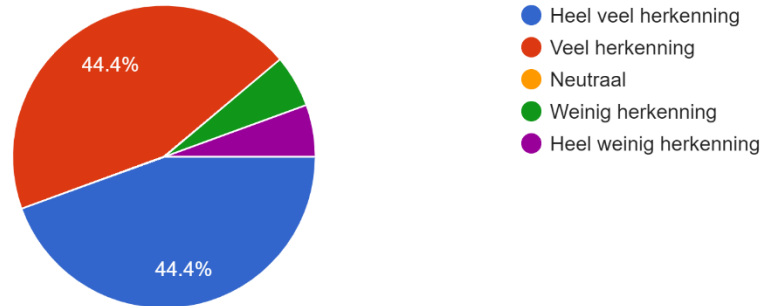
Een tweede oliecrisis in 1979 veroorzaakt een wereldwijde economische crisis waarvan ook de olieproducerende landen te lijden hebben.

18 responses



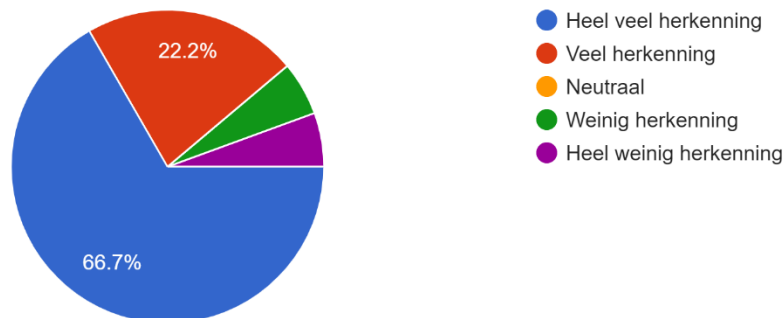
In 1989 viel de Berlijnse muur. Dit wordt door velen gezien als einde van de koude oorlog.

18 responses



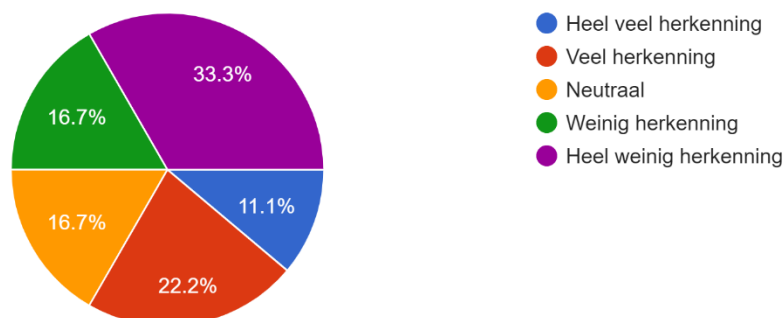
In 1992 stortte er een Jumbo jet neer in de Bijlmer. Deze gebeurtenis wordt ook wel de Bijlmerramp genoemd.

18 responses



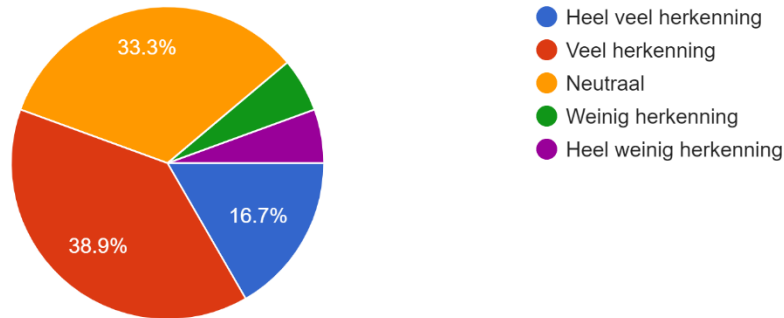
Posh, Scary, Baby, Sporty en Ginger vormden samen een meidenband genaamd Spice Girls.

18 responses



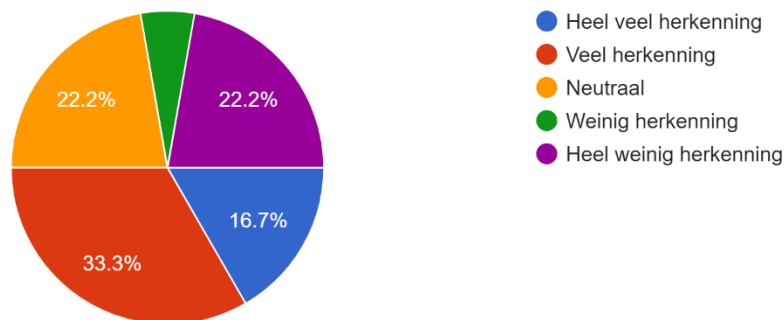
De walkman gaat na 1990 het straatbeeld beheersen.

18 responses



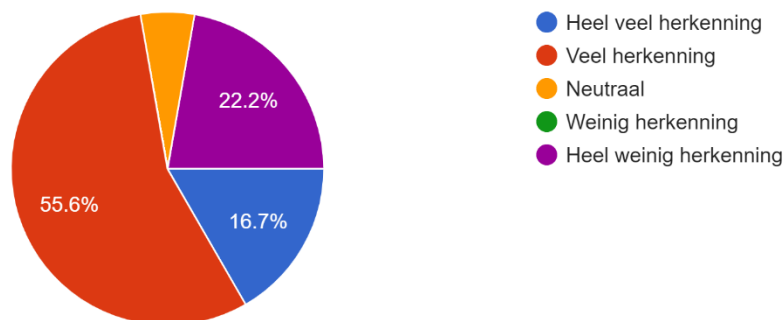
Voetballer Kluivert kwam in de jaren '90 in opspraak omdat hij werd verdacht van verkrachting en/of betrokkenheid bij een auto-ongeluk.

18 responses



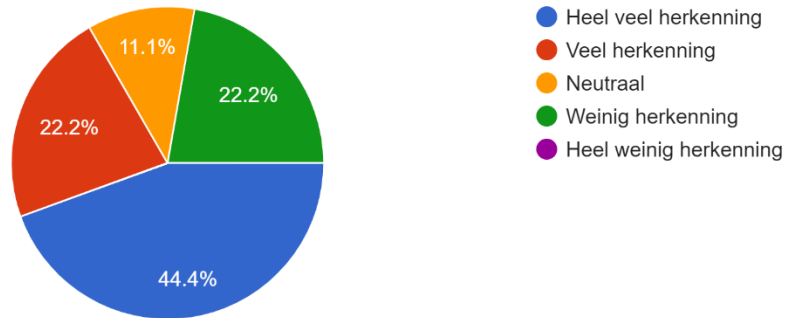
In 1989 werd de schrijver Salman Rushdie vogelvrij verklaard door ayatollah Khomeini vanwege het schrijven van het boek: "De Duivelsversen".

18 responses



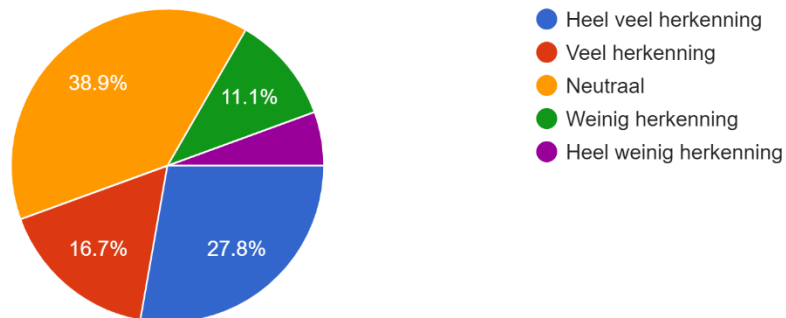
In 2006 werd Saddam Hussein gevonden

18 responses



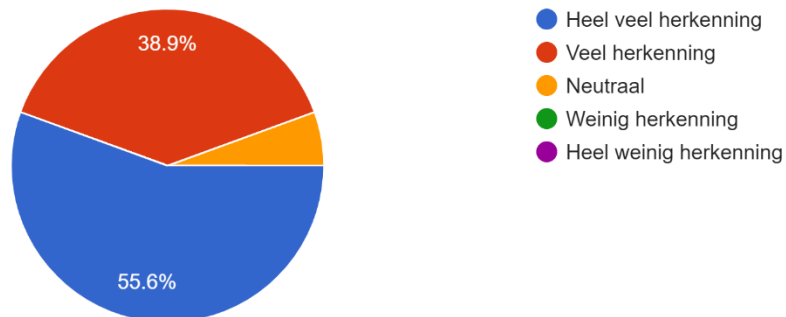
In 2008 bracht Geert Wilders de controversiële film Fitna uit.

18 responses



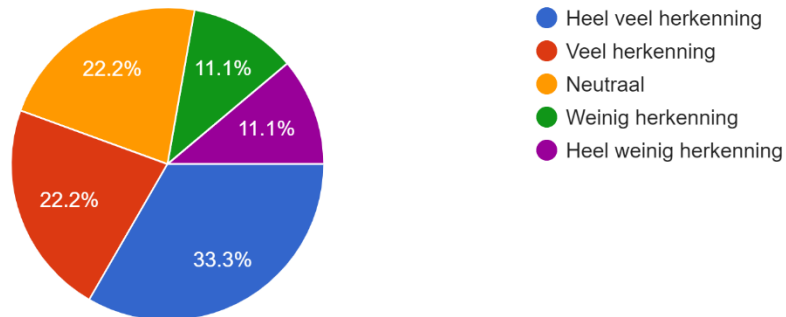
De Franse politie beëindigt in 2015 een gijzeling in een drukkerij in Dammartin-en-Goële door de twee verda...aders van de gijzeling om het leven.

18 responses



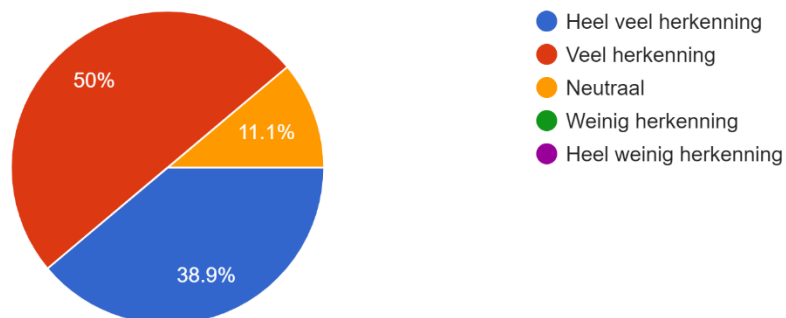
In 2010 was het luchtverkeer in Europa enkele dagen verstoord. Dit kwam door een aswolk van een vulkaan.

18 responses



Vanaf 2014 werd de zwartepietendiscussie veelvuldig gevoerd in Nederland.

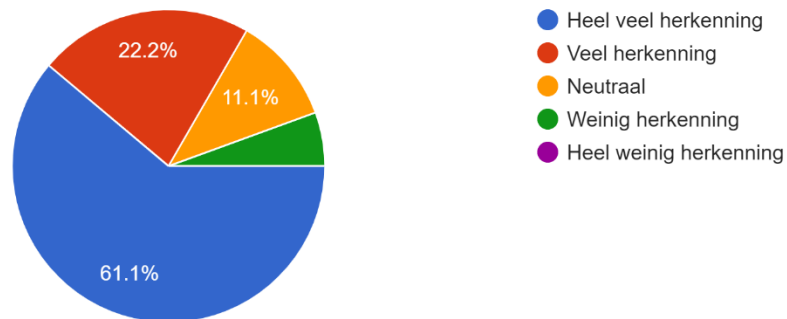
18 responses



Effect of familiar Music on Retrieval Autobiographical Memories in Korsakoff Patients

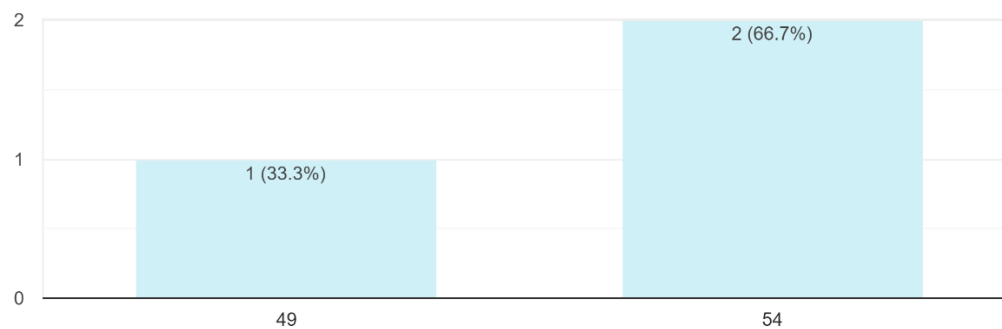
Pim Fortuyn, lijsttrekker van politieke partij Leefbaar Nederland en later LPF, werd in 2003 om het leven gebracht door Volkert van der G.

18 responses



Wat is uw leeftijd?

3 responses



Appendix 4: Score form Autobiographical Memory

Table 5: 7-point Likert scale

Heel erg mee oneens	Mee oneens	Min of meer mee oneens	Neutraal	Min of meer mee eens	Mee eens	Heel erg mee eens
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Informed Consent

Titel Studie: The Effect of Music on the Retrieval of Autobiographical Memories in Korsakoff

Patients

Onderzoeker: Maaïke Mulder

Ik verklaar:

Ik heb de informatiebrief over onderzoek [*titel*] gelezen. Ik kon aanvullende vragen stellen. Mijn vragen zijn afdoende beantwoord. Ik had genoeg tijd om te beslissen over deelname.

Ik weet dat indien ik vragen of bedenkingen heb rond mijn deelname aan het onderzoek dat ik dan contact kan opnemen met een van bovengenoemde onderzoekers. Ik kan verzoeken om informatie te ontvangen over de resultaten van het onderzoek op groepsniveau

Ik weet dat meedoen helemaal vrijwillig is. Ik weet dat ik op ieder moment kan beslissen niet langer mee te doen. Daarvoor hoef ik geen reden te geven. Ik zal nog steeds de van te voren afgesproken beloning voor deelname ontvangen.

Ik weet dat mijn onderzoeksgegevens na het onderzoek nog 10 jaar na publicatie bewaard worden en daarna worden vernietigd. [15 jaar bij medische studies]

Ik weet dat sommige mensen mijn gegevens kunnen inzien. Personen die mijn gegevens in kunnen zien zijn bijvoorbeeld monitors, auditors, en leden van het onderzoeksteam.

Ik weet dat mijn gegevens altijd uiterst vertrouwelijk behandeld zullen worden.

Ik geef toestemming om mijn gegevens te gebruiken voor onderzoekpublicaties, op voorwaarde dat de gegevens in de publicaties volledig geanonimiseerd zijn en niet op mijn persoon terug te leiden zijn. Onderzoeksgegevens kunnen in geanonimiseerd formaat gedeeld worden met andere onderzoekers voor toekomstige studies.

Ik ben 18 jaar of ouder en gezond van geest en lijf. Ik stem in met deelname aan dit onderzoek en neem geheel vrijwillig deel.

Naam

Handtekening participant

Datum

Handtekening onderzoeker

Appendix 6: Instruction participants

Participantnummer:

Conditie (FM/NFM):

Deelnemersinstructie

Hallo, leuk dat je mee wilt doen. Tijdens deze sessie ga ik kijken of muziek jou kan helpen bij het ophalen van herinneringen van vroeger/ waar muziek jou aan doet denken. Ik ga jou zo eerst een muziekfragment laten horen en daarna stel ik een vraag. Dit herhaal ik een paar keer. Als je wilt mag u de muziek gebruiken om een herinnering op te halen. Ik begrijp dat het soms moeilijk is. Als er geen herinnering naar boven komt is dat ook helemaal niet erg. De vragen hebben betrekking op gebeurtenissen in Nederland van vroeger. Je mag ten alle tijden stoppen met de deelname aan dit onderzoek, meedoen is geheel vrijwillig..

Begrijp je wat de bedoeling is?

Dan beginnen we nu met de eerste vraag. Jij krijgt nu een muziekfragment te horen voor 30 seconden en daarna stel ik jou 1 vraag. Ben jij er klaar voor?

..

..

Effect of familiar Music on Retrieval Autobiographical Memories in Korsakoff Patients

Appendix 7: Table containing corrected values of the data file (Translated into English).

Patient	aspect	condition	Used values	New values of missing cell
Nr. 4	Experience of time	FM	P1 + P2	8,335 > 8,34 (P3)
Nr. 5	Experience of time	FM	P1 + p2	11,75 (P3)
Nr. 10	Experience of time	NFM	P2 + P3	5,09 (P1)
Nr. 3	Experience of time	NFM	P1 + P3	7,75 (P2)
Nr. 4	Emotion-valence	FM	P1 + P2	-1,5 (P3)
Nr. 5	Emotion-valence	FM	P1 + P2	3,165 (P3)
Nr. 10	Emotion-valence	NFM	P2 + P3	-4,165 (P1)
Nr. 4	Emotion-valence	NFM	P1 + P3	5 (P2)
Nr. 4	Emotional arousal	FM	P1 + P2	9,5
Nr. 5	Emotional arousal	FM	P1+ P2	8,5
Nr. 10	Emotional arousal	NFM	P2 + P3	7,835
Nr. 4	Emotional arousal	NFM	P1 + P3	9
Nr. 4	Ego perspective	FM	P1 + P2	4,5
Nr. 5	Ego perspective	FM	P1 + P2	4,165
Nr. 10	Ego perspective	NFM	P2 + P3	3,335
Nr. 4	Ego perspective	NFM	P1 + P3	6
Nr.4	Place configuration	FM	P1 + P2	9,34
Nr. 5	Place configuration	FM	P1 + P2	13,2
Nr. 10	Place configuration	NFM	P1 + P3	10
Nr. 4	Sensory detail	FM	P1 + P2	4,84
Nr. 5	Sensory detail	FM	P1 + P2	12,84
Nr. 10	Place configuration	NFM	P2 + P3	12,17
Nr.10	Sensory detail	NFM	P2 + P3	10,5
Nr. 4	Sensory detail	NFM	P1 + P3	3,5

Appendix 8: visual displayed of mean liveliness of AM retrieval after correcting missing values

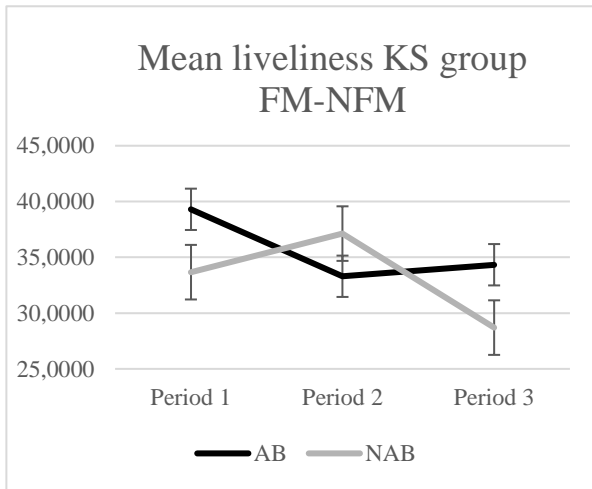


Figure 4. Visual inspection of the comparison in mean liveliness between the FM-condition (FM) and the NFM-condition (NFM) for the KS group

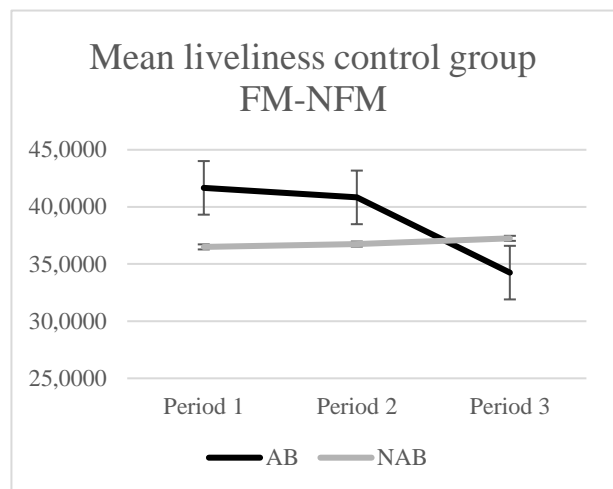
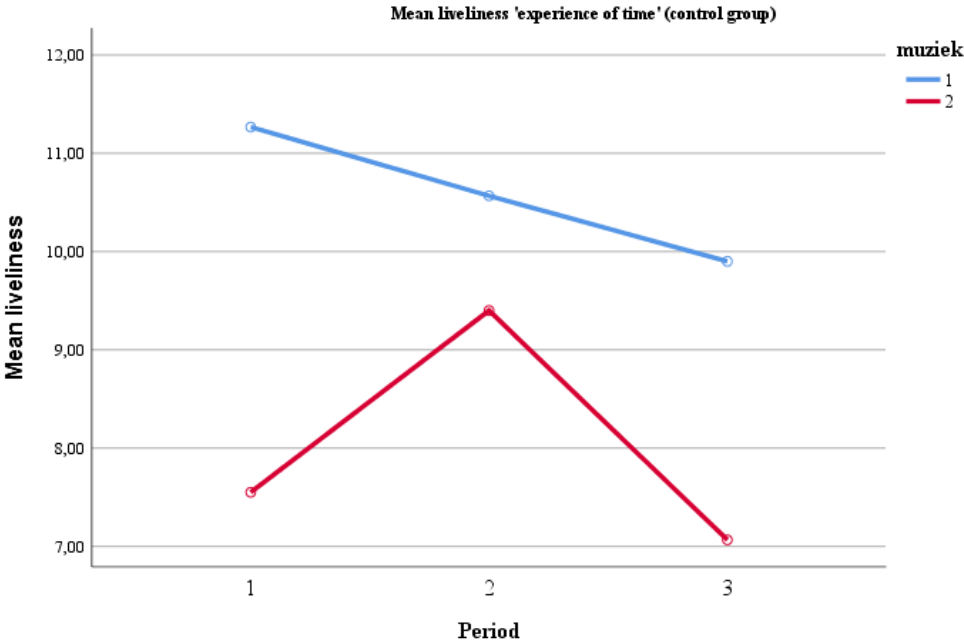
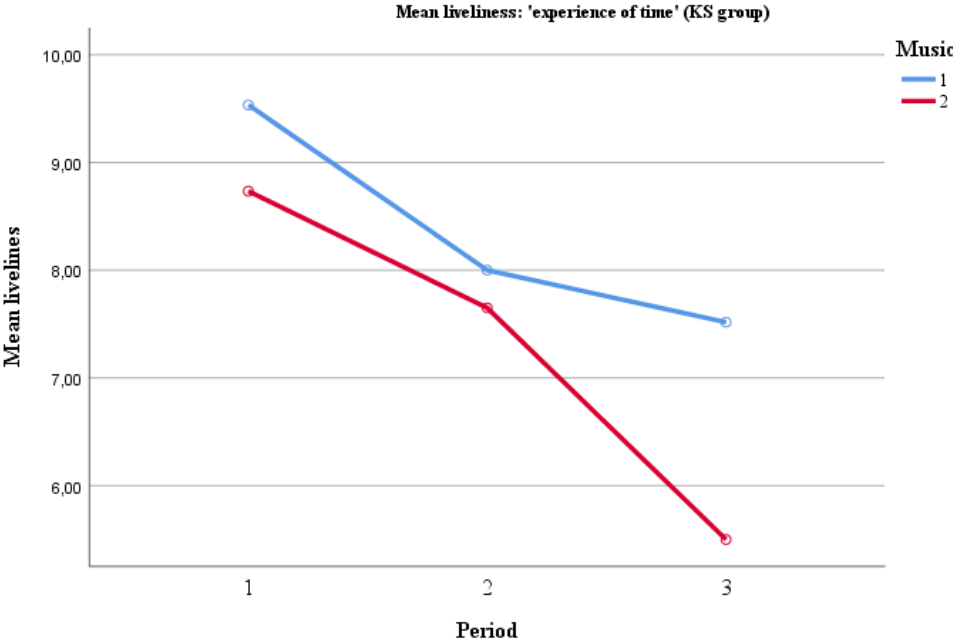
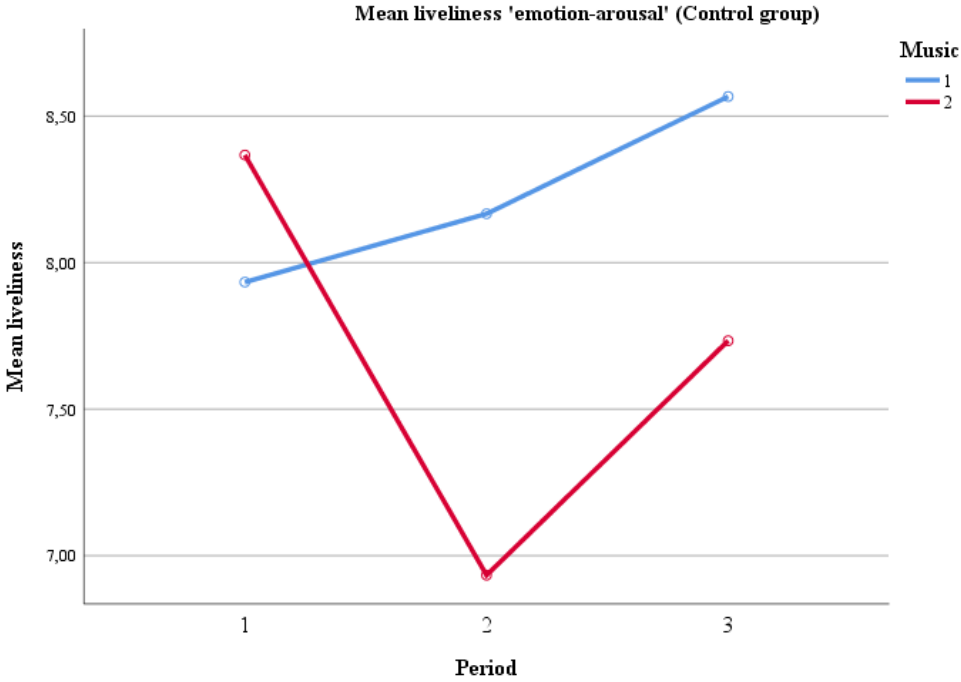
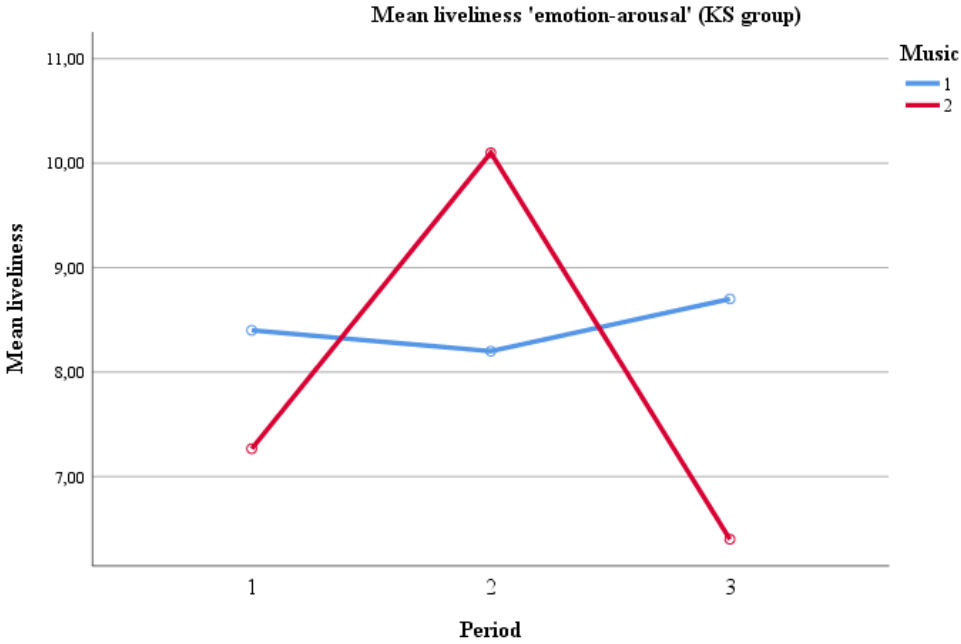


Figure 5. Visual inspection of the comparison in mean liveliness between the FM-condition and the NFM condition for the control group.

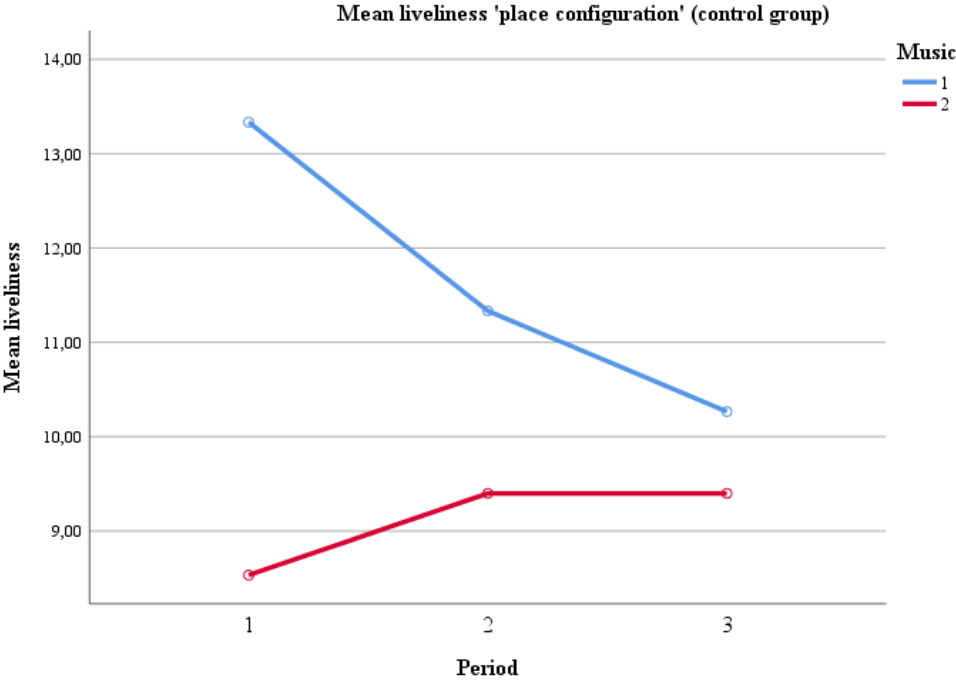
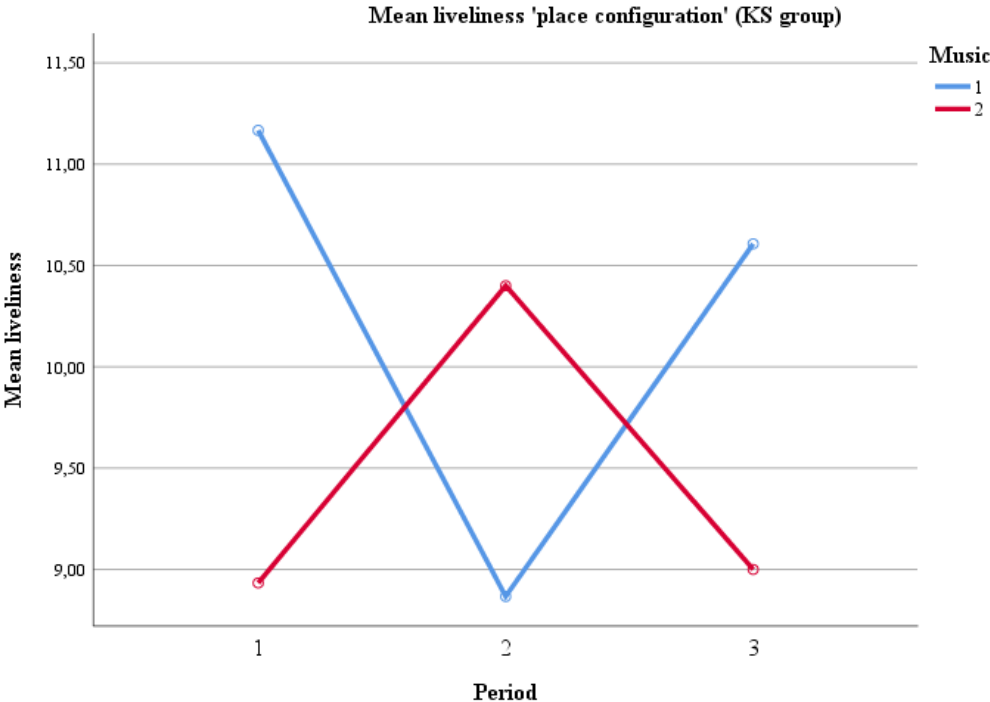
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